

## A new era for arms conversion?



**Stuart Parkinson argues that recently announced military cuts coupled with an expanding 'green' sector suggest the start of a major shift in the UK economy.**

Britain's new coalition government inherited a Ministry of Defence budget with a projected overspend of £38 billion,<sup>1</sup> and a record deficit in the public finances as a whole. So when the Strategic Defence and Security Review (SDSR) was published in October,<sup>2</sup> there was little surprise that it laid out significant cuts to military personnel and equipment over the next five to ten years. During the same period, however, both government and industry projects a major expansion of low carbon and environmental industries. So are we entering a new era of arms conversion for a sustainable society, for which SGR has long argued?

### Cuts to military equipment

The overall reduction in the budget of the Ministry of Defence (in real terms) is projected to be nearly 8% over the next four years.<sup>3</sup> This is significantly less than the cuts made to many civilian departments – such as education, communities and local government, or environment – and does not include extra spending allocated for military operations in Afghanistan or MoD pension payments. Nevertheless, this reduction will lead to large cuts in the vehicles and other equipment available for UK armed forces.

Table 1 (see page 26) shows the main cuts to conventionally armed ships, submarines, aircraft and armoured vehicles planned between 2010 and 2020 as a result of the SDSR.<sup>4,5</sup> For comparison, the 2005 levels are also shown.<sup>5</sup>

Perhaps the most striking aspect of these figures is the cuts that have already been made over the last five years – in simple numerical terms, they are comparable with those planned in the SDSR. Furthermore, when taken over the whole period, the reductions in some equipment areas approach those made as the Cold War ended.<sup>6</sup>

Looked at from one angle, the changes in the SDSR represent a real cut in 'force levels'. Older equipment is being phased out early. For example, the aircraft carrier, 'Ark Royal,' and its Harrier jets are being retired as this article goes to press, and the UK will not be able to launch fighter planes from sea for the next decade. Also, the four remaining Type-22 frigates will be cut and not replaced, while the numbers of Challenger tanks and AS90 armoured vehicles will be cut by 40% and 35% respectively. There will also be cuts in the levels of new equipment bought. For example, the numbers of new fighter planes – specifically, Typhoons and Joint Strike Fighters – will be significantly lower (although specific figures have not yet been announced), while the new Nimrod MRA4 maritime reconnaissance aircraft have been cancelled altogether.

There are also cuts to Britain's nuclear weapons arsenal. The total number of operational warheads will be reduced from 160 to 120, while each nuclear-armed submarine will carry fewer warheads (down from 48 to 40). The decision on whether to replace the Trident submarines will be delayed until 2016 – after the next general election – with the operating lifetime of the existing vessels to be extended to allow for this. This offers an improved opportunity for campaigners to make the case for cancellation of the replacement system.

However, it is clear in some cases that military capabilities will be enhanced. For example, the two

*Continued on page 26*

## Contents

<b>SGR News.....</b>	<b>2</b>
A few words from the Director .....	2
New SGR website goes live.....	2
Security and disarmament activities .....	3
Climate change and energy activities.....	3
Challenging military & corporate power .....	4
Promoting ethical careers .....	4
Letters .....	4
Open letter to the Prime Minister.....	5
A bequest to the Martin Ryle Trust.....	6
<b>Feature Articles.....</b>	<b>7</b>
The Strategic Defence and Security Review ...	7
Nuclear adventures in Finland .....	8
Research investment decisions: time for change .....	10
Energy and climate – time for hope or concern? .....	12
Census 2011 – who will have access to the data? .....	14
Beyond Trident: AWE prepares for the future .....	15
Climate change – are we still sure? .....	17
Transport and land-use: time for a rethink? ..	19
Armed drones: used against the poor .....	20
Challenging commercialism in research assessment.....	22
Synthetic life – too much, too soon?.....	23
Renewable energy funding in the UK .....	24
<b>Publication &amp; Event Reviews .....</b>	<b>27</b>
The strangest dream .....	27
The spirit level.....	28
Green economics .....	28
Newspeak in the 21st century.....	29
Creating your own peace garden.....	30
Disarmament forum.....	30
A tale of two spuds .....	31
Energy, environment and transport forum ....	31

**SGR conference 2011**

More details on p.13

## A few words from the Director

**Unsurprisingly the issue of public sector cuts has dominated the news since the publication of the Cameron government's spending review<sup>1</sup> in October. The review has major implications for many of the areas of concern to SGR.**

Let's start with a few positives. UK military spending will see its biggest fall since the end of the Cold War – including cuts in key offensive weapons systems (see p.1). The budget for international development will be increased by one third. Funding for the Department of Energy and Climate Change (DECC) will increase by 13%. Also, the cut in the core science budget is significantly lower than feared.

However, the negatives are far greater and, on closer inspection, even the positives have catches. For example, the main education budget will be cut more deeply than the military budget. The lower than expected cuts in the science budget are conditional on much stronger commercial priorities being accepted for university research, together with a massive hike in tuition fees for students to cover larger cuts in university teaching. The rise in DECC spending is only half the size of the fall in government spending on other environmental issues. Social housing will see huge cuts.

Meanwhile, numerous positive policy options that would help deal with the current economic problems were either missing or given little priority. Let's take a closer look at those related to the military industrial

sector, for example. The option of cutting military spending at least down to the average level of the EU – as part of the adoption of a less aggressive foreign policy – was ignored. The option of cancelling Trident replacement was rejected (although the schedule for replacement has been delayed). A major cut to the Ministry of Defence's R&D budget in order to facilitate full protection of the civilian science budget was rejected (also by some mainstream science organisations). These were among the options put forward by SGR as the spending review was debated (see pp.3-5).

In this context, it is particularly instructive to consider the case of the UK's two new aircraft carriers, the first of which is already under construction. The Cameron government considered cancelling the second, but discovered that to do so would cost more than having it built – due to penalty clauses in the contract signed with the manufacturers, BAE Systems.<sup>2</sup> This acutely demonstrates the power of the 'military-industrial complex' in forming UK government policy against the national interest. One cannot help thinking that such a contract would never have been agreed with a construction company building schools...

One little-noticed item on the list of government's cuts was the removal of funding for one of its key environmental watchdogs, the Sustainable Development Commission (see p.6). In 2009, the SDC published an influential report, *Prosperity without growth*,<sup>3</sup> which pointed to a path away from

an economy dependent on endless growth. It made very strong environmental, social justice and security arguments for pursuing such a policy. If this government truly aims to be the 'greenest ever' – as it claims – it would have made taking forward the recommendations of that report a key priority. The decision to ignore it and end the watchdog's funding speaks volumes.

Nevertheless, as the front-page article argues, the current military cuts coupled with an expanding environmental sector offer an opportunity to shift fundamentally the balance within the UK science, design and engineering professions for the long-term. It's an opportunity we should take with both hands...

Stuart Parkinson

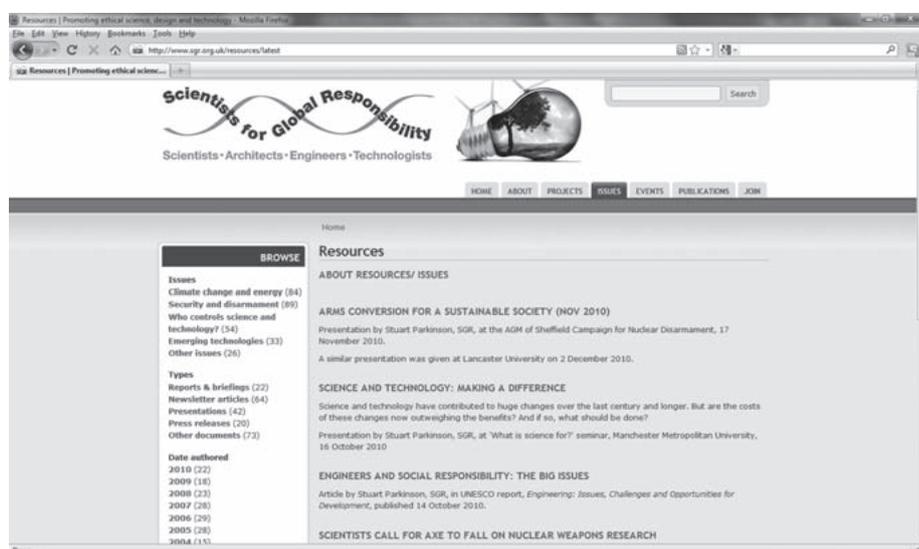
### Notes and references

1. A summary of the main budgetary changes can be found at: BBC News online (2010). Spending Review: In graphics. 20 October. <http://www.bbc.co.uk/news/uk-politics-11583746>. The full documents can be downloaded from: [http://www.hm-treasury.gov.uk/spend\\_index.htm](http://www.hm-treasury.gov.uk/spend_index.htm)
2. The Guardian (2010). BAE warned Cameron over £5bn cost of cancelling aircraft carrier contract. 4 November. <http://www.guardian.co.uk/politics/2010/nov/04/bae-cameron-aircraft-carrier-contract>
3. Jackson T (2009). Prosperity without growth? The transition to a sustainable economy. Sustainable Development Commission. <http://www.sd-commission.org.uk/>

## New SGR website goes live

Over the summer SGR's website was completely redesigned and updated (see screen shot), making it much easier to navigate, more attractive, and easier for staff to keep updated. The website now contains all SGR's main outputs – reports, briefings, presentations, newsletters, articles, conference reports etc – as well as details of forthcoming events and other general material.

Please take a look at: <http://www.sgr.org.uk/>  
The new website was designed and built by GreenNet using Drupal software. SGR's web team is Stuart Parkinson, Kate Maloney, Patricia Hughes and Harry Tsoumpas. We are grateful to the Network for Social Change for providing the funding for the redesign.



## Security and disarmament activities

**Arms conversion has been a strong theme of SGR's work in recent months. This has been especially pertinent in view of the government's Strategic Defence and Security Review (SDSR). We have also continued to make the case for cancelling Trident and its replacement.**

Following on from David Webb's presentation at the 2009 SGR conference, Stuart Parkinson gave three talks in the autumn entitled 'Arms conversion for a sustainable society' – in Derby, Sheffield and Lancaster. The talk in Derby – home of major arms company, Rolls Royce – attracted significant local media attention. Stuart also wrote an opinion piece on the issue for *Professional Engineering*, published in the run-up to the general election. We are also providing assistance to Campaign Against Arms Trade with their new project examining the feasibility of shifting jobs from military industry to the renewable energy sector. Our work challenging military and corporate influence on science (see p.4) obviously overlaps a great deal with all these activities.

Arms conversion was also one of the themes of SGR's response to the government's SDSR, and to the related inquiry by the House of Commons Defence Committee. In these responses, we also pressed the case for nuclear disarmament and argued for a security strategy that focused much more heavily on tackling the roots of conflict and insecurity. Some of these recommendations were reflected in the government's security and defence strategies, published in October, but there is still a lot of progress which needs to be made (see p.1 and p.7).

With the five-yearly Review Conference of the nuclear Non-Proliferation Treaty (NPT) taking place in New York in May, two of SGR's international affiliates – INES and ICAN – took a prominent role in campaign activities. SGR sponsor, David Webb also spoke at a side event (see p.4). ICAN is campaigning for a more comprehensive 'Nuclear Weapons Convention' to replace the NPT, and SGR is supporting these activities in the UK – for example, by distributing its campaign material (see enclosed information sheet, '20 Questions on a Nuclear Weapons Convention')

and helping to obtain high-profile signatories for a letter to the Prime Minister in August arguing for the Convention.

SGR has also supported a number of other efforts to challenge nuclear weapons in the UK. For example, Kate Macintosh put together SGR's objection to planning permission for 'Project Hydrus', the latest phase of redevelopment at the Atomic Weapons Establishment (AWE) (see p.15). The project is now under review following changes in government policy. We also joined other peace groups in encouraging our members to write to their prospective parliamentary candidates in advance of the general election, and then to MPs in advance of the spending review, to call for Trident replacement to be cancelled. Thanks to all of you who wrote.

SGR has also affiliated to two campaigns calling for curbs on armed drones – the International Committee for Robot Arms Control (ICRAC) and the UK-based Drones Campaign Network. This issue is discussed further on pp.20-21.

## Climate change and energy activities

**SGR has once again been busy making the case for sustainable energy and climate policies.**

In the run-up to the general election in May, we took part in a number of campaigning activities. SGR signed a statement, written by the influential Existing Homes Alliance and sent to all party leaders, arguing for more concerted efforts to promote energy efficiency. SGR committee members also signed a statement organised by the Nuclear Consultation

Group, calling for an independent inquiry into some legal aspects of new nuclear power. Stuart Parkinson gave a presentation on the shortcomings of nuclear power at a public meeting in Lancaster, following the announcement that nearby Heysham had been short-listed as a site for a new nuclear power station. Information was also circulated to SGR members on email encouraging them to ask their prospective parliamentary candidates pressing questions on energy and climate issues. Following a request from Green Party activists, SGR provided information to them on countering climate sceptic arguments.

concerns that the government would cut subsidies earmarked for micro-renewable technologies, SGR took part in a campaign organised by the Renewable Energy Tariff coalition in support of the Renewable Heat Incentive (RHI). Heat energy from renewable sources has been much neglected within UK energy policy to date. To this end, we endorsed a campaign postcard sent to 90,000 members of environmental groups to send on to their MPs. In the run-up to the final decision on the RHI, Harry Tsoumpas took part in a parliamentary lobby (see photo). The campaign was successful as, in October's spending review, the government agreed to go ahead with the RHI in 2011.



SGR Secretary, Harry Tsoumpas, at a parliamentary lobby in support of subsidies for micro-renewable technologies in the heat sector.

After the general election, SGR continued to press the incoming government on these issues. Kate Macintosh attended the Liberal Democrats' special conference on the coalition agreement, and put a question about subsidies for nuclear power. SGR also wrote to incoming Secretary of State, Chris Huhne, regarding a range of climate and energy issues. Following

SGR representatives have also attended several seminars and conferences on energy and climate issues in recent months. For example, Martin Quick attended a parliamentary event on renewable energy, while Stuart Parkinson took part in a Royal Society roundtable discussion on the nuclear proliferation risks of nuclear power.

SGR members continue to write in a personal capacity on these issues to government ministers, newspapers, specialist magazines etc. and we are grateful for this valuable contribution to our efforts.

## Challenging military and corporate power in science

**Building on SGR's influential reports on corporate and military influence in science and technology, in recent months we have challenged the incoming government over its policies and led the debate in other forums.**

Our most high-profile activity was co-ordinating a letter to the Prime Minister signed by 36 British professors. It was sent in advance of the government's spending review in October. It argued that any cuts to public R&D funding should come from the Ministry of Defence's R&D budget and, in particular, the multi-billion pound research expenditure at the Atomic Weapons Establishment at Aldermaston. The letter and the list of signatories are reproduced in full opposite. The letter received widespread coverage in media outlets including the BBC News website, *The Guardian*, *BBC Radio 5 Live*, *Professional Engineering*, *Physics Today*, *Morning Star*, Greenpeace UK website, and numerous

other science and 'green' websites. The letter followed SGR-authored letters to the Business Secretary and Science Minister, which received unsatisfactory responses.

SGR has also given a number of presentations covering the issues of corporate and military power in science and technology, as well as related concerns. Back in March, Stuart Parkinson took part in a panel discussion at the Cambridge Science Festival entitled 'Who owns science?' In May, David Webb gave a presentation on the responsibility of scientists at a side event at key negotiations on the nuclear Non-Proliferation Treaty in New York (see p.3). In advance of the government's spending review, Stuart took part in a panel discussion at the Green Party conference in Birmingham, and also gave a lecture on ethical issues in science on a course for science teachers in Manchester.

Other media coverage has also been very positive. In December, Chris Langley appeared in a *BBC Radio 4* documentary examining corporate influence at universities. Stuart Parkinson wrote an article on corporate science, which appeared in the European magazine *Lab Times* in August. David Webb wrote an article on science, war and responsibility for German magazine, *Wissenschaft und Frieden (Science and Peace)*. SGR also responded to inquiries from *The Observer*, *The Herald*, and *Research Fortnight*, as well as requests for information from academics and green campaigners.

Finally, in October, the United Nations Education, Social and Cultural Organisation (UNESCO) published a 400-page book, *Engineering: Issues, Challenges and Opportunities for Development*. This included a section on engineering and social responsibility by Stuart Parkinson.

## Promoting ethical careers

SGR continues to promote ethical careers in science, design and technology, especially to students and recent graduates.

In recent months, we have had a presence at four careers events. Stuart Parkinson gave a lecture on ethical careers to computer science students at Birmingham University. There was an SGR stall at ethical careers fairs at Cambridge and Cardiff Universities, while our ethical careers briefings were also distributed at a careers fair at York University. Thanks to volunteers Alan Cottey, Richard Jennings, Martin Quick, Richard Tregear, Max Wallis and Tony White for staffing the SGR stalls. If you are interested in helping with future events, please contact Kate Maloney at <KateM@sgr.org.uk>.

In July, Stuart Parkinson took part in a live web chat on ethical careers on *The Guardian's* website – see <http://bit.ly/do4xdx>. We also provided information to journalists at *The Independent*, and our ethical careers work received coverage in green campaigners' magazines in Germany and Italy!

## Letters

**Letters to the editor should be sent to <newsletter@sgr.org.uk>. It is recommended that they are no longer than 250 words. They may be edited for brevity or clarity.**

### Low energy debate

I should like to give wholehearted support to the call made by Dr Mandy Meikle (in *SGR Newsletter*, No. 38) for a 'low energy' debate.

Preoccupation with climate change has been a distraction from the wider issue of designing and developing systems that lead to globally just and sustainable societies for a seriously damaged planet. The multiplicity of threats mentioned by Mandy has been caused by about two billion people in the industrialised countries. Now, the same kind of industrialisation is spreading rapidly to the remaining five billion. All that is being considered currently is how to replace cheap fossil energy with new sources, which are mostly between four and eight times as costly, for use in the same damaging systems. Without a priority to reduce energy consumption as quickly as possible in the industrialised countries to no more than a quarter of present levels, the new sources will be an economic disaster, particularly for poorer communities. This huge challenge must be addressed urgently. Incidentally, if this objective is even partially achieved, it can do much to meet the climate change objectives. One thing is certain: it cannot be done while governments in industrialised countries continue to cling to an obsession with monetary growth. Also, it cannot be done without considerable governmental intervention within a newly developed ethical framework.

Even the International Energy Agency has at last acknowledged the likelihood of an 'energy crunch' within the next ten years – possibly as early as 2012.

Yours hopefully,

**John Davies, Swanage, Dorset.**

## Open letter to the Prime Minister on public science funding and nuclear weapons research

As senior scientists and engineers, we are deeply concerned that while the government is threatening to cut public funding for research and development as a whole, it appears to be committed to maintaining high levels of military-related R&D. Of particular concern is the fact that world-class research into health and global environmental problems is under threat, while the government continues to fund the multi-billion pound research programme at the Atomic Weapons Establishment at Aldermaston.

Official statistics indicate that the total public spending on R&D is currently about £8 billion. Of this, the Ministry of Defence spends over £2 billion, more than 25% of the total. Much of this funding is used to support defence industry projects at a time when the industry is reaping bumper profits due to the massive increase in global military expenditure over the last decade. Our view is that current MoD R&D funding is not only disproportionate, it also includes expenditure on programmes which are of minimal benefit or counterproductive to the UK's security. For example, funds for the redevelopment of the Atomic Weapons Establishment's research facilities "to ensure that the existing warhead can be maintained for as long as necessary, and to enable the development of a successor warhead should one be required" (quoting from AWE's mission statement) will, we firmly believe, undermine progress towards multilateral nuclear disarmament.

Our view is that the UK's nuclear warheads should be taken off deployment and placed in secure land-based storage, and that the successor to the Trident system should be scrapped. The facilities at the AWE should be directed solely to monitoring and verification of arms control and disarmament agreements.

Overall, therefore, we believe that any cuts to public science spending should predominantly come from cuts to the MoD's R&D.

However, there are some areas of security-related R&D that should be expanded, including those which support monitoring of arms control agreements, non-violent conflict resolution, and tackling the roots of conflict and insecurity.

The over-arching threats to international security arise from rising fuel and resource costs, the impacts of climate change and other environmental problems, and the widening gap between rich and poor. Nuclear

weapons are of no help in dealing with these problems – indeed, they are likely to make matters far worse. On the other hand, a major shift of military R&D to civilian programmes of work will – if targeted carefully – help to tackle these international problems, improving the UK's security and also leading to greater job creation and a faster emergence from the current recession. As an example of the current imbalance in resources, we note that the current MoD R&D budget is more than 20 times larger than public funding for R&D on renewable energy.

We therefore urge ministers to shift their priorities so that science and technology can contribute to tackling the real threats to the UK's present and future security.

Sincerely

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Professor (Honorary) of Mathematics,  
University of Edinburgh

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Professor (Emeritus) of Physics, Imperial College London

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Robert Hinde CBE FRS  
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David Infield  
Professor of Renewable Energy Technologies,  
University of Strathclyde

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Professor of Sustainable Development, University of Surrey

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Tom Woolley  
Professor of Architecture, Queens University Belfast  
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Peter Young  
Professor (Emeritus) of Environmental Systems,  
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*N.B. All signatories have signed in a personal capacity; where institutions are listed, this is for information only*

Letter co-ordinated by SGR - more details opposite

## A bequest to the Martin Ryle Trust in your will

**Alan Cottey encourages all who have not already done so to include a bequest to the Martin Ryle Trust in their will, as a way of supporting SGR.**

It is natural that we should want to use our personal resources well during our lifetime and to have our estate used well after we die. If we are interested in the use of science and technology for the good of all people and for the protection of life on this planet, we can hardly do better than remember the Martin Ryle Trust in our will.

Those parts of SGR's work that count as charitable – and most of them do – have, over many years, been helped greatly by grants from the Martin Ryle Trust. The main sources of the Trust's income are philanthropic foundations and donations from individuals. SGR members and other regular readers of this Newsletter know that UK taxpayers may increase the value of donations to the Trust by taking advantage of the Gift Aid scheme. Doing this is very simple and currently it increases the value of a donation of, say, £100, to £128. A further effective way of promoting the welfare of future generations is to make a bequest in your will to the Martin Ryle Trust.

Sir Martin Ryle (1918-1984) FEng, FRS, Astronomer Royal, Nobel Laureate, was a physicist, radio astronomer and engineer who was profoundly distressed by the militarisation of science and technology. He devoted his later years to warning about the nuclear arsenals – “this incredible situation” – and to promoting a culture of responsibility among scientists and engineers ... “we should strive to see how the vast resources now diverted towards the destruction of life are turned instead to the solution of the problems which both rich – but especially the poor – countries of the world now face.”

### Practical matters

*What if my assets get eroded in my old age?*

Although many people nowadays, particularly if they are in their fifties or sixties, do have considerable assets, there is another side to the coin. People are now living longer and care in old age can, in some circumstances, be very expensive. This is, however, not an obstacle. You should be able, with professional advice, to have a will that reflects your wishes for whatever estate you eventually leave. Ranking of beneficiaries and apportionment of the estate is often

quite straightforward, albeit wrapped in legal language.

Professional advice in drawing up a will is, in any case, recommended and so is periodic review of a will. After review, you may decide to modify the existing will (with a codicil) or replace it with a new will.

*Inheritance tax.* The MRT is a registered charity and bequests made to the Trust in a will do not attract inheritance tax. The threshold at which inheritance tax starts to apply is currently £325,000 and the tax rate is a flat 40%. Currently therefore, £325,000 of an estate can go to any beneficiaries without attracting tax. Every £1,000 above that sum can go wholly to charity, or £400 can go to HM Revenue and Customs and £600 to non-charity beneficiaries.

*Deed of Variation.* This not an element of a person's will but is worth mentioning here as it is a way in which a beneficiary of a will can divert money to a charity and thereby save on inheritance tax. A Deed of Variation is a voluntary variation undertaken by a beneficiary of a will. As with a will, professional advice in drawing up a Deed of Variation is recommended. A supporter of the MRT says: “When I sold my late mother's house, I could have accepted all of the proceeds as specified in her will – after the Government had taken their share. By signing a ‘Deed of Variation’ I was able to divert the amount liable for inheritance tax to the Martin Ryle Trust and other charities.”

### Don't put it off!

Writing, replacing or modifying a will is not everyone's favourite activity. Still, it is important and when you have done it, you will feel pleased to have settled the matter. When you have decided to make a bequest to the Martin Ryle Trust, please start the wheels turning. Near the end of his life, Ryle wrote: “Our cleverness has grown prodigiously – but not our wisdom.” By supporting the work of the Trust that bears Martin Ryle's name you can help to realise his vision of a society in which science and technology contribute to sustained peace, justice and welfare.

**Dr Alan Cottey is Secretary of the Martin Ryle Trust.**

The Martin Ryle Trust  
PO Box 474, Folkestone, CT20 1GN  
More information about the Trust may be found at:  
<http://www.sgr.org.uk/pages/martin-ryle-trust>

## In brief

- In July, on learning that the coalition government were planning to abolish the Royal Commission on Environmental Pollution and withdraw funding from the Sustainable Development Commission (two important environmental watchdogs), SGR issued a press release condemning this action. Several SGR members wrote to the environment minister to complain.
- SGR members signed a letter in support of Gilles Eric Séralini, French professor of molecular biology, who has spoken out about health concerns related to GM crops, and has consequently been heavily criticised by pro-GM scientists.
- Several SGR committee members took part in a conference in Leeds to found a new campaign to make the case for a steady-state economy as a key way to tackle environmental and social problems. SGR members also advocated this solution in letters to *Professional Engineering*.
- SGR provided information to the University of Strathclyde as it drew up new environmental and ethical policies.
- SGR signed a European petition against the latest developments in the patenting of seeds and animals. SGR members also signed petitions to save the internationally important Pavlovsk seed bank in Russia and the British agricultural research centre, Warwick HRI.
- SGR Director, Stuart Parkinson, took part in the triennial Council Meeting of the International Network of Engineers and Scientists for Global Responsibility (INES) in Paris in May.

## A big “thank you”

...to all those who responded so generously to SGR's October 2010 appeal. We are pleased to announce that by mid December the amount raised had reached nearly £8,000 – well on the way to reaching our target of £10,000.

But it's not too late to make a donation! This can be done using the gift aid form sent out with the appeal letter. Contact us if you need another copy.

Thank you also to all those who make one-off or regular donations throughout the year.

## The Strategic Defence and Security Review – missing the point?

**Paul Rogers argues that only with a fundamental change in approach will the UK's defence and security strategies be 'fit for purpose'.**

The Strategic Defence and Security Review<sup>1</sup> (SDSR), completed by the government in October, was conducted at a time of crisis for the Ministry of Defence (MoD). There were three main reasons for this crisis – all of them related to finance – but beyond this is the overarching problem that the SDSR has continued to fail to address the really important issues facing UK defence policy.

At its heart, the MoD's financial crisis was simply due to the existing budget being inadequate to meet commitments. Put bluntly, the MoD needed an increase of around 15% just to break even, given the unexpected costs of the war in Afghanistan and the rapidly rising costs of some key new projects. On top of this came the coalition government's policy to make substantial cuts in public spending. While the MoD escaped the very large cuts earmarked for some departments, it will still see its budget cut by 8% in real terms over the next four years. These two factors together mean that the MoD is facing a budget that is perhaps a quarter less than it actually believes it needs.

Add to this a third factor – two huge new forty-year projects that are both front-loaded, with heavy capital spending due in the next decade. The one that is best known is the proposed replacement for the Trident nuclear weapons system with estimated £100 billion lifetime costs<sup>2</sup> but proportionately much more in the short term. The other project is the building of two massive new aircraft carriers. At over 60,000 tonnes each, the *Queen Elizabeth*-class ships will be by far the largest warship ever deployed by the Royal Navy, the nearest ships any country will have to the US Navy's *Nimitz*-class super-carriers. The new warships will give the UK a 'global reach' but are also planned to deploy the hugely expensive F-35 multi-role fighter and will require an array of support ships to operate effectively.

Britain may still be seeking to be a mini-superpower but the strains are showing. In order to afford the cost of both new carriers, cuts elsewhere mean that the Navy will have no capability to launch fighter planes from *any* carrier for the next decade. The decision on whether to proceed with Trident replacement has been delayed until after the next general election.

Questions are even being raised within the MoD about whether a like-for-like replacement is needed – a quite extraordinary development considering the sacred-cow status of Britain's nuclear force.

The much bigger problem is that this whole issue of meeting the costs of the new programmes has obscured the need for a much more in-depth review over what the UK's security policy should actually be. Instead, it is far too much a matter of a limited approach that focuses on a narrow interpretation of 'defence' being protecting the state, rather than understanding the nature of future security challenges.

What is dismaying about this is that within the Ministry of Defence there has been some quite innovative thinking about global security trends. The main think-tank, the Development Concepts and Doctrine Centre<sup>3</sup> (DCDC) at Shrivenham near Swindon has carried out some significant analyses that point to issues such as climate change, energy and food shortages and socio-economic divisions as major drivers of global insecurity. DCDC sees some of these leading to major problems of economic marginalisation and increased numbers of fragile and failing states as well as mass migration driven by desperation.

Furthermore, this line of thinking has begun to emerge at a more central level, featuring in both the Labour government's 2008 National Security Strategy (NSS), and the coalition government's NSS,<sup>4</sup> which was published at the same time as the SDSR.

However, there remains a central problem in the whole approach. While recognising the nature of these evolving challenges, the basic response is one of trying to isolate the UK from the dangers and protecting the state, either on its own or more likely in alliances with other like-minded states. In the face of a potentially unstable and dangerous world, the focus of the government's approach is to maintain security, if need be by the use of force, rather than addressing the underlying causes of the insecurity. It is very much a case of closing the castle gates in the face of uncertainty and threat. It can best be described as classic 'liddism' – keep the lid on rather than turn down the heat.

The requirement, then, is for the government's strategies to go much further than conventional defence thinking and take a realistic look at the



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**The UK government is not ready to give up nuclear weapons just yet**

challenges facing the world community – an economically polarised and environmentally constrained system. This would then start the process of recognising the need for a fundamental change of outlook. If this were to happen, then one outcome would be a rapid transition to a low carbon, emancipatory economy. This would be seen to be at the core of the UK's security interests, a radically different outcome but one much more in tune with what is really needed.

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## Nuclear adventures in Finland

**Claus Montonen reveals disturbing evidence of shortcuts, overspending and commercial infighting during the construction of Olkiluoto 3 – the first of a planned new generation of nuclear power stations in Europe.**

In 2002, the Finnish parliament ratified a decision-in-principle by the country's government to approve an application by the power utility Teollisuuden Voima (TVO) to build a new nuclear power plant. The plant, called Olkiluoto 3, was planned for a site that hosted two older, Swedish-built boiling-water power reactors that were built in 1978 and 1980.

Such decisions-in-principle are a legal requirement for all major nuclear installations in Finland. This follows the Finnish Nuclear Energy Act, which requires that such decisions are approved by parliament. An earlier attempt by the major power utilities to get approval for a new nuclear power plant was thwarted by parliament in 1993; a still earlier application in 1986 was withdrawn following the Chernobyl accident.

The success of the 2002 application was hailed as a major breakthrough by the nuclear industry, as it brought to an end a ten-year long standstill in new nuclear power installations in Western Europe and the USA. The reasons for the success of the 2002 application after the failure of 1993 are analysed thoroughly in the book *The Renewal of Nuclear Power in Finland*.<sup>1</sup> An important factor was that the power utilities and the government, acting in collusion, had learnt their lessons from the earlier debacle, and had prepared means by which to counter the two major arguments of the anti-nuclear movement. The first of these arguments sets out the advantages of (and preference for) renewable energy sources and the second highlights the risks associated with high-level nuclear waste. To counter these objections the government adopted a programme for promoting renewable energy in 1999, published a climate strategy in 2001, and approved (again via a decision-in-principle) plans for a permanent deep underground depository for high-level waste in 2001.

TVO is a conglomerate owned largely by heavy metal and paper industries. The contract for building the reactor and power plant Olkiluoto 3 was awarded to a French-German consortium, comprising the companies Areva and Siemens respectively, which had offered to build the plant for a fixed price of €3 billion, based on the new 1.6 gigawatt (electricity) European Pressurised Reactor (EPR). The reactor,

which was the responsibility of Areva, was to be the first of its type. Siemens was responsible for the steam turbines and electricity generators.

Construction started in 2005 and was meant to be finished in 2009. The date of completion was pushed back several times, most recently to 2013, but in May this year the builders finally refrained from promising any fixed date for when the power station will be connected to the grid.<sup>2</sup>

I will return to some of the reasons for the delays below. The result is that costs have escalated dramatically. Construction costs are now estimated to add up to more than €6 billion; in addition, TVO is suing the supplier consortium for €2.4 billion for missing the original deadline for completion. In an effort to recoup some of its costs, Areva and Siemens are suing TVO for €1 billion for obstructing construction by sticking to excessively rigid security requirements.<sup>3</sup> The European courts must now decide who is going to pay for the extra costs: the French or the Finnish taxpayer. It seems highly likely that Areva-Siemens made an offer below their anticipated costs in order to secure the contract, regarded as an enormously valuable reference for securing future sales.

### Construction problems

Soon after the start of construction, difficulties started to appear. Lack of coordination between the multinational construction teams and frequent changes of plan combined with language problems and differences in working culture to lead to confusion and delays. A number of specific instances that occurred suggest that shop-floor know-how concerning how to meet the strict quality requirements for nuclear engineering was inadequate for this project. Assuming the teams represent the best on the continent, the errors seen have worrying implications for the levels of expertise within Europe.

To begin with, the concrete floor slab for the reactor building was cast with concrete of incorrect composition. The error was spotted and the composition changed during the casting, but the floor slab is still too porous in places.<sup>4</sup>

The containment building for the reactor has a wall made out of armoured concrete covered by a steel shell. The quality of the welds holding the steel armour together was not properly checked; when an employee notified the management of the problem, he was duly sacked.<sup>5,6</sup> The steel shell had not been

welded using specified methods and was based on obsolete blueprints. Part of the shell was damaged when in store at the site.<sup>7</sup> The result of all this was that ad hoc patchup measures were taken. This inevitably raises doubts as to the structural integrity of the containment building.

Of the four main pipes within the primary cooling circuit, three were found to have been manufactured using steel with too large a grain. The pipes had to be torn out and cast anew, but in welding the new pipes in place, cracks in the welds have appeared.<sup>8,9,10</sup> It is not clear whether these cracks have arisen because of inappropriate materials or wrong methods.

Another problem, as yet still unresolved, concerns the automatic control system. An unconditional requirement of the contract stipulated that there should be two completely independent control systems that can work in all circumstances. The Finnish Radiation and Nuclear Safety Authority (STUK) and the French Autorité de Sûreté Nucléaire (ASN), which are overseeing the construction of a second EPR at Flamanville, together with the British Health and Safety Executive (HSE), which is looking at the EPR design for possible approval in the UK, have issued a joint statement to the fact that the proposed design for the control systems does not lead to sufficient independence of the two systems.<sup>11,12</sup> They state that the systems are too dependent on computers and electronic networks, which could lead to fatal vulnerability in the case of computer malfunction. Furthermore, they say that the highest-level control systems are not sufficiently well insulated from lower-level control systems, which might mean that failures in lower-level systems could incapacitate the highest level systems. These authorities have called for a redesign of the automatic control systems, but none has so far been forthcoming.

### Adventures still to come

Undeterred by the setbacks experienced at Olkiluoto 3, the Finnish nuclear lobby has been pressing for more new reactors. In 2009, three applications for new nuclear power stations were submitted to the government. In spring 2010, the government proposed the approval of a decision-in-principle for two of the applications: a fourth reactor at Olkiluoto for TVO, and one for the consortium Fennovoima, one partner of which is the German E.ON. The latter application was clearly favoured on regional and possibly also political grounds: Fennovoima promised to build the station in northern Finland, a region hit hard by the recession and suffering high

unemployment, but showing strong support for the major party in the present coalition government, the Centre Party. The main argument presented by the nuclear lobby, however, centered this time on the benefits of nuclear power in an energy mix designed to minimise climate change by curbing greenhouse gas emissions.

The submission by the campaign group for which I work, Technology for Life,<sup>13</sup> to the public hearings on the decision-in-principle pointed out that all existing and planned nuclear power stations could be replaced by a large number of small-to-medium sized biofuel-burning power plants (burning mainly forest residues). Such a scheme would have the additional advantages of generating local employment and being much less vulnerable both to sudden failures of generating units and to global resource shocks than the envisaged configuration of a small number of large units depending entirely on imported fuel. (Even if there are plans for opening uranium mines in Finland, there are none for building enrichment plants, which would be an impossibility given the present national and international political situation). I repeated our arguments in front of the parliamentary subcommittee in charge of preparing the decision for parliament, but our arguments, as well as those of many other organisations, fell on deaf ears. On 1 July 2010, parliament voted in favour of the decision-in-principle to build two additional power reactors. Thus Finland is set for more nuclear adventures.

During the debates, it struck me that one of the major reasons for the success of the nuclear lobby in a small country like Finland is the narrow base of experts (in this case, nuclear engineers). The small numbers (just a few dozen) of them that we have frequently change employer, from power utility to the government's Ministry of Employment and Economy, and then to the safety authority STUK, and to the State Technical Research Center VTT, which is the first to be called when the administration needs advice on matters related to technology. The result is that both the watchdogs and those being watched speak with one voice, making it hard for genuinely independent opinions to be heard. (At times STUK has made critical comments, but only after mounting public pressure following disclosures of malpractice.) Ideally, the politicians should form their own opinions based on more general considerations, but in practice they seem to be intimidated by the unanimous opinions of the 'experts'.

Last month I employed a carpenter for repairs on our house. It turned out he had also been working on the

Olkiluoto 3 reactor. Based on what he had seen and on what he had been told by his workmates, he said that when the reactor starts up, he intends to be as far away from Olkiluoto as possible.

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## Nuclear renaissance in the west?

The 'renaissance' of nuclear power in other western countries is also proving problematic, especially where it involves the EPR plant.<sup>1</sup>

In **France**, a new EPR is being built at Flamanville. Construction began in December 2007, and is currently running at least two years – and perhaps as much as three – behind schedule. Costs have grown substantially, with the latest estimate being €5 billion – 50% higher than that originally quoted. Similar to the Finnish experience, problems have been encountered with the quality of concrete and welding.

In the **USA**, the programme intended to have new nuclear reactors online by 2010 is running at least eight years behind schedule, despite offers of government subsidies. The latest problem is that the partnership between French utility, EDF and US utility, Constellation to build EPRs has been dissolved due to concerns over high costs.

In the **UK**, the safety assessment of designs of two new reactor types – the EPR and the American AP1000 – encountered delays due to concerns about the lack of independence of the main control systems (see main article). The government is proposing that various 'financial support mechanisms' be introduced to enable new nuclear build to take place.<sup>2</sup> It claims these would not technically be subsidies (a claim disputed) – which would be contrary to government policy.

But in **China**, nuclear build is proceeding more swiftly. One reason is that the reactor designs under construction would not have passed the more stringent safety assessments required in western countries.

**Stuart Parkinson**

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## Research investment decisions: time for change

**Helen Wallace highlights the failure of the biotech economy and argues that decisions on R&D investments should be made more democratic and accountable.**

Are you concerned that some scientific research gets funded while other research, which may be more useful or important, does not? How are such decisions made and could they be made in a way that is more democratic and accountable, brings greater benefits to society and at the same time preserves important roles of science, such as improving understanding and informing policy?

Following the credit crunch, there has been much debate about what should be cut and by how much. Scientific institutions, such as the Royal Society, are arguing that slashing science spending by too much would damage the economy. Few would disagree that society needs to invest in research and development, including science and technology. But, however big the pot of public money is for science, who should decide how it's going to be spent? What are the right investments for our future? And what should the relationship be between these decisions and R&D investments made by the private sector?

SGR has done much to highlight and critique the influence of the corporate and military agendas on universities and science funding in the UK. Other organisations, such as Fondation Sciences Citoyennes in France, are actively engaged in making the European science agenda more democratic. As part of a contribution to this debate, GeneWatch UK has recently completed a major investigation of funding decisions in the biosciences, funded by the Joseph Rowntree Charitable Trust.<sup>1</sup> The report analyses the current research funding system, and argues that researchers and civil society organisations need to work together to create a system that is more democratic and accountable and delivers greater benefits for society as a whole.

The report's analysis focuses on public research funding for the biosciences in the UK and the European Union. Its starting point is that research funding priorities (at the level of overall programmes, rather than individual applications) are *political* decisions, about how to best spend public money, which institutions to support and what incentives to provide to researchers in academia and industry.

### The knowledge-based bio-economy

Looking at the biological sciences, the report describes how the idea of the 'knowledge-based bio-economy' (KBBE) has become a key driver of research investment in Europe and worldwide. This vision of the future assumes the biosciences and biotechnology will be a major driver of economic growth and at the same time will deliver technical solutions to health, agricultural, social and environmental problems.

In order to stimulate a new bio-economy, significant financial and political investments have been made. Scientific institutions and funding systems have been re-structured and new systems of incentives for 'innovation' have been devised. Their aim has been to reward researchers who secure patents and venture capital, and who collaborate with the private sector to create 'spin-out' companies and commercialise new products, based on biological knowledge or biologically-based production systems.

Structural changes to R&D systems and policies designed to exploit the potential of biotechnology and the human genome began in the US under the Reagan administration. These changes were mirrored by the Thatcher and Major governments in the UK, and by the European Commission (EC), which identified biotechnology as a key 'technology platform' in a new knowledge-based economy.

In Britain, the New Labour Government, elected in 1997, invested heavily in the KBBE as the presumed basis of future competitiveness with emerging economies in China and India. The funders of New Labour known as the 'biotech barons', and other key supporters of this idea, were appointed to task forces designed to identify the policies needed for future competitiveness. They promoted the idea of a 'genetic revolution' in both health and agriculture, and advocated policies that strengthened protection for intellectual property (IP), opposed regulation, and attempted to create the 'informed consumer' (presumed to be convinced of the benefits of GM crops, and to identify collection, storage and analysis of their DNA as major benefits to their health and to society). In the UK alone, at least 60 Government policy initiatives and reports were commissioned to support and develop the KBBE over 15 years, with many more initiatives focused on the broader context of the knowledge-based economy in general.

The information contained in medical records stored in the NHS was identified as Britain's 'unique selling point' (USP) in the knowledge-based economy, and a

plan to create a central database of electronic medical records ('the Spine') in the NHS was adopted and funded at a cost of £12 billion. The idea was to replicate the DNA database of the Icelandic population being built by DeCode Genetics, and ultimately to introduce gene screening for the whole population, allowing the genetic 'prediction and prevention' of common diseases, such as heart disease and cancer. The concept of a 'genetic revolution' in both health and agriculture was promoted at the highest levels in the British Government. For example, it was highlighted in the then Prime Minister Tony Blair's speech at the joint announcement with President Clinton of the completion of the first draft of the human genome in June 2000, and again in Blair's major speech on science to the Royal Society in 2002.

### A lack of benefits

However, in practice, the benefits of the bio-economy to the UK and EU have been extremely limited:

- The net value of the bio-economy worldwide has been estimated by a Harvard University researcher and from the industry's own figures to be zero or negative, with only two US medical biotech companies (Amgen and Genentech) and one US agricultural biotech company (Monsanto) making significant profits.
- Only two types of GM crops have been commercialised on any scale: insect-resistant and herbicide-tolerant. These crops are grown largely in North and South America for use in animal feed and (subsidised) industrial-scale biofuels (agrofuels). Concerns remain about environmental impacts, food safety, liability for contamination of non-GM crops and foods, and the extent of corporate control of seeds exercised through patents and licensing agreements.
- A number of new biotech drugs have been developed, but Britain's only blockbuster biopharmaceuticals were discovered in the 1980s. Most new biotech 'spin-out' companies from UK universities are never profitable and are a net drain on the economy: according to the Office of Life Sciences they employ only 1,000 people in total.
- Genetic tests of multiple genetic factors are poorly predictive of common diseases and most adverse drug reactions, and none are sufficiently predictive or useful to meet medical screening criteria for use in the general population. The idea that genetic make-up would be highly predictive of who developed cancer was originally promoted by the eugenicists who went

to work for the tobacco industry in the 1950s and is based on a flawed view of the role of genes and environment in common diseases.<sup>2,3</sup>

Billions of taxpayers' money has been spent but the UK and EU have failed to develop new competitive economies, as a result of reliance on the idea that a new biotech economy would be developed. More practical solutions to existing problems have been neglected, as has much R&D that is not seen as contributing to the KBBE. For example, the agricultural extension services in England and Wales, which used to provide on-the-ground scientific support to farmers, were cut in order to prioritise laboratory-based research. Public sector plant breeding, which used to generate income as well as bringing significant international economic benefit and increases in food production, has been abandoned in favour of GM crop research, which has delivered zero return. Alternative 'on-the-ground' approaches to improving health and farming have been sidelined, starved of funding, or even axed altogether, leading to significant opportunity costs due to the failure to implement existing knowledge and best practice in areas such as public health and farmland management.

This does not mean that biotechnologies and the biosciences cannot contribute to health, agricultural or sustainability objectives, or to the economy. However, it does mean that it is necessary to re-think the whole idea of the KBBE and its role in the knowledge-based economy in general. The key features of the KBBE distort the market in ways that make research investment decisions unaccountable to either market forces or democratic processes. Problems include the following:

- 'Pre-competitive' subsidy, via research funding decisions, lacks accountability and transparency and hides political and commercial commitments to the bio-economy and to imaginary markets presumed to be created in the future;
- Public-private partnerships and public procurement policies shift investment risks and externalities onto the taxpayer, intermediaries such as farmers, doctors and health services, and members of the public;
- 'Light-touch' regulation fails to address market failures and protect health or the environment;
- A 'cycle of hype' drives research investment decisions, which become disconnected from reality;
- Policy commitments are not debated but are instead 'sold' to the public as if they were the



inevitable consequences of science and progress.

## Reforming the system for science funding

The GeneWatch UK report concludes that review of the research funding system should lead to a major overhaul. There should be significant reforms to improve the scientific and technical advice available to the UK Government and to the European Union, reform to the patents system, and re-structuring of the funding institutions and systems of incentives for researchers. Objectives should include:

- More democratic decisions about research funding priorities and a more diverse research agenda;
- Greater accountability and scrutiny of major research investment decisions – including economic assessments and appraisals, scrutiny of scientific and technical assumptions, and active steps to prevent political 'entrapment' in research agendas based on false assumptions and misleading claims;
- A role for public engagement in setting research questions and priorities – including consideration of a variety of alternative approaches to addressing problems, and greater democratic accountability for science policy decisions;
- More public engagement in research itself, involving closer co-operation between universities, communities and civil society organisations;
- More funding for research that does not necessarily benefit large corporations but may deliver other benefits, including economic ones (for example, public health research, and research into improving agro-ecological farming methods);
- Funding for 'counter-expertise' and multi-disciplinary research that can identify long-term scientific uncertainties and regulatory gaps;

- Ensuring a thriving scientific culture that can analyse, critique and develop the theoretical concepts that often underlie decision-making, and that are key to developing new understandings;
- A commitment to take public opinions into account in decisions about science and innovation, including methods to ensure full consideration of the broader social, environmental and economic issues associated with adopting particular approaches and technologies.

Making these changes happen will not be easy but, despite the cuts, there are signs of a growing recognition throughout society that our political systems need to change if we are to find answers to the problems that we face. Making the right investments in research and development is central to addressing all the major national and global challenges, including tackling hunger and obesity and creating a sustainable future. These decisions deserve greater public scrutiny and accountability.

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## Energy and climate change – time for hope or concern?

**Some recent developments in the energy and climate change fields, both in the UK and internationally, have given rise to optimism while others are major cause for concern. Martin Quick investigates.**

International climate negotiations are proceeding at a snail's pace, and the US President is struggling to get new legislation on climate change through congress. But the global renewable energy industry is booming as new studies highlight its current and future potential. Added to this, the new UK government claims it will be the 'greenest ever'. Among these conflicting indicators, where are things really moving?

### Assessing UK and European energy resources

A major UK study,<sup>1</sup> *The Offshore Valuation*, coordinated by the Public Interest Research Centre, involving government departments and industry, shows the huge potential for renewable energy from the UK marine environment, mainly from offshore wind. A scenario exploiting just under 30% of the resource could, by 2050, produce energy equivalent to that extracted from North Sea oil and gas, and make the UK a net electricity exporter. The higher output scenarios assume strong grid connections to mainland Europe and technologies that provide energy storage, to cater for intermittency (see *Roadmap 2050* below). The net present worth (NPW) – the value to the nation of the energy generated minus the costs, relative to not exploiting the offshore resources, and brought back to a common date by a notional discount rate – is evaluated for different scenarios. The NPW is positive except in cases where future energy prices are assumed to be very (unrealistically?) low. Where energy prices are high, the NPW is large, up to more than £300 billion.

The European *Roadmap 2050* has been produced by a group of energy experts funded by the European Climate Foundation.<sup>2</sup> This study develops a number of scenarios for an 80% reduction in CO<sub>2</sub> emissions in Europe by 2050. Major improvements in energy efficiency are fundamental to the concept. Long distance grid interconnections (including high voltage DC links with their very low power losses over long distances) are needed to link the energy sources to centres of demand. To allow for industrial and other uses that cannot be completely de-carbonised, the study assumes virtually complete de-carbonisation of electricity production, by scenarios with different combinations of renewables, carbon capture and

storage (CCS) and nuclear power, including a scenario of 100% renewables. A variety of renewable sources is assumed, including a major contribution from solar energy in southern Europe and a large wind capacity (onshore and offshore) in the north. A high degree of electrification of heating and transport is assumed. Off-peak charging of electric vehicles, and heat-pumps with hot water storage on a community or district scale can provide energy storage and demand shaping to ease the incorporation of a high proportion of intermittent renewables. Proposals of this kind, including some with links with North Africa, have significant support within the various EU institutions.

The Centre for Alternative Technology has published an extended and updated version of its report *Zero Carbon Britain*.<sup>3</sup> This proposes developments that could make the UK a net zero carbon emitter by 2030. Unlike many other reports, it starts by assessing how to bring down energy consumption before considering how this demand could be met by low carbon methods of energy production. It has a significant section on land use and agriculture, an important sector when one is aiming at such a stringent target. The report also discusses methods of changing public attitudes, necessary to achieve the lifestyle changes involved. To make the huge changes in energy and transport infrastructure proposed within 20 years is an extremely ambitious target, but something of this order is needed if we really are to reduce the risk of severe climate change.

There is a large degree of overlap between these studies. They would require massive changes to energy infrastructure and have high upfront costs, but would lead to long-term benefits, not only in relation to greenhouse gas emissions, but also for the economy and international security in a world where oil is likely to be in very short supply. The German Ministry of Defence has produced an assessment of the risks in a post 'peak oil' world, indicating the likelihood of conflicts and breakdown of societies if the world has not moved substantially away from dependency on oil and gas.<sup>4</sup> The UK Ministry of Defence and the US Pentagon have similar concerns in relation to both resource shortages and severe climate change.

In order to meet the targets for greenhouse gas emission reductions that these reports aim at, it is essential that action is taken early. This will require a major effort to persuade populations to support the huge changes needed – not least in a European context, where major power-line routes would be

needed in sensitive areas like the Pyrenees. Given the wide range of objectives to be met, changes to the way projects are implemented and financed are likely to be needed to create an overall system that delivers the necessary results – pure reliance on market forces is very unlikely to deliver.

### Energy cost trends and alternative sources

Any study looking over such a long timescale is bound to have major uncertainties in the relative costs of different scenarios. The cost of wind turbines (especially offshore) has recently increased due to bottlenecks in the supply chain. In the past few years, the capital costs of nuclear power stations have grown considerably. For example, up until recently in the USA, construction costs were being quoted by industry sources at \$2,000 per kilowatt (kW), but more recent analysis suggests that the real figures could be as high as \$8,000/kW.<sup>5</sup> This makes it much less likely that any new nuclear programme in the UK could meet the government's stated criterion of no public subsidy. Timetables and costs for the completion of nuclear plants in countries outside East Asia have been considerably extended. The cost of photovoltaic electricity generation is falling rapidly with new technologies and greater supplies of high purity silicon. In some areas with high levels of sunshine, utility scale installations are being constructed.

Meanwhile, the BP Deepwater Horizon oil rig disaster in the Gulf of Mexico has starkly shown the risks of 'unconventional' oil extraction from hard-to-reach reserves, as easily accessible sources become depleted. The environmental impact and high energy use in extracting oil from tar sands is also well known. Even exploiting conventional reserves can cause major problems. In the Niger delta, it is estimated that, on average, oil equivalent to the Exxon Valdez spill has leaked every year and, combined with flaring, has caused massive health problems for the local population.<sup>6</sup> Overall, particularly if the industry has to clean up its act or is prevented from operating in environmentally sensitive areas like the Arctic, it is likely the price of oil will escalate in the near future.<sup>7</sup>

There is a somewhat different picture for natural gas, where extraction of 'tight' gas from shale deposits in the USA is extending the resource base.<sup>8</sup> However, there is some opposition to this, due to concerns about pollution of underground water resources. Exploration of the potential in the UK and mainland Europe is now underway.

Although natural gas is the least carbon intensive of the fossil fuels, most assessments of climate change risks indicate that the need to limit greenhouse gas emissions is a tighter constraint than the ultimate availability of oil and gas. Hence, even if gas supply does become more abundant in the medium term, increasing dependence upon it could still help to push global temperatures to dangerous levels. Furthermore, it should be remembered that significant gas reserves lie in politically unstable parts of the world, so access is less than certain.

Carbon capture and storage – where the exhaust gases from carbon emitting plants are ‘captured’ and then piped to underground storage facilities – continues to be developed towards large-scale commercial operation. However, this development still seems likely to be lengthy. CCS involves significant extra costs and loss of efficiency, although innovative technologies might minimise these. The UK government has recently scaled back its plans for CCS demonstration plants (see below).

For some years, there have been claims that there is huge potential for oil extracted from algae, with very large production from a given area – side-stepping many of the problems related to conventional biofuels. Cultivation in open ponds would seem to be the cheapest method, but this has the problem of the desired species becoming contaminated with unwanted plants. The alternative is the use of isolated ‘bio-reactors’ designed to maximise the exposure to sunlight of the algae ‘soup’, and with the possibility of enhancing production by fertilising the plants with carbon dioxide from power plants. Many of the trials have so far run into problems of harvesting. However, there is growing interest among a range of influential oil users, not least the US military,<sup>9</sup> so development may speed up.

## Climate negotiations and global rivalries

The outlook for reaching international agreement on further curbs on greenhouse gas emissions continues to look doubtful. The very limited agreement at Copenhagen in December 2009, after such intense negotiations, has led to a major loss of diplomatic momentum in the months since. The Cancun negotiations a year later only made limited further progress. A key problem continues to be the severe difficulty in passing legislation through the US congress to curb emissions. Without such legislation, President Obama is unwilling to sign up to legally binding targets at an international level. China, in turn, will not sign up to targets without the USA – especially as its emissions per head of population are considerably lower. With the two biggest carbon emitters at an impasse, the outlook for legally binding international targets does not look good in the near future.

However, there are developments within both the USA and China that give more reason for hope. Obama’s \$150 million clean technology fund is helping to support developments in renewable energy. Meanwhile, China is surging ahead with the development and deployment of renewable energy.<sup>10</sup> China is now the world leader in the production of wind turbines, solar photovoltaics, and solar hot-water panels, and is making substantial efforts to improve its rather low levels of energy efficiency. Renewables now account for 9% of the country’s total primary energy use – a considerably higher proportion than in, for example, the UK. Notably, a significant fraction of China’s emissions is due to the embodied energy in products exported to wealthier nations. Hence, decisions on economic policies and lifestyle in, for example, the USA, UK and mainland Europe can have a significant effect on the total emissions of China.

## Is the UK on track?

In the last few months, there have been a whole range of important developments related to the UK’s low carbon sector. In September, the world’s largest offshore wind energy development – the 100-turbine Thanet wind farm – opened off the Kent coast.<sup>11</sup> With this, the UK’s offshore wind capacity became the largest in the world. Meanwhile, Scotland is on course to exceed its target of generating 31% of its electricity from renewable sources by 2011, prompting the government to revise its 2020 target to 80%.<sup>12</sup>

However, the UK as a whole has still a long way to go to meet its targets for expanding renewable energy, improving energy efficiency and reducing greenhouse gas emissions. The coalition government’s comprehensive spending review provided some good news and some bad news.<sup>13</sup> A £200 million fund for developing low carbon technologies – especially measures to help offshore wind – was retained. The Feed-in Tariff and Renewable Heat Incentive – which support small-scale renewables – were also retained. However, plans for a ‘Green Investment Bank’ were much less ambitious than is needed. Only one of the originally proposed four CCS demonstration plants will receive funding in the short-term. Also disturbing was the announcement of large cuts to spending on ‘Warm Front’ home energy efficiency measures. However, new legislation to improve energy efficiency and energy security markedly is being proposed.<sup>14</sup>

## Concluding comments

It is important to remember that the low carbon economy offers enormous potential, not only for major improvements to energy security and large reductions in carbon emissions, but also for generating employment in these economically straitened times. The UK is finally starting to reap this potential, but the government and public commitment over the next few years will be crucial.

Martin Quick CEng is a retired mechanical engineer who worked in the energy industry. He is also a former member of SGR’s National Co-ordinating Committee.

13

## SGR Conference and AGM 2011

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## STOP PRESS

On 16 December 2010, the UK government announced new proposals for reforms to the electricity market, designed to accelerate the introduction of low carbon energy – see: <http://www.decc.gov.uk/>

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## Census 2011 – who will have access to the data?

**With a subsidiary of major arms company, Lockheed Martin, being a lead contractor for the UK's 2011 census, Geoff Meaden asks if the data collected will really be secure.**

In March 2011, Britain's once-a-decade national census will be carried out. The aim is to record a wide range of information on every person in every household in the United Kingdom, in order to help guide provision for local and national public services. To this end, the census is compulsory. A little-known fact about the census, however, is that the main contract, including data capture, was won by a subsidiary of US corporation, Lockheed Martin, which also helped with the 2001 census.<sup>1</sup> Lockheed Martin is the world's second largest weapons manufacturer<sup>2</sup> and makes Trident nuclear missiles for the USA and UK. It also holds a one-third share in the management contract for Britain's Atomic Weapons Establishment (AWE) at Aldermaston, which is undergoing redevelopment as the government pushes towards replacing its nuclear weapons system. A recent growth area for Lockheed Martin has been 'intelligence and surveillance' and, as part of this work, the company has moved into data collection. Vice-President, Lorraine Martin is reported to have said, "We want to know what's going on anytime, any place on the planet".<sup>3</sup>

There are serious concerns that the data gathered by the census may fall under the US Patriot Act if a US-owned company is involved in its collection and, as

such, there would be a legal requirement for the company to make the information available to their government. Additionally, there is concern that the census information may be made more widely available in the USA, not only for law enforcement purposes, but also to private entities. We have no legal precedents as to whether, under the pretext of national security, this census information can be acquired by the US government. The UK Office of National Statistics claims that our data will be safe<sup>4</sup> but the UK government has demonstrated on several occasions lax security arrangements in the management of digital data containing personal records.

The data gathered by the ten-yearly census is easily the most comprehensive data set in the UK, and it is used extensively for various socio-economic purposes. During the 2001 census 6% of households in the UK failed to comply with submitting their household information.<sup>5</sup> This means that about three million people were 'unaccounted'. Given that there is significant distrust among people of British government connections to large corporations, having Lockheed Martin involved in gathering census information is hardly likely to encourage compliance. This will result in increasingly unreliable census data. One wonders how many US citizens would be happy for a British weapons manufacturer and surveillance company to collect their census data!

By contracting Lockheed Martin to do this work, what was a perfectly respectable and useful socio-

economic activity may now be perceived as part of the security world of intelligence and surveillance. There will be a range of ethical reasons why people may not wish to comply, from concerns about the security of their personal data to not wishing to boost the profits of a weapons manufacturer. So I hope that we in the science and technology communities will give support to people who do not wish to comply with the 2011 UK national census, and that we will campaign to get this contract terminated in the future.

**Dr Geoff Meaden has recently retired as Principal Lecturer, Department of Geographical and Life Sciences, Canterbury Christ Church University, Canterbury, Kent.**

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## Beyond Trident: AWE prepares for the future

**Peter Burt examines the major redevelopment of the Atomic Weapons Establishment, and points out how new facilities could allow the UK to sidestep international controls on nuclear weapons development.**

For 60 years, the Atomic Weapons Establishment (AWE) has been responsible for providing and maintaining the warheads for the UK's nuclear weapons. The Establishment, based on two principal sites at Aldermaston and Burghfield in West Berkshire, has designed, tested, and built all the UK's nuclear weapons including, most recently, the current arsenal of Trident warheads. AWE's work covers the entire life-cycle of nuclear warheads: from initial concept, assessment and design, through to component manufacture and assembly, in-service support, and eventual decommissioning and disposal.<sup>1</sup>

AWE's current role is based mainly around maintenance and surveillance of the Trident warhead arsenal. Around 200-225 warheads were produced for Trident, based on the US W-76 Mk4 design, with production ending in 1999. To ensure that the stockpile remains reliable and 'safe' and that weapons function as they are designed to, deployed warheads are returned to AWE on a regular cycle to allow inspection and replacement of ageing components. AWE also operates an extensive research and development programme aimed at generating the data needed to upgrade Trident warheads and also develop a successor to the current warhead design if required in due course.

Although the 2006 White Paper on the replacement of Trident stated that "decisions on whether and how we may need to refurbish or replace this warhead are likely to be necessary in the next Parliament,"<sup>2</sup> the new government announced in the recently published Strategic Defence and Security Review (SDSR) that a replacement for the current Trident nuclear warhead will not be required until at least the late 2030s. The SDSR also announced that the total number of warheads in the UK's nuclear arsenal (both operational and in reserve) will be decreased from around 225 to not more than 180.<sup>3</sup> These announcements set the context for the work that AWE will be undertaking over the years ahead.

### **Paving the way for the next generation of nuclear weapons?**

The SDSR and the current squeeze on public spending are forcing a rethink of the Labour government's plans for AWE. In July 2005 John Reid,



Aldermaston Women's Peace Campaign

**The Orion nuclear test laser building at AWE Aldermaston.**

then Secretary of State for Defence, announced: "Agreement has been reached with AWE Management Ltd to take forward a programme of investment in sustaining key skills and facilities at the Atomic Weapons Establishment. This will include the provision of necessary extra supporting infrastructure ... The purpose of this investment of some £350 million over each of the next three years is to ensure that we can maintain the existing Trident warhead stockpile throughout its intended in-service life."<sup>4</sup> This was the first public mention of the Nuclear Warhead Capability Sustainment Programme – a programme that had its inception in 2002 but was not announced until three years later, by which time well over £100 million had already been spent on upgrade work at AWE.

John Reid's statement stressed that investment work at AWE was needed to replace ageing facilities needed to maintain the existing Trident warheads and, at the same time, recruit new scientists so that AWE could retain its skills base. However, the investment programme is also essential in allowing joint warhead research work with the USA to continue, and the new facilities will allow AWE to develop and build a new warhead if asked to in future. Worryingly, it sends out a signal that the UK is ready to retain its nuclear weapons capability for the next 50 years, regardless of the commitment under Article VI of the Non-Proliferation Treaty, which requires nuclear weapon states to "pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date."<sup>5</sup>

AWE's site development strategy maps out an extensive infrastructure upgrade programme, which will almost entirely rebuild the Aldermaston and Burghfield factories. In part, the work is needed to replace facilities dating from the 1960s and 1970s, which do not meet modern building and safety standards, but it will also

upgrade and update AWE's scientific research facilities. The investment programme will require the construction of a number of large, complex, facilities which will take up to ten years to design, build, and commission. According to AWE's staff newspaper AWE Today: "At its peak the construction work will make AWE one of the largest construction sites in the UK – similar in scale to the Terminal 5 project at Heathrow."<sup>6</sup> Expenditure on AWE's investment programme has rocketed upwards since John Reid's announcement in 2005, and will reach around £1 billion per year between now and 2013.<sup>7</sup>

Work already is nearing completion on a number of projects at AWE. New office space has been constructed, partly to provide accommodation for the new staff who have been recruited, and AWE has recently taken delivery of three new supercomputers, each able to perform trillions of calculation per second for modelling the events that take place inside a nuclear warhead as it explodes. Orion,<sup>8</sup> AWE's new £183 million nuclear test laser facility, is expected to undertake its first firing next year, as part of a programme of plasma physics research aimed at heating materials to the extreme temperatures created during a thermonuclear explosion.<sup>9</sup>

Construction work is well underway on a number of other projects: manufacturing facilities for high explosives and conventional items at Aldermaston, and a small-scale components manufacturing facility at Burghfield. Construction of a brand new warhead assembly-disassembly facility, Project Mensa, has begun at Burghfield. This is a controversial location because, although the project will replace an existing facility that faces severe safety challenges and will play a vital role in decommissioning warheads when they are taken out of service, the Burghfield site is situated in a flood risk area and is close to the urban area of Reading.

## Undermining international arms control?

At Aldermaston planning permission has been granted for Project Pegasus, a new facility for processing and storing enriched uranium, and also for Project Hydrus, a new hydrodynamics research facility.<sup>10</sup> AWE undertakes hydrodynamics research to test the properties of materials under immense pressures, which cause solid materials to exhibit fluid-like behaviour. Explosives are used to generate high-pressure shocks in warhead materials and models, and powerful high speed flash x-ray machines capture images of the resulting impact.

AWE's promotional literature emphasises the role hydrodynamics research plays in ensuring the safety and reliability of ageing warheads. However, data from hydrodynamics experiments could also be used to enable warhead upgrade work or even design of a new warhead. AWE's hydrodynamics research, like much of its warhead physics research programme, generates data that was historically obtained from underground nuclear weapons tests, and is thus aimed at allowing the UK to sidestep the controls of the Comprehensive Test Ban Treaty (CTBT). Although a portion of the research time on the Orion laser has been allocated to universities to allow laboratory astrophysics and other civil research work to take place, the Ministry of Defence has indicated that Project Hydrus will exclusively support defence activities.<sup>11</sup>

The current squeeze on public spending has forced the government to look again at the AWE investment programme, which is currently under review to establish how savings might be made. Hydrodynamics research will be a major area affected by the squeeze. This is because of the recently published treaty between the UK and France on co-operation over nuclear weapons research, which states that the two nations will set up a joint hydrodynamics research facility at Valduc in France rather than each build their own individual facilities, thus saving money for both nations.<sup>12</sup> It appears likely that as a result the scope of Project Hydrus will be scaled back considerably.

### The big decision

Postponement of the decision on whether to develop a new generation of UK nuclear weapons has raised questions about AWE's role over the years ahead. Rather than undertake development work on a new weapon, AWE now finds itself in a position where its role will be confined to stockpile stewardship and decommissioning for the short and medium term

future. The Establishment currently appears to be over-resourced to focus on just these tasks, and is seeking to diversify its role into other aspects of management of the nuclear weapon cycle and national nuclear security programmes.<sup>13</sup>

However, at some time in the future, the government will have to make a decision on whether or not to develop a new warhead design. A warhead replacement programme would cost £2-3 billion at current prices, and ministers would have to make a choice between giving the go-ahead to design of an untested new warhead, which could never be validated without breaking the CTBT, or retaining the current Trident warhead, which is reliable but ageing.

Paradoxically, new warheads may well end up being less safe and reliable than existing warheads. Designing and building new nuclear warheads without testing them is risky, even with the sophisticated models of AWE's warhead physics programme. US analysts Sidney Drell and James E Goodby have pointed out that "it takes an extraordinary flight of imagination to postulate a modern new arsenal composed of such untested designs that would be more reliable, safe, and effective than the current US arsenal based on more than 1,000 tests since 1945."<sup>14</sup>

In contrast, the reliability of the existing warhead arsenal can be guaranteed using engineering-based inspection and re-manufacturing techniques. This requires regular inspection and rebuilding of the weapons, detaching and checking each of the thousands of individual components that make up a warhead and its subsystems. If a part shows any problems or signs of deterioration, it is simply replaced by an identical part. Stocks of identical parts can be created through re-manufacturing parts according to their original specifications. As long as the basic weapon design is not changed, this engineering approach will continue to work. The method (sometimes referred to as curatorship) is a tried-and-tested technique, being the method used to maintain the USA's stockpile of nuclear weapons during the Cold War.

A programme to develop a new nuclear warhead design at AWE is not needed and should not be given the go-ahead by a future government. Rather than increasing the capability of nuclear weapons, the current arsenal of warheads should be 'frozen in time' – maintained and serviced but without any upgrade in performance – until the time comes to retire them from service. Investment in research

facilities intended to cheat the CTBT should be cancelled, and work at AWE that supports global arms control – research into disarmament verification techniques and warhead decommissioning – should be stepped up. With President Obama's arms control agenda beginning to bear fruit, prospects for multilateral nuclear disarmament look promising, and this area of work must be the future for AWE.

**Peter Burt is Director of the Nuclear Information Service: <http://nuclearinfo.org>**

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## Climate change – are we still sure?

**Climate scientists have had a poor press in recent months. Stuart Parkinson investigates whether this is a sign that the scientific evidence of climate change is less robust, or just media misrepresentation.**

Over the last year or so, climate science has been heavily criticised in the media, especially in the UK and USA. Particular criticism has been directed at researchers at the Climate Research Unit at the University of East Anglia (UEA) and also at the Intergovernmental Panel on Climate Change (IPCC), which summarises the evidence of climate change, its causes and its potential effects, for international policy-makers. So, has the criticism been justified? Is the scientific evidence on the threat of climate change less robust than previously claimed?

### Stolen emails and 'hidden' data

The first wave of criticisms surfaced in November 2009 in the run-up to the Copenhagen climate negotiations, when about a thousand private emails were stolen from a server at UEA and released online.<sup>1</sup> These emails included correspondence between some leading climate scientists over the previous 13 years, including the Director of UEA's Climate Research Unit, Prof Phil Jones, and Prof Michael Mann of Pennsylvania State University.

Of the emails released, a small minority contained comments that were used to question the integrity of the scientists involved. For example, one of most widely circulated emails (written back in 1999) included the comment, "I've just completed Mike's Nature [the science journal] trick of adding in the real temps to each series for the last 20 years (i.e. from 1981 onwards) and from 1961 for Keith's to hide the decline".<sup>1</sup> Using a "trick" to "hide the decline" was interpreted by climate sceptics as evidence that data had been massaged to hide a true decline in global temperatures.

However, the explanation for these comments was far more mundane. The 'trick' referred to was simply shorthand for 'an effective methodology for processing the data,' and the 'decline' being 'hidden' was a well-known (at least within climate science circles) problem with a particular tree-ring data-set, which diverged from other comparable temperature data-sets.<sup>2</sup> Other 'suspect' comments within the emails were similarly innocuous, as a number of climate scientists pointed out,<sup>3</sup> although a few caused raised eyebrows due to their belligerent tone.

Nevertheless, the media furore caused by these emails – dubbed 'climategate' – was such that four separate investigations were carried out into the concerns during 2010. Three were carried out in the UK – one by the House of Commons Science and Technology Committee, and two commissioned by the UEA but carried out independently.<sup>4,5,6</sup> These focused mainly on the conduct of researchers at the Climate Research Unit, with the third review in particular going into considerable detail. The fourth, meanwhile, was carried out in the USA and focused on Michael Mann's research.<sup>7</sup>

The reviews rejected allegations that climate scientists had colluded to withhold scientific evidence, interfered with the peer-review process to prevent dissenting scientific papers being published, deleted raw data, or manipulated data to make the case for climate change appear stronger than it is. There was, however, some limited criticism, especially regarding inadequate responses to data requests under the Freedom of Information Act.

### Glaciers and the IPCC

With the debate about climategate still reverberating around the web, climate scientists were hit by another allegation in mid-January 2010. This one was directed at the IPCC and, in particular, a claim in its landmark 2007 report that Himalayan glaciers could melt away by 2035. The IPCC quickly admitted that this was a mistake that had crept into a paragraph in volume two of the report, but argued that its overall conclusions concerning the problems of melting glaciers in the 'summary for policymakers' remained valid.<sup>8</sup> Indeed, volume one of the report had been accurate in its reporting of the research on glacial retreat in the Himalayas. As journalists questioned whether the mistake undermined the IPCC's credibility, vice-chair of the IPCC, Jean-Pascal van Ypersele, was quoted as saying, "I don't see how one mistake in a 3,000-page report can damage the credibility of the overall report".<sup>8</sup>

However, this was not enough to quell critics. Not only was this mistake used by numerous commentators to question the validity of the whole report, further allegations of IPCC 'mistakes' and improper conduct of climate scientists were made, especially in *The Sunday Times*, but also in some other British newspapers. The alleged mistakes concerned issues such as the threat to crop yields in Africa due to climate change, possible links between trends in natural disasters and climate change, and the vulnerability of the Amazon rainforest. As climate scientists pointed out – for example on the

*RealClimate* website – there was generally little substance to any of the criticisms.<sup>9,10</sup>

Let us take as an example the criticism of the IPCC claim that "up to 40% of the Amazonian forests could react drastically to even a slight reduction in precipitation." In an article in *The Sunday Times* at the end of January,<sup>11</sup> journalist Jonathan Leake alleged the claim was 'bogus', arguing that the IPCC had misrepresented research, and quoted British climate researcher, Simon Lewis, to back up his allegations. Unfortunately for Leake, Lewis filed a complaint stating that his views had been misrepresented in the article. *The Sunday Times* upheld the complaint, acknowledged that the article had incorrectly criticised the IPCC and removed the piece from its website.<sup>12</sup> Unfortunately, the retraction took place over four months later, so the damage to the credibility of climate science had been done.

To deal with the rising concerns about the accuracy of IPCC reports, the UN Secretary General requested the Inter-Academy Council (IAC), an umbrella group of many of the world's most prestigious science academies, to carry out a review of the IPCC's internal procedures. The IAC reported in August, concluding that "the IPCC assessment process has been successful overall".<sup>13</sup> However, it did make a series of recommendations to improve the robustness of future reports, including adopting clear procedures on conflicts of interest.

### Recent climate science

In amongst this frenzy of debate over the integrity of climate scientists, media reporting of climate science itself has taken a back seat. Nevertheless, the evidence continues to mount about the extent of the threat.

For example, papers in a special issue<sup>14</sup> of a Royal Society journal published online in November 2010 examine how quickly the world may reach 4°C of warming above the pre-industrial average, as well as the impacts this may bring. They conclude that a 'business as usual' scenario could yield such a change as early as the 2060s, with considerable impacts on, for example, water availability and crop yields.

Meanwhile, although the UK has experienced unusually cold temperatures during recent winters, the globally averaged temperature continues to be exceptionally high, with 2010 set to be among the three highest years on record.<sup>15</sup> Moreover, the decadal average of global temperature – a more

reliable indicator than annual average – has been markedly higher in the first decade of the 2000s than in any previous decade on record.

Another study that examined ‘expertise’ in climate science is also notable.<sup>16</sup> It analysed the views and publication records of over 1,300 climate researchers. Of those with highest rate of climate science publications, 97-98% were convinced that human activities were causing climate change. Sceptical researchers had much lower levels of expertise in the field.

## Sceptics and public opinion

If there is so little substance behind the media criticisms of the last year, one must ask how such stories became so prominent. A detailed examination is beyond the scope of this article, but one facet has certainly been the influence of leading free-market advocates and their allied think tanks, which oppose new regulations enacted in the name of climate change. It is notable, for example, that Richard North – fellow of the Institute for Economic Affairs – carried out the research for *The Sunday Times* article on the Amazon discussed above.<sup>17</sup> Meanwhile, former Conservative Chancellor, Nigel Lawson – who founded the climate sceptic organisation, the Global Warming Policy Foundation<sup>18</sup> – is frequently invited to give his views in the media. That is not to say that all climate sceptics are free-market champions, but without this very powerful lobby it is unlikely such a media storm would have been created. SGR has also highlighted the powerful role of the oil industry in supporting free-market think tanks in their promotion of climate sceptic ideas over the last two decades.<sup>19</sup>

How much has this corrosive media coverage undermined public belief in climate change, and support for action to tackle it? Results of recent opinion polls provide some interesting answers. One conducted in early 2009 by the University of Cardiff and Ipsos Mori showed that, while public concern about climate change has fallen, it was nevertheless still high – over 70%.<sup>20</sup> In addition, only 20% believed there was serious disagreement among scientists over whether climate change is caused by humans. Another poll, commissioned by BBC News at a similar time, showed that the increase in doubt over global warming was due to the cold winter and not the scientific controversies.<sup>21</sup>

## Conclusions

Reports in the mainstream media in the UK over the past year or so have given the distinct impression that evidence for the threat of climate change is less than clear. But an investigation of the facts behind the headlines, coupled with an examination of the academic research, reveals that this is anything but the case. While significant uncertainties in the science do exist, the defining aspects of the problem – that climate change is happening, that it is mainly caused by human activities, and that it is likely to have very serious impacts if left unchecked – remain solidly backed by the data.

Nevertheless, it is clear that attempts to discredit the science of climate change will continue. Although sceptics have had limited success so far, with more unusually cold weather this winter in the UK, their hand will be strengthened. Hence, organisations like SGR need to continue to challenge unbalanced media coverage. Meanwhile, although the basic evidence is robust, climate scientists do need to deal with some of the weaknesses in their research activities – especially concerning openness with data. These actions will allow us to overcome misinformation and thus keep up the pressure on policy-makers to take the necessary action to bring about a rapid reduction in greenhouse gas emissions.

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## Transport and land-use: time for a rethink?

**Hugh Barton reports on the results of a major academic research project into future urban form and transport, which throws uncomfortable light on some of the government strategies for tackling climate change.**

SOLUTIONS<sup>1</sup> is a recently completed £1.75 million research project that spanned five years and combined the expertise of five universities – Cambridge, Leeds, Newcastle, West of England and University College London. It was funded by the Engineering and Physical Science Research Council. The study – its name is short for ‘Sustainability Of Land Use and Transport In Outer NeighbourhoodS’ – modelled land-use and transport futures and found that, far from cutting transport carbon emissions, current government policies will lead almost inevitably to a significant increase.

SOLUTIONS’ strategic-level research involved modelling land use and transport futures up to 2031 in London and the greater South East, and in Tyne and Wear. Current regional and local planning strategies – including Regional Spatial Strategies, Local Development Frameworks and transport policies – were incorporated. The results from these models showed that total carbon dioxide emissions could increase by 34% in the South East and 10% in Tyne and Wear, casting serious doubt on the ability to achieve national targets for emission reductions.

The most alarming conclusion was that even if strategic land use transport policies are changed significantly – i.e. with development being much more compact or dispersed than at present – and congestion charges are imposed across all the major cities, the result is broadly the same: total carbon dioxide emissions will continue to increase. Essentially the reason is simple: the momentum of social and economic change is such that it overwhelms any benefits that might be gained from extra investment in public transport or a better balance between employment and housing. Therefore new solutions must be adopted.

The second major conclusion concerned housing supply and demand. In the London and greater South East region – accounting for over a third of the UK population – the research strongly backed the conclusions of the 2004 Barker review that strict containment of our cities is curtailing housing supply, at a significant economic, social and environmental cost. The over-reliance on brownfield development, often in the form of flats, together with greenbelts



that constrict urban growth and squeeze development into inappropriate locations, forces up housing prices, exacerbates social exclusion, increases travel distance and reduces economic competitiveness. The strong recommendation from SOLUTIONS is to find ways (despite the current economic difficulties) to open up new options for housing supply.

Results drawn from SOLUTIONS local level research, involving empirical analysis of local facilities and household travel in 12 suburban neighbourhoods, were also salutary. The studies showed that most recent developments, far from being an improvement on older localities, showed the most carbon-intensive behaviour. The level of car dependence for ‘local’ trips was 80% in some neighbourhoods, while others, older but socially quite similar, were only 40% car dependent. This has some (modest) implications for emissions, but huge implications for the level of physical activity. It suggests current policies and practice are creating ‘obesogenic’ environments, where sedentary lifestyles are implicitly encouraged.

It was also clear that the nature of intensification in suburbs is unpredictable: high-density brownfield development is occurring not only close to local centres and good public transport but also in less accessible locations, forcing high car ownership and use. The signals given by government to local authorities and house builders are often resulting, despite good intentions, in unsustainable development.

There were some more positive results from the SOLUTIONS research, however. In growth areas where alternative neighbourhood designs were

explored, the most successful forms – often based on local high streets and graded densities – gave the *opportunity* for very high levels of active travel (walking and cycling to get somewhere) and commensurately low innate car dependence. The results suggest that walkable and viable places can be created and that people will take the opportunity to walk in these localities. Thus the empirical evidence from the research is hopeful. While there are clear differences in behaviour between different groups in the population, the dominant factor determining whether people walk or not is distance. If we can build and evolve places that really create attractive, accessible, safe environments, then people will walk and in turn contribute to reducing carbon emissions from transport.

Nevertheless, the overall message from SOLUTIONS holds little comfort. Strategic and local trends are moving in the wrong direction, despite government policies. This will seriously undermine efforts to meet national targets to reduce greenhouse gas emissions over the next decade or more. But on the positive side, the study shows that we can adapt neighbourhoods, where there is development pressure, to be progressively more efficient and much less carbon hungry.

**Professor Hugh Barton was co-investigator of the SOLUTIONS project. He is director of the WHO Collaborating Centre for Healthy Urban Environments at the University of the West of England, Bristol.**

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## Armed drones: how remote-controlled, high-tech weapons are used against the poor

**David Hookes explores the ethical and legal implications of the growing use of armed, unmanned planes in the 'war against terrorism'.**

The rapidly increasing use of aerial robot weapons in the so-called 'war against terrorism' is raising many ethical and legal questions. Drones, known in military-speak as 'UAVs' or 'Unmanned Aerial Vehicles' come in a range of sizes, from very small surveillance aircraft, which can be carried in a soldier's rucksack and used to gather battlefield intelligence, to full-scale, armed versions that can carry a sizable payload of missiles and laser-guided bombs.

The use of the latter type of UAV in Iraq, Afghanistan, Pakistan and elsewhere has aroused great concern, since it often entails considerable 'collateral damage' – in other words, the killing of innocent civilians in the vicinity of the targeted 'terrorist' leaders. The legality of their use in carrying out what are effectively extra-judicial executions, outside any recognisable battlefield, is also raising serious concern.

### Background

UAVs have been around for at least 30 years in one form or another. Initially they were used for surveillance and intelligence gathering (S&I); conventional aircraft would then act on the data gathered to deliver a lethal attack. UAVs are still used in this role but, in the last decade, have themselves been fitted with missiles and guided bombs in addition to their S&I technology. These modified versions are sometimes referred to asUCAVs where 'C' stands for 'Combat'.

The first recorded 'kill' by aUCAV, a CIA-operated 'Predator' drone, occurred in Yemen in 2002. In this incident a 4x4 vehicle allegedly carrying an Al-Qaida leader and his five companions was attacked and all the occupants annihilated.<sup>1</sup> It is not known whether the government of Yemen approved these executions in advance.

### Worldwide military interest...

As might be expected, the US military leads the development and use of UAVs, especially since the 9/11 attacks, which led to a rapid escalation in drone production and deployment. Currently they have about 200 'Predator' armed drones and about 20 of its big brother, the 'Reaper' drone, in service in the

so-called AF-PAK (Afghanistan-Pakistan) theatre.<sup>2</sup> The total number of drones possessed by the US military is now about 7,000.<sup>2</sup>

Some of these drones have been leased or sold to UK forces, also for use in Afghanistan, where they have carried out at least 84 flight missions to date. The Reaper can carry up to 14 'Hellfire' missiles or a mixture of missiles and guided bombs.<sup>2</sup>

Perhaps unsurprisingly, Israel is also a major developer of UAVs, which it has used in Palestinian territories. There are a number of documented instances<sup>3</sup> of the Israeli military using them during its attack on Gaza in 2008-9, which resulted in many fatal civilian casualties. One of those killed was the 10-year old boy, Mu'min 'Allaw. According to Dr Mads Gilbert, a Norwegian doctor who worked at Gaza's al-Shifa Hospital during the attack on Gaza: "Every night the Palestinians in Gaza re-live their worst nightmares when they hear drones; it never stops and you are never sure if it is a surveillance drone or if it will launch a rocket attack. Even the sound of Gaza is frightful: the sound of Israeli drones in the sky."

Israeli arms company Elbit Systems, in a consortium with French arms company Thales, has won a contract to supply the British army with a surveillance drone called 'Watchkeeper'.<sup>4</sup> This is an improved version of an existing Israeli drone, Hermes 450, already used by UK forces in Afghanistan. Its Wankel engine is manufactured in Litchfield, UK by UEL Engines Ltd, a wholly-owned subsidiary of Elbit Systems. The Watchkeeper is said to be able to detect footprints on the ground from above the clouds.<sup>4,5</sup>

Many other countries also have drone programmes: Russia, China and various EU consortia have models under development. Even Iran has an operational drone, while Turkey is negotiating with Israel to be its supplier.<sup>6</sup>

Of course, the UK has its own extensive, independent programme of drone development, coordinated and led by BAE Systems. The most important ones are the 'Taranis'<sup>7</sup> and 'Mantis'<sup>8</sup> armed drones, which are also said to be 'autonomous', that is, capable of piloting themselves, selecting targets and even possibly engaging in armed combat with other aircraft.

Taranis uses 'stealth' technology to avoid detection and looks like a smaller version of the US B-2 'Stealth' bomber. Taranis was revealed, at some distance away from the public, at Warton Aerodrome in Lancashire in July 2010. TV reports emphasised its possible civilian use for police work. It seems somewhat over-specified for this, given that it weighs eight tonnes, has two weapons bays and cost £143m to develop. Flight trials are expected to begin in 2011.<sup>9</sup>

Mantis is closer in appearance to existing armed drones but more advanced in its specification and powered by two Rolls Royce model 250 turboprop engines (see photo). Its first test flight took place in October 2009.<sup>10</sup>

As discussed in the SGR report *Behind Closed Doors*, UK academics have been involved in BAE-led drone development through the £6m FLAVIIR programme, jointly funded by BAE and the Engineering and Physical Sciences Research Council.<sup>11</sup> Ten UK universities are involved, including Liverpool, Cambridge and Imperial College London.

### ... and the reasons for this military interest?

The military's interest in drones is not difficult to explain. For one thing, drones are relatively cheap, each one costing about one tenth of the cost of a conventional multi-role combat aircraft. And they can stay in the air for much longer than conventional aircraft – typically upwards of 24 hours. At present, they are 'piloted' remotely, often from a position many thousands of miles away from the combat zone, using satellite communications. The drones used by US and UK in AF-PAK are controlled from trailers at Creech Airforce base in the Nevada desert.<sup>12</sup> Thus the pilots are safe, can avoid stress and fatigue, and are much cheaper to train. Since the drones carry multi-sensor surveillance systems, the multiple streams of data can be monitored in parallel by a team of operators rather than by a single pilot. In short, in the straitened circumstances of the ongoing economic recession, drones give you a 'bigger bang for your buck'. According to the defence correspondent of the *Daily Telegraph*, Sean Rayment, armed drones are "the most risk-free form of combat to be invented",<sup>12</sup> a statement that, of course, completely sidesteps the mortal risks to innocent civilians.

Mike Young



Mock-up of BAE Systems Mantis armed drone (2008)

## Legal and ethical dimensions

There have been a number of legal challenges to the use of drones. The American Civil Liberties Union (ACLU) and the Centre for Constitutional Rights (CCR) have filed a lawsuit challenging the legality of their use outside zones of armed conflict. They argue that, except in very narrowly defined circumstances, “targeted killing amounts to the imposition of a death penalty without charge, trial, or conviction”, in other words, the complete absence of due process.<sup>13</sup>

The UN Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston, says in his May 2010 report<sup>14</sup> that, even in the area of armed conflict, “the legality of targeted killing operations is heavily dependent on the reliability of the intelligence on which it is based”. He points out that in many instances it has been shown that this is intelligence is often faulty. Alston also states: “Outside the context of armed conflict the use of drones for targeted killing is almost never likely to be legal,” adding that, “in addition, drone killing of anyone other than the target (family members or others in the vicinity, for example) would be an arbitrary deprivation of life under human rights law and could result in State responsibility and individual criminal liability.”

Even the most conservative estimates suggest that at least a third of the deaths caused by drone strikes in the AF-PAK military theatre have been non-combatants.<sup>15</sup> Some estimates put the proportion much higher. An assessment by Pakistani officials concluded that over a three-year period, there were 50 non-combatants killed for each alleged militant killed.<sup>16</sup> This clear disregard for civilian life is emphasised in an issue of the *Peacemaker Briefing*:<sup>17</sup> “The excitement about the low-risk death dealing capability of drones in defence circles, allied

to the view that attacks are precisely targeted and accurate, seems to overlook the fact that at least 1/3 of those killed are probably civilians.”

Another important feature of the use of drones is that they appear to be almost tailor-made for use against poverty-stricken people who, for various reasons, may be resisting the will of a technologically advanced power. Such people are variously described as ‘terrorists’ or ‘insurgents’ but may simply be striving to control their own resources and political destiny. Often they will have limited or no advanced technological capability. It is difficult to see that drones could be used effectively on the territory of a technologically advanced power since they could be shot down by missiles, conventional fighters, or even other armed drones. Even stealth technology does not give 100% invisibility, as demonstrated by the downing of a B-2 bomber during the NATO bombing of Serbia.<sup>18</sup>

## Conclusion

Drones should be seen as a very significant issue for SGR members as they can only be developed using the most advanced, science-based, technological resources, placed at the service of the military. The uses of drones often have very dubious legality, and the ethics of providing advanced, technological weaponry for use against the most impoverished people on the planet needs no comment.

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## Challenging commercialism in research assessment

**Sally Hunt describes the campaign by the University and College Union challenging proposals that aim to assess the quality of university research on the basis of 'economic impact'.**

In July there was cause for some optimism in the scientific community after the universities and science minister, David Willetts, announced that the government was delaying controversial changes to the way UK research is funded.

The news came after the University and College Union (UCU) led a vigorous campaign<sup>1</sup> against the proposals, announced by the Higher Education Funding Council for England (HEFCE) in September 2009, which would have forced 25% of future research to be assessed on 'economic impacts'.

UCU is not opposed to research activity being accountable to the public. We have a responsibility to explain why what we do is important and to ensure that our work is accurately explained to the wider world. In searching for a quick mechanical fix, HEFCE risked eroding the basic science base yet further, wiping out the humanities entirely and generating an odious sub-industry in academic spin for the disciplines that remain. As well as trashing whole fields of knowledge that they consider to be irrelevant, they risk inadvertently wrecking those that they think they value.

Over 18,000 people signed UCU's petition opposing the economic impact proposals and they came from every kind of university, every discipline, from both applied and basic fields, and from every cohort, their multitude and diversity a slap in the face for those who seek to reduce research to sectional interests or academic nimbyism.

They signed the petition because they recognised that the proposals threatened to wreck the very basis of innovation in knowledge. Nobel Prize winning science such as Sir Harold Kroto's discovery of carbon-60, Sir Tim Hunt's identification of cyclins or even Crick and Watson's use of X-ray crystallography to reveal the structure of DNA show two things about research. First, that it is fascination that powers discovery. Second, that social and economic impact can take decades to become clear even in the case of the greatest breakthroughs.

The truth is that rather than being set against each other, applied and pure fields of knowledge exist in a



symbiotic relationship. Many people, rightly, saw that research funding privileged certain areas of research against others and penalised many areas of applied research. By stressing the need for all research to demonstrate its impact, HEFCE simply shifted from one damaging discrimination to another, subjecting all research activity to a narrow, mechanistic test of its value.

Our universities are world-beaters in research – doing more with less than colleagues in any other industrialised country. We need greater public investment in both basic and applied research, not to be asked to make a false choice between one or the other.

Was July's optimism misplaced? The government's Spending Review,<sup>2</sup> published in October, saw the science budget frozen for the next four years – an effective real term cut of around 10%. Crucially, ministers signalled that research with obvious commercial value would be prioritised. It looks like the academic community must prepare for battle all over again.

UCU's campaign against the original HEFCE proposals exposed why talk of making research more 'commercially useful' is so worrying. It betrays a short-term view of science and academic research

that ignores the lessons of history. Discoveries take time, and seeking to ration funding on this basis will come back and haunt us. As Sir Richard Sykes, chair of the UK stem cell foundation, warned recently, Britain risks losing its position as world leader in stem cell research because there is too little money to turn breakthroughs in to treatments.<sup>3</sup>

It was disingenuous of the business secretary to call recently for more for less from the academic community when it comes to research. The £3.5bn a year currently spent on publicly funded research (via the Research Councils) generates an additional annual output of tens of billions of pounds in UK companies. With just 1% of the global population, the UK produces 7.9% of the world's research publications and 12% of all citations.<sup>4</sup>

The government has to understand that a policy of cutting research funding will only advance the decline of the UK as an academic world power. The UK delivers world-class research on a scale not matched anywhere else on the planet on a pound-for-pound basis. We are already punching above our weight. Other countries around the world are investing in universities and their research departments. We will not be able to compete if we are up against countries with bigger budgets and proper political support.

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## Synthetic life – too much, too soon?

**Michael Reinsborough asks whether synthetic biologists are rushing ahead with development of associated technologies before the science is properly understood.**

In the early history of Europe, written knowledge, available only to a select few, was hand copied by monks. By copying ancient manuscripts, the monk would learn to write. Only after a lifetime of copying the great books, or perhaps never, would a monk be able to consider writing something himself. This relationship of learning to write by copying is also the origin of synthetic biology. Recombinant DNA splicing (now over thirty years old) is the process of cutting and pasting a gene from one organism into another, much like copying a letter or a word found in one manuscript into another. As part of gene mapping projects seeking to 'read' DNA code, researchers had to copy short strands of DNA in order to compare them. This artificial synthesis of short strands of DNA, initially very expensive and time consuming, has led from mapping DNA to the possibility of writing or even rewriting genetic code. With the hubris of a junior monk aspiring to be Plato or to improve upon the Latin bible, a new generation of synthetic biologists aspire to rearrange all the paragraphs, all the words, and all the letters at the same time.

The synthetic biology paradigm sees the DNA sequence of a cell as a sort of software that an engineer can decode, rewrite, and improve. The engineer uses a computer to represent and arrange genetic code, and then sends their new design to one of the many make-to-order gene synthesis companies who synthetically construct the genetic material for them. In the lab this new material can then be introduced into a microorganism. This past year Synthetic Genomics Inc. lead by Craig Venter, made world headlines<sup>1</sup> when they announced that they had copied the entire genome of the *Mycoplasma* bacterium synthetically, added a marker gene to enable recognition, and reinserted it into an existing bacterium that had had its own DNA removed. This organism was then able to divide and reproduce using the synthetic DNA. While this was not the creation of man-made life that sound-bite science journalism suggested (the existing cell in which the synthetically made DNA was inserted was not itself artificially created), it was a significant proof-of-concept experiment for a potential synthetic biology industry estimated to be worth billions of dollars in the future.

The uses of synthetic biology (if it can be made to work) are enormous. Anything made in nature could,

in theory, be manufactured cheaply in biochemical factories. Synthetic biology advocates emphasise the possibility of a cure for malaria, cheap biofuels, and potential solutions for climate change, all very media-friendly goals. But early investors in synthetic biology are attempting to patent the basic processes at the beginning of any synthetic biology revolution and therefore achieve sweeping monopoly control over any potential benefits. Besides venture capital firms from the dotcom sector, the infamous oil company BP, agribusiness giant Cargill, chemical company Du Pont, Virgin Fuels, and pharmaceuticals giant Pfizer are some of the global corporations bankrolling R&D and funding start-up companies in synthetic biology.

But success is not the only thing to be concerned about in risky synthetic biology. Both bio-terror and 'bio-error' are concerns. With mail-order gene foundries available on the internet, a laptop and a garage laboratory are the new resource threshold for weaponising viruses.<sup>2</sup> The possibility that experimental bugs will escape into the environment with unforeseen consequences is also a major concern. But for a scientist, it is perhaps the breathtaking reductionism of the synthetic biology paradigm that is most concerning. In fact, many synthetic biologists are not biologists at all but come from disciplines such as computer science and electrical engineering. The application of explicitly computer science models and electrical circuit diagrams is new to genetic biology.

A gene is a small unit of DNA originally thought to express a specific trait, for example, the production of a protein.<sup>3</sup> In reality, genes and parts of genes interact in complex ways producing proteins that suppress or promote the behaviour of other genes, creating a system of cellular regulation (including timing and amount) for the production of a protein. Building a cell that will make a particular protein would involve changes to not just one gene but to many genes at various locations within a strand of DNA. Synthetic biologists are attempting to represent these genetic pathways for controlling the metabolism of a cell in something similar to electric circuit diagrams. Any DNA for which a purpose cannot be found (so called 'junk DNA') is stripped out of the synthetic biologists' model for the cell. Synthetic biologists also want to work below the level of the gene at what is called the codon. A codon codes for one of 20 distinct amino acids that make up proteins. The codon is a set of three rungs on the DNA spiral ladder, each of which can be one of four different letters in the DNA code (C,G,T,A). Because there are 64 different codons that represent only 20

distinct amino acids the synthetic biologist can choose between several codons that express the same amino acid (codon optimisation).

While synthetic biologists are definitely involved in copying all of their information from existing patterns in nature, they are making assumptions about the modular independence of this information and moving it out of its original biological context. This reductionism may miss complex checks and balances that create stability in natural systems. Perhaps it would be better to spend more time reading and faithfully copying the great manuscripts of life before we decide we can scramble all the paragraphs, all the words, and all the letters of all the books at the same time.

**Dr Michael Reinsborough holds a PhD in the history of science from Queens University Belfast.**

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3. DNA produces RNA, which builds proteins. Proteins – made up of amino acids – are the stuff of which life is made.

## FiT for purpose? Renewable energy funding in the UK

**David Elliott critically assesses the financial mechanisms offered by the UK government to stimulate growth in renewable energy technologies.**

Although the UK's renewable energy resources are among Europe's best, especially its wind, it is well known that we have developed these resources relatively slowly and are trailing far behind most other countries in the EU. This is partly because the UK government opted for a financial support mechanism, the Renewables Obligation (RO), which depends upon a competitive market for encouraging the adoption of renewable energy technologies. This is in contrast with most of the rest of the EU, which adopted the guaranteed-price Feed-in Tariff (FiT) approach. See the box 'RO versus FiT'.

Under its FiT system, Germany has installed 25 gigawatts (GW) of wind generation capacity, whereas the UK, despite a much better wind regime, has only managed 5 GW so far<sup>1</sup> – and some of that only came about because of direct state investment, introduced because the RO system was not delivering enough support for offshore projects.

Worse still, the UK's RO costs consumers more than the German FiT system. In the financial year 2005/6, the RO cost consumers 3.2 pence/kWh, whereas in

2006 the German FiT only cost consumers 2.6 p/kWh – and provided much more energy from renewable sources.<sup>2</sup>

The competitive nature and high costs of projects coming under the RO may also be key factors in the backlash that has occurred against wind projects in parts of the UK.

To be competitive, developers have often had to invade sensitive upland sites for high wind speeds. Under the FiT, however, developers have been able to use less invasive, lower wind-speed sites; indeed in much of Germany and Denmark that is all that is available. It has also been possible for locally owned community projects to flourish; 80% of wind projects in Denmark are locally owned. In the UK, most are owned by multinationals – mainly EDF and E.ON. So far, there are only two wind co-ops, and opposition to wind continues. Ownership brings psychological as well as financial buy-in. As the Danes say, "Your own pigs don't smell."

It was clear to many that the RO was not working and eventually, after much lobbying (by environmental groups, some sections of industry and others), the UK government brought in a FiT in April 2010 – but only for small projects, below 5 MW. That means that its focus is on domestic and community projects using

smaller scale 'micro-generation' technologies, such as solar photovoltaic (PV). The overall target set is not high: it is expected that by 2020 the FiT will lead to just 2% of the UK's electricity coming from these small-scale renewable sources.<sup>3</sup>

Local micro-generation has its attractions. It avoids losses from long-distance transmission, which can be up to 10%. But it is currently quite expensive, solar PV in particular, meaning fairly high levels of FiT support are needed. However, FiTs do help build the market for new technologies, so that the price of these technologies falls and the FiT level can gradually be reduced. That worked in Germany for large-scale wind power, and also, on a smaller scale, for solar PV – it now has about 10 GW of PV. But this success came at a relatively high cost, to the extent that in mid-2010 the German government decided to pull back the throttle on PV to avoid too much extra cost to consumers.

This could be seen as a failure of nerve – the FiT system should have gradually reduced the cost. But the concern over cost to consumers is a valid issue, one that also emerged when the UK FiT started up. It was argued that, given the expense of solar PV installations, the way the FiT provided support to the technology was economically regressive.<sup>4</sup> Those who could afford to invest, say, £10,000 in a PV array might get £1,000 per annum back for the electricity they generated and used, paid for by all the other consumers, who would be charged extra via their electricity bills.

However, the actual cost per head would be small – perhaps an annual £10 surcharge on bills by 2020, since the expected size of the UK FiT scheme is small. PV retailer, Solar Century said it would be less than £3 by the time the scheme is up for review in 2013. If by then demand for expensive options is outstripping expectation, the Department for Energy and Climate Change now says a revised tariff level might be introduced, much as in Germany.<sup>5</sup>

So overall maybe equity is not a major issue. But getting access to the programme will still be hard for many people without the odd spare £10,000. So it is encouraging to see plans for a 'green energy loan' scheme, under which energy supply companies and others (e.g. the Co-operative Group) may offer consumers zero- or low-interest loans for installing new renewable energy systems, to be paid back from the resultant energy savings, thus avoiding extra charges on the taxpayer or the other consumers. A 'pay as you save' scheme along these lines is likely

### RO versus FiT

Under the Renewables Obligation (RO), electricity suppliers must meet specified targets for supplying from renewable sources each year. They can pass on the extra cost of doing so to consumers. In return, the suppliers get Renewable Obligation Certificates ('ROCs') for each eligible megawatt hour (MWh) sold. If they manage to get more ROCs than they need to meet their obligation, they can sell them on; if they miss their target they can buy in from others. This means the ROCs have a market, and a market value. But the value of the ROCs varies. This makes it hard for developers to predict future earnings, and therefore hard to borrow money to fund projects. Interest rates on borrowings for RO projects are higher than those under the guaranteed price FiT system – where future earnings are known many years in advance. So under the RO, consumers must be charged more than they are charged under a FiT for the same type of project.

In the FiT system, each MWh of renewable electricity produced attracts a pre-set tariff when it is fed into the grid. This is why earnings can be calculated in advance and interest rates kept low. The FiT also has a built in price reduction ('degression') formula to reflect expected improvements in technology and markets (typically 2% per annum, depending on the technology), so costs are guaranteed to come down with time. By contrast, under the RO, the same number of ROCs is always given per MWh supplied, regardless of the state of development of the technology and its market. This can lead to excess earnings via ROCs by projects whose generation costs have fallen. So far, overall, around £1 billion more than was actually needed has been paid out by consumers – making the RO even more expensive. The RO mechanism has now been adjusted so that the number of ROCs varies according to the technology, making it a little more like a FiT. However, all onshore wind projects, for example, still get the same number of ROCs per MWh supplied, regardless of their level of development. So the excess payment problem to mature projects still persists.

Wikipedia



Pelamis wave energy converter

to be included the forthcoming Energy Security and Green Economy Bill,<sup>6</sup> as part of the coalition government's 'Green Deal' programme, which is expected to be available in late 2012.

There certainly seems to be support for self-generation. A YouGov survey for Friends of the Earth, the Renewable Energy Association and the Co-operative Group<sup>7</sup> found that 71% of the homeowners asked would consider installing green energy systems if they were paid enough cash. So perhaps, one way or another, uptake will be significant.

However, some still worry about using a FiT to push PV down its technology 'learning curve' to lower prices, given its initial high cost. The UK FiT sets the price for PV high, so that those who install it get the same rate of return (as a percentage of their investment) as those using other, cheaper technologies. For example, within the FiT system,<sup>8</sup> retrofit PV projects of 4 kW or less receive 41.3 p/kWh, whereas onshore wind turbines of between 1.5 and 5 MW only get 4.5 p/kWh. This difference may be fine if there is good justification for accelerating PV take-up, but that is a matter of judgement. For electricity, in the UK context, large-scale onshore and offshore wind is clearly a better bet for the moment in terms of price and the scale of the resource – the UK offshore wind resource has been estimated<sup>9</sup> at over 200 GW and perhaps even more than 400 GW. And although offshore wind currently costs around 14.5 p/kWh under the Renewables Obligation, the lowest level of support offered under the FiT for PV is 26.8 p/kWh. But PV prices are falling, with claims that they could reach

grid parity in some locations with a few years, and the potential long-term resource, even in cloudy UK, is reasonable – the government's *2050 Pathways Analysis* report talked of perhaps 95 GW peak.<sup>10</sup> So PV could well be next in line for expansion, and the FiT, plus the loan scheme, might be a starting point.

Even so, domestic-scale micro-generation has its limits. PV is less affected by the scale issue, as there are no economies of scale from the technical point of view, except via the bulk buying of components and the sharing of installation costs for larger projects. But it is a different situation for micro-wind generation, which is only effective in terms of the energy generated per unit cost in a very few urban locations in the UK; larger, grid-linked machines in windy places are much more efficient and cost-effective. Solar heating (to be supported under the forthcoming Renewable Heat Incentive) may be the best domestic option, but even this benefits from economies of scale e.g. for grouped-solar schemes sharing a large heat store, or even solar-fed district heating. It is a similar situation for micro-Combined Heat and Power (CHP): larger-scale mini- or macro-CHP, linked to district heating networks, are generally more efficient.

According to the report *Power in Numbers*<sup>11</sup> from the Energy Saving Trust, "the economics of all distributed energy technologies improves with increasing scale, leading to lower cost energy and lower cost carbon savings and justifying efforts for community energy projects". For some smaller-scale renewable systems, it adds, "it is only when action occurs at

scales above 50 households, and ideally at or above the 500 household level, that significant carbon savings become available."

Fortunately the 5 MW UK FiT ceiling, although low, does provide the chance to operate at a slightly larger community scale, which may redeem the whole thing – and there are proposals for the 5 MW limit to be raised. Meanwhile, though, most larger renewable energy projects still have to cope with the RO as the UK's main support mechanism, since the belief within government and much of the industry is that it is now too late, and would be too disruptive, to change over fully to a FiT.

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## A new era for arms conversion?

Continued from p.1

Equipment	2005 level	2010 level	2020 level
Aircraft carriers	3	2	1 (+ 1 in reserve?)
Destroyers and frigates	28	23	19
Submarines (conventionally armed)	11	7	7
Challenger (battle tanks)	~360	~330	~200
AS90 (heavy artillery)	~140	~120	~80
Fast jets (fighter planes)	~250	~200	??
Nimrod (maritime reconnaissance planes)	14	0	0
VC10/ TriStar/ A330 (air tankers/ transport)	24	18	Up to 14

Table 1 – Main cuts to UK conventional military equipment between 2005 and 2020<sup>4,5</sup>

new Queen Elizabeth class aircraft carriers will be three times the size of their predecessors – although only one will be actively deployed and fighter planes will only be carried from about 2020. Likewise, the new Astute class submarines will have greater capabilities than the Trafalgar class they replace. Possibly most disturbing of all is the rise of robotic aircraft ('unmanned aerial vehicles') to make up for some of the lost capability in air power (see pp.20-21).

Nevertheless, taken together these changes do comprise a real reduction in military capability. Such a change will be difficult to reverse given public opposition to the wars in Iraq and Afghanistan, and increasing support for nuclear disarmament.

Just as importantly, they mark an increasing shift in the UK industrial base away from the military/defence sector, freeing up skilled workers for other key areas of the economy. Perhaps the most significant changes in the short term will come as a result of a reduction in military servicing and maintenance contracts due to the early retirement of older equipment.

### Expansion of the environmental sectors

The situation is very different in the low carbon and environmental sectors in the UK, which include renewable energy, energy efficiency, pollution control, recycling and related areas. A recent government-commissioned report concluded that these sectors now employ an impressive 880,000 people, including those in the supply chain.<sup>7</sup>

As the national 'Low Carbon Transition Plan' continues to be rolled out, new funding streams have been confirmed for offshore wind, marine power, small-scale renewables and trains. In addition, a new parliamentary bill will be introduced, a major aspect

of which will be to improve delivery of energy efficiency measures. A new 'Green Investment Bank' will also be set up. (These measures are discussed further on pp.12-14). While there is concern that all the measures currently being proposed or implemented are not yet enough to meet the UK's climate change targets, there is nevertheless a widespread belief that these sectors will expand markedly over the next five to ten years and beyond.

### Arms conversion for a sustainable society?

As discussed in the last SGR Newsletter,<sup>8</sup> there has been considerable resistance within the military industrial sector to 'conversion' to civilian technologies. However, there are signs that this attitude is at last starting to change, as shown by quotes<sup>9</sup> from the CEO of the West of England Aerospace Forum: "This is a perfect opportunity for [defence industry] diversification and renewable energy presents a massive new market...A [wind] turbine blade is not dissimilar to a helicopter blade. It's electrical and mechanical engineering."

However, history shows that it is at a macro-economic level where arms conversion really occurs.<sup>10</sup> As military/ defence spending is reduced by government, finance – both public and private – becomes available to support other areas of the economy. This happened to some extent as the Cold War drew to a close. Employment in the UK's military industrial sector shrank by 150,000 jobs in the ten years from 1985,<sup>11</sup> while jobs were created elsewhere in the economy. Employment in this sector is now only 215,000<sup>12</sup> – less than a quarter of the low carbon and environmental sectors – and set to fall further. Meanwhile, the coalition government has signalled that it sees the 'green' economy as highly important to economic recovery.

So, can it be true that the Cameron government will be a champion of arms conversion for a sustainable

society? Hardly – Cameron has stated that he wants UK military spending to remain high in order to support the use of armed force to defend national interests.<sup>13</sup> Nevertheless, he is battling against a major change in British public opinion, which has resulted from the failure of policies that have prioritised military force to combat international terrorism. There is also acknowledgement within the new National Security Strategy that the UK's security priorities are shifting (see p.7). Finally, there is the realisation that a move to a 'greener' economy is overwhelmingly in the country's best interests.

There is still a long way to go, but the changes underway in the military and industrial sectors are major. Scientists and engineers need to work with peace campaigners and others to make these changes go further and become more permanent.

**Dr Stuart Parkinson is Executive Director of Scientists for Global Responsibility.**

*This article is based on presentations given in Sheffield (17 November 2010) and Lancaster (2 December 2010).*

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## The strangest dream

Eric Bednarski (Director) – National Film Board of Canada, DVD documentary, 90 mins., <http://films.nfb.ca/strangest-dream/>

### Review by Roy Butterfield

This riveting documentary is principally an account of the life of nuclear physicist and peace campaigner, Joseph Rotblat. It explores his disenchantment with his role as a nuclear physicist in helping to develop the first atom bomb, his resignation from the Manhattan project before the bombs were dropped on Japan, and his life's work thereafter, which he dedicated to nuclear disarmament and peace initiatives via the Campaign for Nuclear Disarmament and more than 50 years of Pugwash Conferences. The documentary's title is taken from the well-known peace song, *Last night I had the strangest dream*.

Rotblat was born in Warsaw in 1908 into a prosperous Jewish family, which became impoverished during World War I. He trained as an electrician, gained (part-time) his first degree at the Free University of Poland (MA, 1932) followed by a PhD (Warsaw, 1938) in physics. He married just before the outbreak of World War II and, when Germany invaded Poland in 1939, he accepted a post at Liverpool University to work with James Chadwick (the discoverer of the neutron) on the development of a cyclotron. His wife, who was ill, could not accompany him. He was not re-united with his family again until after the war; his wife died in the meantime and he never remarried.

He had earlier realised that an atomic-fission bomb could be constructed and, worried that Germany might develop one (to the extent that Chadwick, with whom he collaborated, apparently explored German bomb craters with a Geiger counter), determined to beat them to it. The UK had no money for this but a team of top-flight physicists – led by Robert Oppenheimer, Rotblat and Chadwick – was recruited by the US. A complete, secret new town was built in New Mexico – Los Alamos – and the Manhattan project was born, resulting in the first atomic bomb, exploded in July 1945. The DVD illustrates all this with archival material, recorded interviews with Rotblat, Oppenheimer, General Leslie Groves (the military commander) and many others. Rotblat was shocked to be told by Groves that the real purpose of the bombs was “to subdue the Soviets” and further appalled to discover that, although Germany had abandoned its A-bomb programme, they were to be dropped on Japanese civilians. He was the only scientist to resign from the project on ethical grounds, although others expressed disapproval after the event.

Casualties from the first bomb ('Little Boy'), which was dropped on Hiroshima within weeks of the successful test, and the second, which was dropped on Nagasaki three days later, were estimated at around 145,000 killed immediately, with tens of thousands dying later from radiation sickness. Rotblat heard of this on the radio, having returned to Liverpool. (The military had come to suspect him of being a Russian sympathiser and a security risk – especially since he had learned to fly in the US and was therefore a potential deliverer of secret material to the USSR by air!) Russia, surrounded by US air bases, did want a bomb and succeeded in testing one in Kazakhstan in 1953.

Rotblat moved to London in 1950 to take up a professorial appointment at St Bartholomew's Hospital to work on medical applications of nuclear radiation. At the time, contamination hazards due to the fallout from bomb tests in the atmosphere were disregarded and when, in 1954, the first hydrogen bomb was tested (103 times the energy release of Hiroshima) at Bikini Atoll, the spread of the fallout was grossly underestimated. The DVD includes footage of an interview with a Japanese fisherman on the *Lucky Dragon*, fishing miles outside the defined danger zone. He recalls a silent flash, a rumbling noise seven or eight minutes later, followed in an hour by white, tasteless, snow-like ash, blistered skin within three days, and deaths among crew members within months. Numerous other boats were contaminated similarly and tons of fish had to be destroyed. Rotblat obtained and analysed ash samples and deduced from them that the magnitude of the test, the fallout and the contaminated zone were all much bigger than the Government claimed. This led subsequently to a worldwide ban on above-ground nuclear bomb tests.

The Russell-Einstein manifesto was released in 1955 and support sought for an international conference on the elimination of war. A Canadian millionaire industrialist, Cyrus Eaton, offered this on condition that it was held in Pugwash, his village in Nova Scotia. The first Pugwash Conference was held in 1957, attended by 22 international scientists including Rotblat. They adopted the Russell-Einstein manifesto as their charter. (Rotblat and Russell were also founder members of CND in the same year.) The success of this and subsequent Pugwash Conferences depended largely on discussion

contributions not being attributed, the mutual trust of an independent scientific community and absence of governmental affiliations. Rotblat was Secretary General until 1973 and gave his last Pugwash Presidential address in 1997 when he was 89, concluding potently: “Was there a need to have done more? Should we have done more? I can't help feeling that the answer is yes.... Many scientists are still not willing to face reality. Many discourage or actively hamper young scientists from being concerned with the social impact of science.”

The 50th anniversary conference returned to Nova Scotia in 2007, by which time its remit had broadened to include chemical weapons, the arms trade, regional conflicts and broader concerns about human survival. The idea of a permanent US/USSR hot-line stemmed from a Pugwash initiative during the Cuban missile crisis. Nuclear test ban negotiations followed, with a test ban treaty signed one year later. Seismic monitoring was a Pugwash initiative, as also was the 1997 US/Vietnam peace accord. Rotblat provided inspiration for all this, working from a small office in the British Museum. He and Pugwash jointly received the Nobel Peace Prize in 1995.

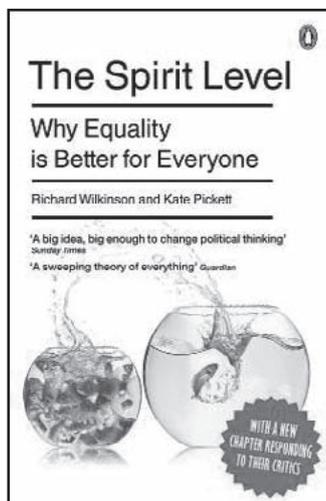
Rotblat strove for 60 years to eliminate nuclear weapons and conflict, urging “if you want peace prepare for peace”. This is not only an inspiring 'must watch' DVD for anyone advocating peace but also a moving tribute to a truly remarkable man.

**Roy Butterfield is Professor Emeritus of Civil Engineering, Southampton University, and a member of SGR's National Co-ordinating Committee.**

## The spirit level – why equality is better for everyone

Richard Wilkinson and Kate Pickett – Penguin, 2010, 368 pp., £9.99, ISBN 978-0141032368 (paperback)

Review by Martin Quick



Richard Wilkinson and Kate Pickett show convincingly that in industrialised countries and different US states, the greater the income inequalities, the worse are a wide range of social, health and other indicators. The analysis starts from epidemiological studies over a long time by the authors, both professors at the University of York, and other medical and health institutions. The indicators

covered include mental health and drug use, lifespan, physical health and obesity, educational performance, levels of violence, homicide and imprisonment, and degree of trust in societies. A measure of each indicator is plotted against the level of inequality in each society and a regression line drawn, showing the relationship clearly. Japan and the Scandinavian countries are among the most equal and come out well on most of the social and health indicators, while the USA, UK and Portugal are the most unequal countries and generally come out badly. What is perhaps surprising is that in very unequal societies, even those people at the top of the pile come out less well than those in more equal societies.

Although not brought out by the authors, it appears to me, particularly from the data on the different states in the USA, that historic racial divisions are linked with worse social and health indicators.

In addition to studying correlations, the authors discuss the causal links between levels of equality and many of the health and social indicators.

While increases in average income do give benefits in poor countries, once basic needs have been met and average income exceeds a certain figure, indicators like life expectancy and infant mortality correlate better with equality than with income. Cuba comes out well on the UN human development index, combined with a low ecological footprint.

The implications for sustainability are discussed. In more unequal societies, many people feel a lack of status and often try to overcome this by spending on things seen as demonstrating higher status, thus fuelling rampant consumerism. This is damaging for use of resources and the environment.

This book has been widely praised in a number of countries and quoted by politicians of all persuasions. Whether they will act on its clear message is uncertain! The book is easy to read and understand and has important lessons for our society.

**Martin Quick is a retired chartered mechanical engineer and a former member of SGR's National Co-ordinating Committee.**

## Green economics – an introduction to theory, policy and practice

Molly Scott Cato – Earthscan, 2008, 240 pp., £19.99, ISBN 978-1844075713 (paperback)

Review by Martin Quick

Molly Scott Cato is the Green Party spokesperson on economics and her book covers a wide range of thinking in green and alternative economics, from the origins of economics in ancient Greece to the most recent thinking. Some themes will be familiar, such as the need for localisation and the importance of recognising environmental constraints as more fundamental than economic factors.

The adverse effects of using Gross Domestic Product (GDP) as the most important economic indicator are clearly shown – where 'bads' such as the costs of pollution and accidents are counted along with the 'goods' we really need. GDP omits all activity that is not paid for by money, so huge areas of vital activity such as domestic work, child care and, in many societies, food production – activities mostly carried out

by women – are not counted. Studies are quoted that show minimal correlation between conventional measures of economic success (GDP per head) and people's well being and happiness, once basic needs are met.

The present economic meltdown has shown ultra-free market economics, minimal regulation and over-reliance on the financial sector to be disastrous. The explanation in the book of the way commercial banks conjure money out of thin air, creating debt on which they charge interest, is particularly relevant. To paraphrase the famous American economist J K Galbraith, it's a confidence trick so simple that people cannot believe it is real. It is this which has led to the unsustainable level of debt and the need to pay the interest which drives unsustainable growth.

The book covers different types of money systems including local currencies. It indicates the sort of large-scale projects, for example on improving energy efficiency and investment in renewable energy, that could invigorate the system, but these need to be done in ways that do not rely on pouring money into the black hole that banks have become. The benefits of co-housing where environmental impact is reduced by residents using shared facilities is one of many examples of desirable lifestyle choices.

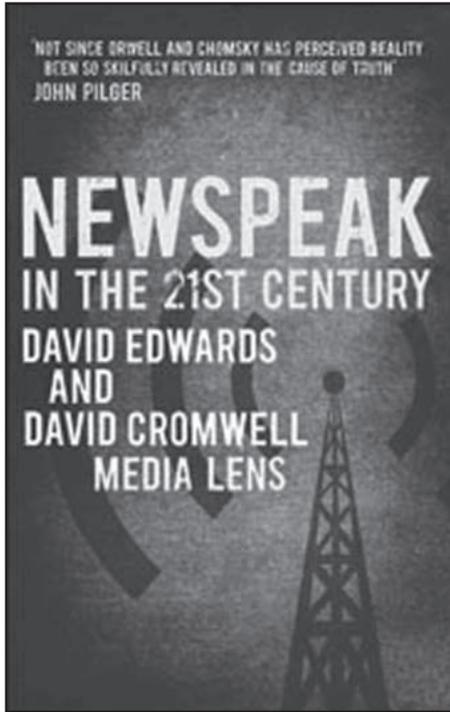
It is good to see mentions of concepts such as conviviality, which do not occur in many economic writings but are of real significance to people. The book has some nice quirky cartoons and lots of references for people who wish to follow particular areas further.

**Martin Quick**

## Newspeak in the 21st century

David Edwards and David Cromwell (Media Lens) – Pluto Press, 2009, 304 pp., £16.99 (paperback), ISBN 978-0745328935

Review by Jim McCluskey



We are now nine years into our 'war on terror'. Confidence in entire categories of establishment figures is approaching meltdown (politicians, bankers, multinational corporations, Roman Catholic priests). We face multiple mega-threats to our species (global warming, the population explosion, energy and water shortages). Perhaps it is not surprising that many are wondering what is going on?

Our mystification is aggravated by being continually asked by the political and media establishment to believe what, on reflection, are preposterous propositions: 'we need continuous growth with limited resources'; 'competition is superior to co-operation'; 'we must maintain weapons that can destroy the planet ready to be launched at a moment's notice in order to ensure our safety'. Many other contentious issues could be mentioned that remain largely unchallenged in the corporate media.

To find out what is really going on and to witness (but not take part in) a public discussion on such issues most people turn to the media, in particular television and newspapers. How do the media respond to this huge responsibility? Not well - the above anomalies are made to appear unexceptional, even normal. *Newspeak* unpicks the way this is done. John Pilger

declared: "Not since Orwell and Chomsky has perceived reality been so skilfully revealed in the cause of truth."

Filleting the news as presented by the media is a special skill that has to be learned. Many of us know we are being manipulated but sometimes cannot quite locate where or how this is being accomplished. Each chapter in *Newspeak* is a lesson in how to unravel the tangled web of lies and half-truths.

*Newspeak* presents convincing evidence that "the 'free press', truly, is not what it seems" and gives ample examples of "... the consistently distorted, power-friendly performance of the media at all levels." Distorting factors are explored including the need not to threaten profits and advertising revenue and also the way in which capacity for self-deception drives the propaganda system.

One chapter includes a discussion of 'the magnificent fiction' of BBC balance. It is pointed out that the BBC's upper echelons are largely populated by senior corporate and government figures, with a revolving door linking them. The bias of balance and the adoption of 'neutral views' is explored (e.g. the assumption that the UK and the US are motivated by humanitarian concerns in Iraq is a 'neutral' view adopted continuously without challenge). A further chapter treats us to a prescient 'A to Z of BBC Propaganda'.

The section on climate change points to gaping holes in reporting and how the compelling science is described in ways that dissipate its impact. To cognitive dissonance and profit-friendly clichés we can add straight propaganda supporting the 'sceptics'. Reporting of the lead-in to the Iraq war is critically analysed, as is ongoing news of the war itself, including the way the 2004 and 2006 *Lancet* reports on Iraqi civilian deaths were handled. Other topics discussed include reporting on Israel/Palestine, Iran and Venezuela.

A final chapter makes a plea for compassion, awareness and honest journalism: "...we should take the side of compassion against indifference, greed and hatred" and "we should seek to identify the real causes of human and animal suffering with as much honesty as we are capable..." We must free ourselves from self-serving bias.

The authors of *Newspeak* make a convincing case, offering "... evidence for a profound, consistent bias favouring powerful interests stretching right across the media 'spectrum'" (p.17).

There is still much to do. Perhaps the authors' next book will unpick those commonly used words and phrases that are themselves lies or encapsulate networks of lies, repeated so often by the establishment and the media that they represent a form of brainwashing: terms such as 'defence', 'the defence industry', 'the Ministry of Defence', 'our independent deterrent', 'our vital interests', 'the coalition of the willing', 'insurgents', 'the war on terror', 'rogue states' and 'the free world'.

**Jim McCluskey has a background in civil engineering, writing and peace activism.**

### Radical Statistics conference 2011

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booking form at  
[http://www.radstats.org.uk/  
conf2011/index.htm](http://www.radstats.org.uk/conf2011/index.htm)

## Creating your own peace garden

Pax Christi, April 2009, 4 pp

Review by Kate Macintosh

This small document causes one to repeat the question asked by Gertrude Jekyll in 1896, "what is a garden for?" Her reply, condensed, was "it is for delight, for sweet solace ... to call home over-wearied spirits." What is one then to make of a publication promoting the creation of peace gardens, which shows not a single plant?

The sentiments expressed in the text are of intentions shared by all those working for peace and are strong on process, such as "bringing communities together to plan, work, and care for a common project for the enjoyment of all." But the products shown in the illustrations will bring little lasting enjoyment to anyone but those who made them and moved on. While stating "the planning and design of a garden is itself a work of art", the authors show no appreciation of the enhancing and inspiring qualities that a lovely garden, no matter how small, can bring. It is the

hallmark of good design that the whole is greater than the sum of its parts but the exemplars selected here have the reverse characteristic.

Rather these are examples of what Sir Hugh Casson called 'godwotery': unplanned accretions of objects assembled without any overall intention, objects with significance for the object-maker but not contributing to a greater whole. A single forest tree would be worth any of these piles of painted pebbles.

Symbolism is a dangerous route to travel in artistic terms. There is mention in the text of another two schools where plants rather than painted stones were the materials used to create a garden. It would be good to have images of these.

Of course, one is aware of the austere tradition of Japanese Buddhist sand and rock gardens, raked to

symbolise flowing water, but that is not what we have here. The authors seem to mistake slogans for actuality and participation for artistic design. The resultant places may have given some satisfaction to the children involved but they do not merit being built into the fabric of public or semi-public places. One suspects that the children would have got at least an equal satisfaction, and arguably learnt more, through planting and tending trees and shrubs.

There are many weighty reference volumes on good landscape design but few on peace gardens. I would recommend to these authors the small Architects for Peace publication *Places for Peace* as a more in-depth study (ISBN 0-9515051-0-6).

**Kate Macintosh MBE is a retired architect and Vice Chair of SGR.**

## Disarmament forum – ideas for peace and security

Vignard, K (Ed.) – Journal of the United Nations Institute for Disarmament Research, Issue 2/2009, June 2009, 57 pp.

Review by Jim McCluskey

2009 was the 10th anniversary of the quarterly publication *Disarmament Forum*, published by the United Nations Institute for Disarmament Research (UNIDIR). The editor tells us: "*Disarmament Forum* has been an accessible and informative tool, offering expert analysis and creative thinking to a broad audience. Each issue has brought together unique perspectives on topics as diverse as fissile materials and nuclear terrorism, and the role of civil society in disarmament issues. Not only does it remain the sole journal of the United Nations dedicated exclusively to disarmament and security topics, the French language version of *Disarmament Forum* has on several occasions made significant contributions to the disarmament and security literature in that language."

There are over 40 back issues accessible on the web (<http://www.unidir.org>).

The anniversary issue is entitled *Ideas for Peace and Security* and includes a series of short essays about building security and promoting disarmament, with contributions on arms control, the Conference on

Disarmament, a human rights standard for the Arms Trade Treaty, the non-proliferation regime, dual-use education for life scientists, the control of space, and disarmament education.

The thoughtful article on the Conference on Disarmament will be of particular interest to those keen to get this potentially useful intergovernmental forum out of its deadlock of recent years. UNIDIR describes it as "... a negotiating chamber in waiting rather than a body that has regressed into a talk shop."

The article on the Ottawa Treaty on landmines and the Convention on Cluster Munitions describes the latter as a "stunning achievement" and points to the crucial role of civil society in bringing about this success. In both cases "... civil society campaigns framed the issues as humanitarian problems; helped set the international agenda; sustained the process by educating state representatives, the media and the public about the problem; maintained pressure on governments to participate in the process; and scrutinized the positions of governments."

The important question of child education in disarmament is discussed by Kerstin Vignard, who points to the need for an awakening of awareness on armaments matters to parallel the awakening over environmental concerns. Perhaps, she says, we should go back to the rules of the playground and schoolyard: treat others as you would like to be treated; share; keep your promises; don't bully or shove; don't cheat, and might doesn't make right. If our leaders behaved according to these simple precepts most of our peace/war issues would disappear overnight!

This publication is of interest to all those working for a saner and safer world.

**Jim McCluskey has a background in civil engineering, writing and peace activism.**

## A tale of two spuds: the tasty alternative to GM potatoes

Konstam at the Prince Albert Restaurant, London, 18 March 2010

Review by Eva Novotny

A potato-tasting event was held at the restaurant 'Konstam at the Prince Albert' in London in March. The potatoes were non-genetically-modified blight-resistant varieties bred in Hungary and further tested in Wales at the Sárvári Research Trust. The objects of the event were, firstly, to confirm (or otherwise) the tastiness and suitability of these potatoes for culinary purposes (virtues that had been denied by the GM industry) and, secondly, to bring more attention to these worthy potatoes.

For the past few years, the biotechnology industry has been striving to develop blight-resistant GM potatoes. A three-year outdoor trial is now in progress at the John Innes Centre in Norfolk. This research is funded entirely by public funds, unlike research on the Hungarian varieties, which receives no public subsidy. In 2007, trials of GM potatoes by the German chemical giant BASF began – in spite of local protests – just

outside Cambridge at the National Institute of Agricultural Botany. These were due to last five years. However, they were terminated prematurely.

Late blight is a very serious disease of potatoes and a new, virulent strain – Blue-13 – has developed over the past few years. Some varieties that had previously resisted blight have succumbed to Blue-13. However, non-GM blight-resistant varieties from Hungary, most of which are designated as Sárpo potatoes, have proven hardier. They have many other advantages as well, including a low carbon-footprint and resistance to viruses. They can be grown in poor soils and stored without refrigeration. Some varieties even enjoy drought resistance. These potatoes are receiving 'glowing reports' from Ireland, with Wales and Scotland also showing growing interest. They are popular in box schemes and farmers' markets.

In addition to the event chef's presentation of Sárpo Mira, Sárpo Axona, Sárpo Una and Blue Danube potatoes in a variety of ways, such as soup, puree, chips, etc., there were informative talks by Dr David Shaw (Director of the Sárvári Research Trust), Pete Riley (Campaign Director of GM Freeze) and Liz Hosken (Director of the Gaia Foundation).

The verdict was that the potatoes are very tasty. One participant was a representative of a major supermarket, who said she would try to persuade her company to bring these to their market.

Sponsors of the event were the Gaia Foundation, Sárvári Research Trust, Konstam restaurant and GM Freeze.

**Dr Eva Novotny is a former member of SGR's National Co-ordinating Committee.**

## Westminster energy, environment and transport forum on aviation and shipping

Whitehall, London, 11 March 2010

Review by Martin Quick

This seminar on the environmental issues associated with aviation and shipping was organised by the Westminster Forum, which involves parliamentarians and people from government departments, industry, universities and non-governmental organisations.

Currently aviation and shipping each emit 2-3% of global carbon dioxide emissions, but aviation in particular is rising rapidly. The global warming effect of aviation is at least twice that from carbon dioxide emissions alone, as water vapour and nitrogen oxides emitted in the stratosphere have warming effects not produced at lower levels. One fact I found surprising was that the net warming effects of marine emissions were currently negative. This is because the warming caused by carbon dioxide is offset by two other factors. The first is large emissions of sulphur dioxide from heavy fuel oil, which form reflective sulphate particles that have a cooling effect. The second factor is that emissions of nitrogen oxides destroy methane, which is a potent greenhouse gas. Thus cleaning up the emissions from shipping that cause local environmental and health problems will enhance the greenhouse effect.

The industry speakers' assumptions on reasonable levels of carbon emissions were well beyond those that

would be consistent with the rapid and large reductions necessary to avoid dangerous climate change advocated by the research director of the Tyndall Centre for Climate Change Research. There was much discussion about the best framework for controlling and reducing greenhouse gas emissions from aviation and shipping. The general view of the meeting was that some form of emissions trading scheme would be the most effective, but with the recognition that, unless this was a global scheme, there could be significant 'leakage' due to planes or ships being fuelled in countries outside the scheme, or ships being registered in such countries. The British government appears to be ready to allow a doubling of passenger numbers to and from the UK, on the basis that the aviation industry can buy emissions permits from other sectors of the economy, which it assumes can reduce emissions more readily and at lower cost than aviation. However, meeting the huge reductions needed by industrialised countries is likely to be difficult in most economic sectors.

There are a number of technical advances, particularly in aviation, which can significantly improve energy efficiency. Examples include a blended wing-body configuration for large planes, unducted fan

propulsion, low nitrogen oxide engines and light-weight construction. In addition, operational changes can reduce fuel consumption, such as avoiding extremely long flight stages, where much of the energy is used in carrying a huge fuel load. However, such changes are not likely to be made as quickly as they need to be without strong pressure. Even high carbon prices in an emissions trading scheme are unlikely to have a large effect on the amount of flying, and other means of discouraging excessive flying may be needed. I questioned the favourable treatment for aviation in relation to other sectors apparently being pursued by the UK government.

My personal hope is that people will see the vital need to reduce emissions, and will cut down on flights that could be substituted by other means (e.g. teleconferencing) or for trivial purposes (such as weekend shopping trips to New York or stag nights in Tallinn!), but more forceful measures are likely to be needed.

**Martin Quick CEng is a former member of SGR's National Co-ordinating Committee.**

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## Editorial Issues

### The editorial team for this issue of the SGR Newsletter was:

- Stuart Parkinson
- Vanessa Spedding
- Kate Maloney
- Alasdair Beal

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Copy deadline for next issue: 6 May 2011

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