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Challenging the mindset of war


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Destroyed tank in Iraq

Stuart Parkinson critically assesses new UK and Western military initiatives, and how engineers and scientists can be involved in challenging the cycle of violence.

An article[1] published in early 2014 in *The Guardian* pointed out that, since the outbreak of World War I, Britain forces had been at war, somewhere in the world, in every year since. With the parliamentary vote in 2013 not to intervene militarily in Syria and the planned withdrawal of UK troops from Afghanistan (finally completed in October 2014) there was hope that the country would, at least for the immediate future, manage to avoid armed conflict.

But this was not to be. With the rapid rise of IS forces in Iraq, Britain has allowed itself to be sucked into yet another open-ended war in the region. In addition, the ongoing Ukraine conflict has demonstrated that old rivalries between Russia and NATO remain close to the surface, while Western 'military intervention' in Africa and elsewhere in the Middle East continues. All this is being used to encourage the governments of NATO countries that they should increase military spending, continue to give priority to military action, and develop and deploy even more new weapons systems.

But there are alternatives. In trying to understand which alternatives might be most effective, this article draws on research in peace studies to try to understand how past activities by the UK and other Western countries – including their engineers and scientists – have contributed to the current problems, and what could be done differently in future.

The rise of IS

IS – or Islamic State (though most Muslims unsurprisingly will not use this name) – has developed from Al-Qaeda in Iraq (AQI),[2] itself formed in response to the US-led invasion in 2003. Its extremely violent methods – including vicious public executions – have dominated media coverage (and even helped cause a split between it and AQI), but much less attention has been given to how it has been able to build significant support in Iraq in the last few years. A key reason was the poor human rights record of the Western-backed Maliki government, which was responsible for torture and arbitrary detentions, and used brutal militias to help maintain control.[3] A further reason was Western involvement in secret torture programmes – recently admitted, for example, in a US Senate Intelligence Committee report. So IS has been able to gain support, not just from hard-line jihadists and former members of Saddam's regime who fought the US-led coalition, but also many disaffected Sunni Muslims who have fallen foul of the regime or Western agencies since. In addition, by building links with jihadist groups fighting in the Syrian civil war, it has also rapidly gained ground in that country. According to a UN report,[4] it has seized weapons mainly from the Iraqi military, which has of course been recently well supplied by the US. It is also possible that some of the arms that went missing in Libya after the NATO-supported toppling of Colonel Gaddafi have found their way to IS.

The aim of the new US-led coalition formed to fight IS has moved rapidly from protecting fleeing refugees to a comprehensive strategy to "degrade and ultimately destroy" the militia.[5] Air-strikes are, at the time of writing, the tactic of choice with over 1,000 carried out so far causing much destruction.[6] The coalition is also arming sympathetic militias, such as Kurdish groups, and deploying thousands of 'military advisors' to train them and the Iraqi army. It is also likely that US and UK special forces are operating in

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A few words from the Director

With early campaigning for the general election already started, now is a good time to reflect on the Coalition government's record on science, design and technology for a more peaceful, just and sustainable world. Since this is potentially a very large field, I'm just going to focus here on a few key areas – especially those on which SGR has worked in recent years.

On energy and climate issues, the government's performance has been patchy at best, with the occasional positive achievement submerged by a lot of poor policies and initiatives. Energy conservation – which should be the centrepiece of action – has frequently been marginalised. This has been demonstrated most prominently by the fiasco of the Green Deal (see p.14) where the implementation of home energy efficiency measures has fallen drastically since the new scheme was adopted in 2012. On the supply side, some important achievements have been outweighed by numerous negatives. On the plus side, 15% of the UK's electricity now comes from renewable energy, with generation from offshore wind sources being the highest in the world. However, the government's new subsidies for the North Sea oil and gas sector, increasing hostility to onshore wind (contrary to public opinion), gung-ho support for fracking (see p.7), introduction of a raft of large subsidies for new nuclear power (in contradiction to the 2010 Coalition agreement), and a lack of strict criteria for the carbon neutrality of imported bioenergy have all undermined the now-notorious promise to be the 'greenest government ever'. Although UK carbon emissions have continued to fall, this has mainly been due to the prevailing economic difficulties, leading government advisors to complain that UK action remains "insufficient" to meet agreed targets. And, as the discussions at the recent SGR conference highlighted (see p.21), much scientific research points to the inadequacy of current carbon targets.

On military technology, the government's record has been especially poor – although this has not been much of a surprise. As the front page article discusses in more depth, increased promotion of UK arms sales – including Cameron's notorious trade tour of the Middle East during the Arab uprisings of 2011 – has demonstrated how little this government understands about the hazards of such activities. Coupled with the ongoing pursuit of projects such as Trident replacement and new aircraft carriers, and the open-ended air campaign in Iraq, the emphasis on 'force projection' has remained. Yet, austerity measures have forced some significant cuts in military capability and deployment – while the 2010 National Security Strategy showed some recognition of the need to put more emphasis on tackling the roots of insecurity. Also notable is that the most recent figures for military R&D spending show that it has fallen to historically low levels – although the government has vowed to reverse the fall.

On science policy, there is also much to be concerned about. A complex network of policies and initiatives has been pursued over the last few years and these have been drawn together into a new science and innovation plan – published just before Christmas. A key part of this plan is to embed the idea that universities should not just carry out teaching and research, but should also deliver economic growth as a core activity. This will further compromise the impartial role that universities are supposed to play in society. In addition, the government has increasingly directed research agendas mainly based on economic criteria. The most prominent example is the defining of '8 Great Technologies' which are starting to receive priority funding. Controversially these include synthetic biology – which includes creating new life-forms – and autonomous systems – which are of particular interest to the military for use in drone warfare. More positively, another of the eight is energy storage technology – which is important in the wider exploitation of renewable energy sources. However, in general, the development of renewable energy technologies remains marginalised with only offshore wind and marine being given significant support. In contrast, nuclear power and fracking are identified as important areas for R&D investment. Perhaps the most striking illustration of warped priorities is the fact that Ministry of Defence R&D spending remains 25 times the level of public R&D spending on renewable energy.

Would a new government lead to significant changes in the above policies? It's clear that the leadership of the larger political parties remain wedded to similar militaristic and unsustainable policies but, with the election on a knife-edge, there is the promise that smaller parties or rebels within the larger parties can exert greater influence for positive change. So it's important to question your local candidates and find out their individual positions on key issues – so whether it's Trident replacement, local renewable energy, drone warfare, synthetic biology, fracking or something else, make sure they know which policies would attract your vote!

Stuart Parkinson

The new National Co-ordinating Committee

The election for SGR's National Co-ordinating Committee for this year was held during the Annual General Meeting on 4 October (see report on p.21). The following were elected:

Chair: Dr Philip Webber
Vice-chair: Dr Jan Maskell
Treasurer: Alasdair Beal CEng
Secretary: Dr Charalampos (Harry) Tsoumpas

Committee members:
Martin Bassant MPhil; Dr Tim Foxon; Dr David Hookes; Dr Paul Marchant CStat

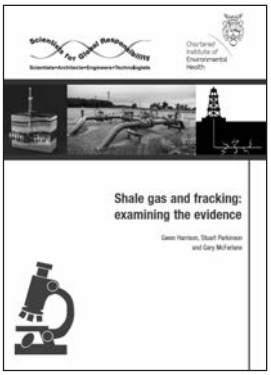
The NCC and staff (from left to right):
Tim Foxon, Stuart Parkinson, David Hookes, Georgina Sommerville (now on maternity leave), Paul Marchant, Jan Maskell, Alasdair Beal, Philip Webber, Martin Bassant, Harry Tsoumpas

New SGR report on fracking

In July, SGR launched a new 16-page report entitled *Shale gas and fracking: examining the evidence*. The short report critically examines the main claims made by the UK government and the energy industry in their outspoken promotion of this controversial fuel/technology. It looks at environmental, economic and social issues, drawing on relevant academic literature, and highlights many reasons for concern.

The report has attracted a great deal of interest, and led to lots of debate. About 2,500 copies have been downloaded from the SGR website in the first six months since its launch. Printed copies have been sent to local councillors, environmental health officers and other stakeholders in affected areas. The report also received some good media coverage in *The Mirror, Professional Engineering, Bloomberg News*, and several other outlets – with debate taking place in various online forums. The authors are Gwen Harrison, Stuart Parkinson and Gary McFarlane, and it is co-published with the Chartered Institute for Environmental Health.

A summary of the findings of the report – together with some updated material – can be found on p7. Printed copies of the report can be ordered from the SGR office and it can also be downloaded from: http://www.sgr.org.uk/projects/shale-gas-and-fracking-main-outputs



SGR is now hydro-powered!

Just before Christmas, a new community-owned hydro plant just outside Lancaster began generating electricity. This was particularly welcomed by SGR as the electricity is being fed into a micro-grid which supplies Halton Mill – SGR's home. Excess electricity is then sold on to the national grid.

The hydro plant was installed by Halton Lune Hydro (HLH), a local non-profit organisation. The plant uses a 100kW Kaplan turbine. A second turbine is planned to be installed in a year's time. When both turbines are operating, the plant is expected to supply enough electricity for 300 average homes, saving over 500 tonnes of carbon dioxide annually.

The plant has been fitted with a fish screen, fish pass and monitoring system – all approved by the Environment Agency – which will lead to local ecological benefits.

More information is available on the HLH website: www.haltonlunehydro.org

The turbine waiting to be taken for installation

Climate change activities

SGR continues to be very active on climate change issues. In addition to debating climate change at our conference in October (see p21) and publishing our new report on fracking (see above), we carried several other activities especially focused on raising awareness in the run-up to major intergovernmental conferences in New York and Lima (Peru).

In the summer, we published articles in *Clean Slate* and *Laboratory News* highlighting how spending shortfalls for action to tackle climate change could be filled via cuts in military spending. We also advised the International Peace Bureau on their new report on peace and climate change.

Stuart Parkinson gave two presentations – one focused on the ethics of the issue to climate scientists at the University of Leeds, and one focused on climate science at a community event in Lancaster.

Several SGR members also took part in the People's Climate Marches around the UK which took place on the weekend before the New York Climate Summit. We also published a blog on the need for much greater action by the EU during the Lima conference. The latter attracted a great deal of interest online.

SGR newsletter or website?

Members may have noticed some gradual changes over the last few years as the SGR Newsletter has become less frequent, while at the same time there has been an increase in articles posted on the SGR website.

With debate, campaigning and socialising moving increasingly online, we have been trying to identify the best balance, both for our members and for the audiences we seek to influence. Many still prefer the printed word and are (with good reason) resistant to the rapid changes in the way the world communicates, while many others are eager to use the new technologies to accelerate change to a more sustainable and just society. (The debate over which is more effective or sustainable will continue for many years, I'm sure!)

The situation SGR has now reached is for a printed newsletter to be produced and sent out approximately once a year – supplemented six months later by the annual report – while individual articles, presentations and other material are posted on the website roughly once every two weeks. The latest newsletter is also now available to members in electronic form – please contact the office (see back page) if you want to sign up for this rather than receiving a printed copy (if you haven't already).

As ever, we welcome feedback on whether we have the balance right – please send this to the SGR office.

Stuart Parkinson

Staff update

SGR's office manager, *Gina Sommerville*, went on maternity leave at Christmas. We wish her all the best with the upcoming birth.

In January, we welcomed *Vanessa Moss*, who has been recruited to cover the office manager role for the coming year. She can be contacted via the SGR office (see back page), and her email address is <vanessam@sgr.org.uk>

New science education work

Last spring, SGR carried out a pilot for our new education activities for school children and university students. Organised by Jan Maskell, with the help of students from Lancaster University, we hosted an activity day for 30 eight- and nine-year-olds from a local school. The day included:

- tours of the Lancaster Cohousing site, including a look round a super-insulated 'passive house' and a chance to see community renewable energy technologies at work, including solar hot-water panels, solar photo-voltaic panels, and a biomass-fuelled boiler;
- hands-on activities, including making model water turbines and 'insect hotels'; and
- a talk from a local organic farmer on sustainable agriculture.

The aim of the day was to show school children greener uses of science, design and technology – and to provide an inspiring alternative to education activities funded by fossil fuel and arms corporations, which are prominent in their support of science festivals etc.

Our activities were specifically arranged to meet elements of the national curriculum on science, geography and citizenship.

This coming spring, we are planning a wider range of activities under the banner of Science4society week. It will run from 16th to 23rd March. If you would like more information, please contact Jan at <janm@sgr.org.uk> or via the SGR office.

School children test out home-made water turbines at an SGR science education day

Nuclear weapons activities

With momentum increasing for nuclear disarmament, especially on the international stage, SGR has provided important inputs into the debate in recent months.

Our briefing on the impacts of the UK's nuclear weapons on the climate and humanity, should they ever be used, continued to be in demand – including at intergovernmental nuclear weapons conferences in New York and Vienna. The Vienna conference was especially important as the Austrian government announced there its intention to lead efforts to achieve a nuclear weapons abolition treaty.

The Rethink Trident campaign was re-launched in the autumn – supported by SGR and numerous peace groups, politicians and celebrities. The aim is to run a high profile campaign against replacement of the UK's Trident nuclear weapons system as we head towards the scheduled parliamentary vote in 2016. The re-launch included a full page advert in The Guardian and a parliamentary seminar. We also supported the International Day for the Total Elimination of Nuclear Weapons.

In the summer, Philip Webber took part in an expert seminar on humanitarian impacts of nuclear weapons in London. In September, an article on the SGR website about nuclear weapons and the Scottish independence referendum attracted a lot of interest. Later in the autumn, a new book on nuclear weapons was published – which included a chapter by Philip. In December, Stuart Parkinson spoke about the issue at a Labour Students event at Lancaster University.

Update on militarisation of science

A key area of SGR's work continues to be challenging the militarisation of science and technology.

SGR speakers have given presentations on this issue at several events in recent months. In the summer, Stuart Parkinson ran two workshops at an international peace conference in Sarajevo, Bosnia, to mark the centenary of the outbreak of World War I. Stuart also spoke on the issue at the NATO counter-conference in Newport, the Breaking the Frame gathering in Derbyshire (see p23), a Campaign Against Arms Trade campaigners event in Manchester, and the Edinburgh International Science Festival. Notably, the Edinburgh event was a public debate resulting from protests by SGR and others over the festival's sponsorship by arms corporation, Selex.

In the autumn, following concerns that R&D on drones at Liverpool University was being used for military purposes, we signed a joint letter complaining to their University Council.

We also raised our concerns about military technologies during activities for the Global Day of Action on Military Spending. Working with several other peace organisations, we took part in a protest outside the Ministry of Defence.

We have also used our findings about military R&D as the basis of joint campaign work on the forthcoming National Security Strategy. With other peace groups, we have called for a major shift in resources towards tackling the roots of conflict, rather than developing yet more new weapons systems. Our activities included a letter to leaders of the main political parties and a submission to a parliamentary inquiry.

Finally, interest has remained high in our reports on this issue, with many copies recently downloaded from our website.

Peter Nicholls 1935-2014

Peter Nicholls, who has died aged 79, was a professor of biological sciences and a very active member of SGR, particularly on the issue of nuclear disarmament.

Peter spent 50 years researching the biochemistry of haem proteins, which react with oxygen in our bodies to create useful energy for cells. His knowledge of the field was encyclopedic but Peter's life was never just about the biochemistry. As a scientist growing up in the nuclear age, he felt a special responsibility to advocate peace and disarmament. Within this, he always strove to ensure that the scientific evidence used in his political advocacy was of the same high quality as in his research.

Born in Southampton, Peter graduated from St John's College, Cambridge in 1956, and then stayed on to study for a PhD. His work during this time led him to brush up against the issue of dual-use biochemistry research.

Although he was active in the disarmament movement from the first Aldermaston marches, his political life started in the college common room. There he was involved in a takeover by graduate students of the undergraduates' Samuel Butler Room in St John's, which eventually led to the formation of the college's graduate society. The adjoining room – in which he expounded forcefully on the topics of the day – is still known as the Peter Nicholls Room.

Peter's first academic posts were in the USA: at universities in Oregon and Pennsylvania. In 1963, he became an associate professor at the State University of New York in Buffalo. However, his position there became increasingly difficult when he refused to oppose protests against the Vietnam War. He therefore left in 1969, taking positions in the UK and Denmark, before eventually settling in 1975 at Brock University in Canada. There, his wide knowledge of biology, chemistry and physics was especially helpful in providing robust scientific analyses during his tenure as president of Science for Peace, SGR's equivalent in Canada.

Taking early retirement in 1998, Peter then became a visiting professor at the University of Essex. He divided his time between mentoring the next generation of scientists and travelling to London, Brussels and Geneva to advocate disarmament issues as chair of Abolition 2000 UK. His combination of intellectual authority, charm and humour enabled him to deal on equal terms with ministers, diplomats, civil servants, admirals, grassroots campaigners and students.

Chris Cooper and Stuart Parkinson

Peter's final articles for the SGR Newsletter can be found on p10.

See also: The Guardian (2014). Peter Nicholls obituary. 30 December.

John Westergaard 1927-2014

John Westergaard, who has died aged 86, was a professor of sociology, specialising in the examination of social inequality. He played a key role in the development of the sociology profession, and was a sponsor of SGR and before that Scientists Against Nuclear Arms.

Among the influences that led John into academic social science were adolescent experience of Nazi occupation in Denmark (where he was at secondary school) and a strong desire to try to understand the twists and traumas of political responses to that occupation. Issues of and around policy preoccupied him ever since. After graduation in sociology in 1951 from the London School of Economics, his research – there, at University College London, and then from 1975 with a professorial post at Sheffield – focussed on two main fields. The first was urban development, housing provision and land-use planning, while the second was class inequality and related economic and political processes. It was the latter that came to be his principal interest.

In both fields, John's work came to centre on the often unacknowledged (and since the mid-1970s notably sharpening) persistence of relative class inequalities despite growth of 'average affluence'. He was also very interested in the subtleties of 'power' involved in preserving such inequalities, which persist as much from dominant though little-stated assumptions in public and private policy about 'the limits to change' as from overt exercise of superior clout. He published two influential books, *Class in a Capitalist Society* (1975; with Henrietta Resler) and *Who Gets What?* (1995). His recognition of class inequality as a defining feature of capitalism came long before its importance was more widely acknowledged. In *Who Gets What?* he pinpointed the top 1% of wealth holders as the capitalist core. He was gratified to see the recent attention given to inequality by, among others, the French economist Thomas Piketty.

His considerable activity within the sociology profession led to him serving the British Sociological Association as president from 1991 to 1993.

As an SGR sponsor, John saw the responsibilities of all scientists, 'social' as well as 'natural', to include not only rigorous pursuit of factual evidence, however this may confound either personal or wider expectations; but also alert concern with the uses to which outcomes may then be put. This is of course easier to say than to do; but, he believed, "it is more readily done with collective backing from a body such as SGR."

Stuart Parkinson
(with thanks to Alan Walker)

See also: The Guardian (2014). John Westergaard obituary. 23 May.

Rick Mather 1937-2013

Rick Mather, who died in April 2013 aged 75, was an influential architect specialising in low energy design. His projects – including the Ashmolean Museum in Oxford, Dulwich Picture Gallery, and the masterplan for London's South Bank Centre – won many design awards. He was a sponsor of SGR from 2005, and before that of Architects and Engineers for Social Responsibility.

A native of Oregon, United States, Rick moved to London in 1963 to work at Lyons Israel Ellis, which was well-known as a breeding ground for architectural talent. He studied urban design at the Architectural Association and later taught there, remembered as a generous mentor who shared his enthusiasm with others.

Mather set up his own practice, Rick Mather Architects, in 1973 after completing a house for himself in Camden. Early projects, such as Gladwell House (1977-1979) in London, demonstrated his love for complex interiors in a simple container.

A commission for the Zen chain of restaurants raised his profile. Then followed the Climatic Research Unit at the University of East Anglia (1985), which was one of the UK's earliest low energy super-insulated buildings. Other higher education projects included a student residence at Keble College, Oxford.

Mather's lifelong interest in 1930s modernism influenced the Klein House, Hampstead, a runner-up for the Stirling Prize. A simple white box from the outside, its inside cuts apart to reveal a basement swimming pool and the sky above through various glass floors and staircases. In an extension to Soane's gallery/mausoleum in Dulwich (1995-2000), a cloister and open-sided courtyard provides a modern space without impinging on the original building.

Mather had a capacity to realise projects where others had failed. For example, his South Bank Centre respects the existing buildings and breathes new life into the Centre, while ensuring work could be done in stages as funding and tenants became available. The liveliness of the South Bank today owes a great deal to this careful approach.

The Stirling-shortlisted Ashmolean Museum in Oxford (1999-2009) brings together all these strategies: working with an existing structure, clever use of every inch of space and responding to historic context. Recent commissions came from the USA. His last project was his biggest yet: a new wing for the Peabody Essex Museum in Salem, Massachusetts. The site is next to an early pilgrim burial ground where his distant relative, Cotton Mather, lies.

Sophie Hebden
(with thanks to Matthew Wickens)

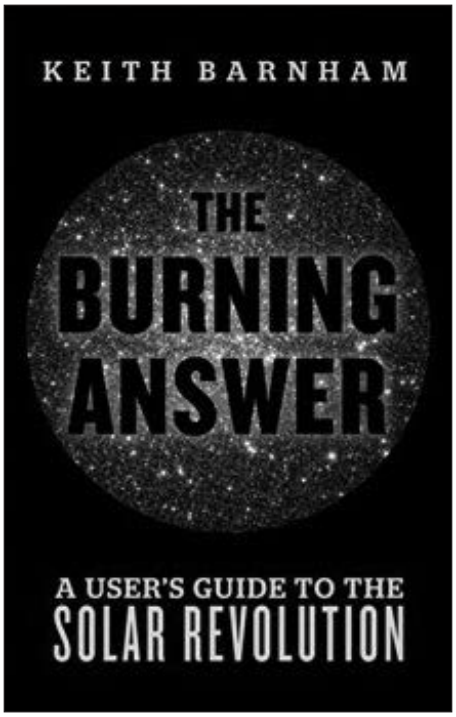
See also: The Twentieth Century Society (2013). Obituary: Rick Mather. May.

Sponsors news

Several of our sponsors/ patrons have been in the news in recent months.

Tom Kibble, emeritus professor of theoretical physics at Imperial College London, has received a knighthood[1] for his work, with others, in the 1960s which predicted the Higgs boson, the particle which gives other particles their mass. The boson was eventually discovered by physicists using the Large Hadron Collider in 2012. Tom, who was chair of SGR's predecessor, Scientists Against Nuclear Arms, from 1985 to 1991, had narrowly missed out on a Nobel Prize for his work.

Keith Barnham, another emeritus professor of physics at Imperial College, has published an important new book, *The Burning Answer: A User's Guide to the Solar Revolution*.[2] In it, Keith looks at the recent progress and current potential of renewable energy technologies to support a major transition to a sustainable society. He takes a very innovative approach, arguing that industrial society has mistakenly been exploiting the equation $E=mc^2$ – which has led to the development of nuclear weapons and nuclear power – rather than prioritising the application of $E=hf$ – which is central to the development of solar technologies.



Stephen Hawking, the world-famous Cambridge physicist, has regularly been in the news in recent months, not least with the release of his biographical film, *The Theory of Everything*. Of more specific interest to SGR, however, has been his recent warning in a BBC interview that "the development of full artificial intelligence could spell the end of the human race".[3] Stephen said primitive forms of artificial intelligence can prove useful, but fears the consequences of creating something that can match or surpass humans.

References

1. BBC News (2014). 13 June. http://www.bbc.co.uk/news/science-environment-27835298
2. Orion Publishing Group (2014). https://www.orionbooks.co.uk/Books/detail.page?isbn=9780297869641
3. BBC News (2014). 2 December. http://www.bbc.co.uk/news/technology-30290540

Shale gas and fracking: examining the evidence

Gwen Harrison and Stuart Parkinson summarise SGR's recent briefing which finds numerous causes for concern regarding the planned extraction of shale gas in the UK.

Shale gas – extracted by the technique of hydraulic fracturing or 'fracking' – is being promoted by the UK government and parts of the energy industry as having a large potential to contribute to the country's energy needs. Claims have been made that it will bring down energy bills and increase energy security without significant environmental and health impacts. But there is much public concern that this will not be the case – and many argue that there are more sustainable options. With fracking for shale gas being relatively new, there are many gaps in the scientific literature regarding its impacts, and the public debate often relies on information from either anecdotal sources or the industry itself. However, an increasing volume of impartial, evidence-based information now exists.

In July, SGR and the Chartered Institute of Environmental Health (CIEH) published a joint briefing,[1] which drew on peer-reviewed literature to present a robust, fully-referenced overview. It challenged some of the commonly-repeated claims that, in many cases, fail to stand up to proper scrutiny. In this article, we summarise and update the key findings of the briefing.

Fracking: the basics

Until recently, the technique of fracking has only been used in conventional wells (i.e. those within naturally porous rocks like sandstone, in which fluids can flow freely) to stimulate recovery when extraction becomes more difficult. Fracking for 'unconventional' gas or oil (i.e. that trapped in low permeability rocks such as shale) has only taken place on a large scale within the last decade in the USA. To date, only one UK shale gas well has been fracked: Preese Hall in Lancashire. While shale gas is chemically no different to natural gas extracted in other ways, the process of extracting it is very different, and requires huge numbers of wells (because the gas cannot travel large distances), and millions of gallons of water mixed with synthetic chemicals.

Potential local environmental and health impacts

A report for the European Commission concluded that the cumulative risk of groundwater and surface water pollution and releases to air from fracking is high,[2] and evidence of fracking-related contamination is well-reported in the scientific literature. For example, a recent study in Pennsylvania examining gas concentrations close to shale gas wells found methane in 82% of drinking water samples, with average concentrations six times higher for homes within 1km of a well.[3] UK regulations are more stringent than in the USA, making direct comparison difficult. Local environmental impacts may be less severe here. Nevertheless, it is virtually impossible to eliminate human error, poor well-construction, cement bond failure, etc., especially in such a new, complex and poorly-regulated industry (see below). Given the large number of wells proposed, failure of even a fraction could have significant impact. The reality is likely to lie somewhere between what proponents claim, and opponents fear.

Both Water UK (the water industry body) and the Chartered Institute of Water and Environmental Management have expressed concern over the requirement, during hydraulic fracturing, for vast quantities of freshwater.[4,5] Furthermore, fracking fluid returning to the surface is classed as radioactive waste and is therefore likely to require off-site treatment and disposal, placing a substantial burden on waste-water treatment infrastructure. Water and waste-water will require transportation to and from site, which could range from 14 to 51 daily vehicle movements per well pad for up to 3 years.[6]

There are concerns about the potential health impacts from fracking-related airborne pollutants, including methane, volatile organic compounds, particulate matter and nitrogen dioxide. A number of peer-reviewed studies have also suggested a possible link between fracking and various health impacts, including hormone disruption.[7,8] The Chief Medical Officer for New Brunswick in Canada published a report in 2012[9] which highlights the complete absence of any current substantive epidemiological study for populations exposed to shale gas extraction, suggesting that much more research is required before fracking can be deemed not to represent a threat to human health.

Both the European Union[10] and United Nations Environment Programme (UNEP)[11] have concluded that fracking may result in unavoidable environmental and health impacts even if the gas is extracted properly, and more so if done inadequately. They suggest that even if risk can be reduced theoretically, in practice many accidents from leaky or malfunctioning equipment and bad practices occur regularly.

Regulatory regime

There is widespread concern that the current regulatory regime is inadequate to address the potential impacts of fracking, but the UK government has rejected many calls for it to be tightened. The Royal Society recommended that industry-specific regulations be developed,[12] but the UK government has rejected this. Professor Robert Mair of the Royal Society specifically stated a need for an "independent examination and onsite inspection programme".[13] However, there is currently no legal requirement, or indeed resource, for the regulatory bodies to implement this. Neither are there any provisions within existing frameworks to require specific monitoring of fracking operations, i.e. periodic and regular sampling and analysis. This effectively allows the industry to decide monitoring frequency, scope and, critically, who carries it out. Proposed amendments to the Infrastructure Bill (see later) may go some way to addressing this.

The UK government has also created a conflict of interest by announcing its intention to allow local councils to keep 100% of business rates from shale gas operations, rather than the 50% that they were entitled to before,[14] thereby financially incentivising them to grant planning permission for shale gas operations.

Climate change

Climate change is arguably the most important issue, and the discussion can be broken down into the following three aspects.

Comparative emissions

There is disagreement among scientists over the life-cycle emissions of shale gas versus conventional gas and coal, the discrepancy depending largely on fugitive emissions (unintentional methane leakage). A recent review[15] by the Department of Energy and Climate Change (DECC) concluded that emissions from UK shale gas should be comparable with conventional gas and lower than coal. However, there are several reasons why this may be an optimistic assessment, not least because it excluded post-production emissions, which may be considerable. It is also important to note that even the life-cycle carbon emissions of conventional natural gas are at least nine times that of any of the main renewable energy technologies.[16]

Diversion of finance away from renewables

The UK government's clear support for shale gas and, by contrast, reductions in its support for

renewable energy and energy efficiency, may be deterring investment. A group of investors responsible for over £1 trillion recently wrote to Chancellor George Osborne arguing that "The UK has the potential to offer a safe harbour for renewable energy investors in Europe, but the delay in delivering a stable policy framework is weakening our prospects and holding back investment".[17] Furthermore, Lord Browne of Cuadrilla – one of the companies at the forefront of fracking in the UK – has admitted that "In 2011, the UK spent over £4 billion supporting the production and consumption of oil and gas, more than is spent to support renewable energy".[18]

Total global emissions

Finally, but most importantly, shale gas exploitation is likely to increase global carbon emissions. Within a given country, coal may be substituted by shale gas. However, there is little to prevent this unused coal from being sold in international markets, thereby increasing carbon emissions elsewhere.[19] In the absence of a global constraint on emissions, leading analysts (including those from the Tyndall Centre and DECC[20]) warn that shale gas will be additional to, not instead of, coal, leading to an overall increase in carbon emissions and a consequent acceleration of climate change.

Economic and social issues

Virtually all economic analysis – including that of Deutsche Bank, the International Energy Agency and DECC – refutes the claim that fracking will reduce energy bills in the UK.[21] Unlike the US, the UK is tied into the international market, where gas is sold to the highest bidder, regardless of its origin. Any increase in domestic gas production will therefore have little impact on the UK price. Furthermore, the development, or persistence, of gas-fired energy infrastructure in the UK locks us into its continued use, and ties us into an international gas market vulnerable to geopolitical and other disruptions to supply.[22]

Although fracking will generate jobs, job leakage is probable.[23] The job creation potential is also significantly less than that of the low-carbon energy sector, which itself may suffer from diversion of investment to shale gas.

The views of the public will be instrumental in deciding whether fracking goes ahead on any large-scale. Recent government opinion polling[24] puts public support for fracking at only 26%, the least popular of the energy sources on which it canvassed opinion.

Can we manage without shale gas?

It was outside the scope of our report to carry out a detailed assessment of the alternatives to shale gas. However, we noted both in the report and in a follow-up paper[25] that there is considerable potential in a combination of alternative options, such as:

- energy conservation measures in buildings to reduce demand for natural gas for space heating;
- expansion of the use of electric heat-pumps to provide space heating;
- renewable energy technologies – especially wind and marine – to supply electricity; and
- biogas to replace natural gas for heating and electricity.

Update

Several key developments have occurred since our report was published:

1. Parliament's Environmental Audit Committee has recommended a moratorium on fracking for shale gas to avoid breaching the UK's carbon budget.[26]
2. Scotland and Wales have announced moratoria on unconventional oil and gas extraction while further research is carried out into potential safety and health impacts.
3. Recent debate on the Infrastructure Bill has focused on the possibility of a ban on fracking in National Parks and other sensitive areas totalling around 40-45% of the land in England offered for shale gas extraction.[27]

Conclusions

The SGR briefing has found numerous concerns related to fracking for shale gas, especially:

- major shortcomings in regulatory oversight regarding local environmental and public health risks;
- the large potential for UK shale gas exploitation to undermine national and international efforts to tackle climate change;
- the water-intensive nature of the fracking process which could cause water shortages in many areas; and
- the complete lack of evidence behind claims that shale gas exploitation will bring down UK energy bills.

The briefing also points out that, despite claims to the contrary, evidence of local environmental contamination from shale gas exploitation is well-reported in the scientific literature.

The largest problem, however, remains climate change. Given that, even without shale gas, proven global reserves of fossil fuels are five times higher than can be burned without a 2°C global temperature rise being likely,[28] the exploitation of shale gas is very risky. In the absence of a global cap on emissions, the use of shale gas will be in addition to not instead of coal, and will therefore result in an overall increase in emissions. Until such a constraint on emissions is in place, this problem remains unresolved.

Gwen Harrison MSc is lead author of the SGR briefing, *Shale gas and fracking*. Dr Stuart Parkinson is Executive Director of SGR, and holds a PhD in climate science.

References

1. Harrison et al (2014). Shale gas and fracking: examing the evidence. SGR. www.sgr.org.uk/publications/shale-gas-and-fracking
2. p5 of Harrison et al (2014)
3. p5 of Harrison et al (2014)
4. p6 of Harrison et al (2014)
5. p6 of Harrison et al (2014)
6. AMEC (2013). DECC: Strategic Environmental Assessment for further onshore oil and gas licensing.
7. Kassotis et al (2014). Endocrine Disrupting Activity of Hydraulic Fracturing Chemicals and in Vivo Adverse Health Outcomes. endo.confex.com/endo/2014endo/webprogram/Paper16236.html
8. Rabinowitz et al (2014). Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania. ehp.niehs.nih.gov/wp-content/uploads/advpub/2014/9/ehp.1307732.pdf
9. p8 of Harrison et al (2014).
10. EU (2011). Impacts of shale gas and shale oil extraction on the environment and human health. europeecologie.eu/IMG/pdf/shale-gas-pe-464-425-final.pdf
11. UNEP (2013). Gas fracking: can we safely squeeze the rocks? www.unep.org/pdf/UNEP-GEAS_NOV_2012.pdf
12. The Royal Society and The Royal Academy of Engineering (2012). Shale gas extraction in the UK: a review of hydraulic fracturing. royalsociety.org/policy/projects/shale-gas-extraction/report/
13. p6 of Harrison et al (2014)
14. p7 of Harrison et al (2014)
15. p9 of Harrison et al (2014)
16. Barnham K (2014). The Burning Answer. Widenfeld and Nicolson: London. pp135-136.
17. UK Sustainable Investment and Finance Association (2013). UKSIF and Aldersgate Group co-ordinate investor letter to the Chancellor calling for decarbonisation target. tinyurl.com/kxxfnuu
18. p11 of Harrison et al (2014)
19. p9 of Harrison et al (2014)
20. p9 of Harrison et al (2014)
21. An extensive list of studies can be found on p10 of Harrison et al (2014).
22. Ekins P (2012). The UK's new dash for gas is a dangerous gamble. New Scientist. tinyurl.com/lbwyynt
23. AMEC (2013) – as note 6.
24. DECC (2014). DECC Public Attitudes Tracker – Wave 11. tinyurl.com/kye7h6l
25. SGR and CIEH (2014). Shale gas and fracking: examining the evidence – a rebuttal to critics. www.sgr.org.uk/sites/sgr.org.uk/files/SGR+CIEH-shale-gas-rebuttal.pdf
26. House of Commons (2015). tinyurl.com/kd8echz
27. Greenpeace (2015). tinyurl.com/lgpoef3
28. Leaton et al (2013). Unburnable Carbon 2013: wasted capital and stranded assets. Carbon Tracker and Grantham Research Institute on Climate Change and the Environment. tinyurl.com/ls9gzfb

Too close for comfort: Cases of near nuclear use and options for policy

Sasan Aghlani outlines just how close the world has come to the inadvertent use of nuclear weapons in the last 60 years – and suggests some immediate measures to reduce the risks.

Nuclear weapons have not been detonated in conflict since 1945. There is a danger however of becoming too complacent about this record of non-nuclear use. If risk is defined as probability × consequences, the risk of nuclear use is much higher than we have long assumed.

A recent Chatham House report documents 13 instances between 1962 and 2002 where nuclear weapons were almost inadvertently used due to miscalculation, miscommunication, or technical errors.[1] What prevented their use on many of these occasions was the 'human judgement factor' – intervention of individuals who, based on prudent assessment of situations and against protocol, either refused to authorise a nuclear strike or relay information that would likely have led to the use of nuclear weapons.

Decision-making under pressure

A recurring theme in the report is that those involved in 'command and control' are under great psychological pressure when making decisions regarding nuclear use, chiefly due to the short window for action. In one such case a research rocket was mistaken for a Trident missile in 1995 and Russian President Boris Yeltsin had only minutes to decide whether to launch a retaliatory strike against the United States. He delayed his decision for as long as possible while following the rocket's trajectory, talking over the phone with the possessor of the second 'nuclear briefcase' until it became clear that the rocket would land outside of Russian territory.[2]

In another example, in 1979, US National Security Advisor Zbigniew Brzezinski received a call from a General at US Strategic Command stating that the Soviet Union had launched 220 nuclear missiles at the United States. A minute before informing the President that the United States was under attack, he received another phone call stating that the alert was caused by a faulty computer chip.[3] It was Brzezinski's decision to delay his call to the President which proved decisive.

Political climate

Many of the cases examined in the Chatham House report involve incidents which transpired during the Cold War, and the authors examine how political tensions can affect nuclear decision making. In one example, a realistic but poorly-timed NATO training exercise in 1983 simulated a nuclear attack and inadvertently put the Soviets on alert. The exercise went ahead in spite of the concerns of the US National Security Advisor, who had recognised that US-Soviet relations were especially bad at the time.[4]

The report finds that regional conflicts also have the potential to escalate quickly and take on a nuclear dimension. Previous conflicts between India and Pakistan, which intensified to the point of nuclear threats, relied on outside mediation to calm tensions. States like Pakistan, where the military wields significant power, might also be more prone to a type of risk-taking that is unpredictable.

Prudent judgement saves the day

Human judgement will always be an imprecise but vital part of nuclear command and control. The alternative – the automation of nuclear weapon launch policies – is fraught with its own profound problems. The Soviets had introduced a semi-autonomous system, 'Perimeter', designed to automatically launch nuclear-tipped Intercontinental Ballistic Missiles (ICBMs) at the United States if it detected a launch.[5] The logic behind Perimeter was that in order for a state's nuclear weapons to deter, the state needs to convince others that it can inflict 'unacceptable damage' even if devastated in a first-strike.

Too Close for Comfort raises a deeply disturbing paradox about nuclear weapons. While prudent judgement has saved the day in some instances, miscalculation and misperception have brought us close to inadvertent nuclear use in others. The human factor is therefore a double-edged sword. It is not simply the case that only technical errors can lead to inadvertent use: accurate data still requires decoding and interpretation by fallible human beings so that wrong conclusions are not drawn.

Recommendations

With the current absence of a complete ban on nuclear weapons, the report offers a number of near-term policy options that could potentially reduce the risks of inadvertent nuclear use. These include adopting measures that buy time, such as taking thousands of nuclear weapons off 'hair trigger' alert, and retargeting nuclear weapons to the ocean. Recommendations also include increased trust- and confidence-building measures, a wider set of decision-makers involved in nuclear command and control, and educating militaries about the humanitarian impacts should nuclear weapons ever be used again.

One concern emerging from the report is lack of transparency. Nuclear weapons possessors are anxious about revealing details about their nuclear launch policies, and want to avoid embarrassment over instances where they may have come close to launching nuclear weapons due to negligence or miscalculation. There are likely to be other instances where the world has come close to nuclear war by accident, choice, or sloppy practises that we simply do not know about due to secrecy. This poses the question: for how long can the world depend on people making the right calls?

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References

1. Lewis P, Williams H, Pelopidas B, Aghlani S (2014). Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy. Chatham House Report. www.chathamhouse.org/publications/papers/view/199200
2. Pp.16-17 of note 1.
3. Pp.12-13 of note 1.
4. Pp.13-16 of note 1.
5. See: Hoffman D (2011). The Dead Hand: Reagan, Gorbachev and the Untold Story of the Cold War Arms Race. Icon Books.

The struggle to ban chemical weaponry: Lessons from World War I to the present

Peter Nicholls examines the development and use of chemical weapons over the last 100 years, especially during World War I, highlighting some of the ethical debates involving scientists and policy-makers.

The reappearance of chemical weapons with casualties in the hundreds in Syria is a depressing development whatever the political or military context and whoever is responsible.[1] Of all the scientific disciplines, chemistry may sustain the closest relationships between the research and its commercial uses, as illustrated by Primo Levi's well-known experiences as a chemist in 1940s Italy.[2] Since the days of alchemy, the discipline has been a struggle for wealth and power as well as knowledge. And then from a profitable commercial role it attracts the interest of the state and the military.

The road to chemical weapons use in WWI

Lewisite (Cl-CH=CH-As(Cl)$_2$) was first synthesised in 1904 by a young graduate student, Julius Arthur Nieuwland, who also happened to be a catholic priest, during studies for his doctorate.[3] Exposure to his own compound sent him to hospital. He worried about its use as a possible poison gas and decided not to publish too much. But his discovery was taken up again in 1918, too late for military use in World War I but in time for massive inter-war stockpiling in the USA, Japan and elsewhere.[4]

The turn of the nineteenth to the twentieth centuries had seen an increased development of chemicals and microbes to be employed in war. Use was only seen as morally problematic by political and military leaders in a series of very slow steps. Covert or even treacherous use was regarded by many as acceptable. For example, in the North American 'Indian' wars of the late eighteenth century, Lord Amherst[5,6] welcomed the availability of small pox infested blankets given to the fractious Native Americans.

So it was also considered acceptable for one of the most accomplished German scientists, Fritz Haber, friend of Einstein, to develop a German gas warfare programme in WWI.[7,8] Haber, who went on to win the 1918 Nobel prize in chemistry for his creation of the Haber process for nitrogen fixation, also 'optimized' the military use of the gases chlorine (Cl_2) and phosgene ($COCl_2$) which initially had some success in causing enemy soldiers to abandon their trenches and retreat. The group Haber assembled (James Franck, Otto Hahn, Richard Willstatter, Heinrich Wieland and others, many eventual Nobelists) worked on both chemical attack and defence (the two sharing much of the science). It was an amazing team that would be hard to match for scientific ability in any field. Willstatter and Wieland went on to begin modern enzymology and Franck and Hahn to become nuclear physicists, in Franck's case helping develop the atomic bomb. Franck thus has the dubious distinction of having worked on two weapons of mass destruction.

Haber paid a high personal price for his work. After a reported argument over the work, his young wife Clara committed suicide, shooting herself with Haber's own officer's revolver. To assuage his grief

Table 1a. A partial list of poison gas preparation and usage in World War 1 (and immediately thereafter)[a,c]

Gas	Type	Date of first significant use	First use location	Responsibility	Casualties	Deaths
ethyl bromacetate	tear gas	Aug 1914	Western front	France	?	0
xylyl bromide	tear gas	Jan 1915	Russian front	Germany	?	?
chlorine	respiratory	Jan/Apr 1915	Ypres	Germany	7,000	350
chlorine	respiratory	Aug 1915	Russian front	Germany	>>9,000	>>1,000?
chlorine	respiratory	Sept 1915	Loos	Britain	low	0?
phosgene	respiratory	Dec 1915	Ypres	Germany	>1,000	69
mustard gas	vesicant	Jul 1917	Ypres	Germany	?	?
hydrogen cyanide	systemic respiration	1917	Arras	France & Britain	low	very low
lewisite	vesicant/ respiratory	stockpiled/ not used	---	USA	0	0
diphenyl chlorarsine	tear gas/ irritant	1919	Russia	UK	?	?
Total WW1	**all**	**1914-1918**	**all fronts**	**all combatants**	**1,240,000**	**~88,500**

Table 1b. Recent examples of poison gas preparation and usage in war[b,c]

Gas	Type	Date of first significant use	First use location	Responsibility	Casualties	Deaths
sarin	nerve	1984+	Iran	Iraq	~100,000?	~20,000?
sarin/tabun	nerve	1988	Kurdistan	Iraq	?	~5,000
sarin/tabun	nerve	2013	Ghouta	Syria?	3,600	400-1,400

References

a. Wikipedia entry (2014) http://en.wikipedia.org/wiki/Chemical_weapons_in_World_War_I and other websites referenced therein.

b. Wikipedia entry (2014) http://en.wikipedia.org/wiki/Ghouta_chemical_attack and other websites referenced therein.

c. Spiers, E. M. (2010) A history of chemical and biological weapons. Reaktion books..

World War I soldier in a gas-mask (reconstruction)

Haber returned immediately to the front, before her body was buried. His team continued to develop the chemical weapons. Their effectiveness varied. As recent Syrian and Iraqi events show, they are deadly in terrorist mode against civilians. Military usefulness in WWI was relatively low against well-protected and gas-masked troops. Less well-equipped soldiers on the Eastern front were decimated. Chlorine, phosgene, and mustard gas ($Cl(CH_2)_2S(CH_2)_2Cl$) were all tried out on the battlefield by both sides – see Table 1.

The UK and chemical weapons

After the war, the Royal Air Force dropped diphenyl chloroarsine, an irritant agent designed to cause uncontrollable coughing, on Bolshevik troops in Russia in 1919.[6] Winston Churchill, then secretary of state 'for war and air', suggested that the RAF should use chemical agents in the Middle East during an Iraqi 'revolt' in 1920. We do not know whether gas was actually used[6] but the then British Manual of Military Law[9] stated that the rules of war applied only to conflict "between civilised nations" and "they do not apply in wars with uncivilised States and tribes". Churchill's position was also without nuance, as illustrated by the quotes in Box 1.

Such views were independent of political party and not just a shibboleth of right-wingers. Geneticist, enzymologist and communist J. B. S. Haldane also enthusiastically endorsed gas warfare in a little book (Callinicus) dedicated to this topic, named after a supposed Greek philosopher probably invented by Haldane for the role.[11] Churchill and Haldane were expressing these views before the invention of the brutally lethal nerve gases. Whether sarin and tabun would have caused them to rethink their position we do not know.

Box 1. Winston Churchill's comments on chemical weapons, 1919

"I do not understand this squeamishness about the use of gas. We have definitely adopted the position at the Peace Conference of arguing in favour of the retention of gas as a permanent method of warfare. It is sheer affectation to lacerate a man with the poisonous fragment of a bursting shell and to boggle at making his eyes water by means of lachrymatory gas."

"I am strongly in favour of using poisoned gas against uncivilised tribes. The moral effect should be so good that the loss of life should be reduced to a minimum. It is not necessary to use only the most deadly gasses: gasses can be used which cause great inconvenience and would spread a lively terror and yet would leave no serious permanent effects on most of those affected."

Source: War Office[10]

The 'defence' of the weapons was of course only needed if there was a critique. International legal and moral doubts had begun quite early. A 'use' ban was proposed in the Hague convention of 1899 and reemphasized by the Geneva agreements of 1905. Article 23 states that it is especially prohibited to employ poison or poisoned armaments.[12] The initial impetus was against the poisoning of food and water supplies, a treacherous activity with a seedy history that long predated any chemical knowledge. Gas was new. Only after its use in WWI did the nations pay serious attention, which led to the Geneva protocols of 1925.

Britain signed and ratified the relevant Geneva Protocol on 9 April 1930, which banned the use of toxic gases and bacteria in war, although not the development and production of these weapons. The UK military consequently carried out extensive testing of chemical weapons from the early 1930s onwards until fairly recently. In the Rawalpindi experiments, hundreds of Indian soldiers were exposed to mustard gas in an attempt to determine the appropriate dosage to use on battlefields.[13] Many of the subjects suffered severe burns from their exposure to the gas. Subsequent illnesses caused by carcinogen use were not tracked.

It took until the 1990s for the UK to get rid of its stocks, signing the Chemical Weapons Convention on 13 January 1993 and ratifying it on 13 May 1996. Britain had a long time to conform. There was a 70 year gap between the 'use' ban and the 'possession' ban.

Moving towards a total ban

The usual pattern with weapons of mass destruction, when the initial Churchillian and Haldanian enthusiasm has worn off, is firstly to claim that the research programmes involved are only defensive in nature, and finally that they even have positive aspects, usually medical benefits. Such attempts to make threat research defensive, and then useful, have been a common theme in the negotiations over the banning or control of chemical, biological, and nuclear weapons.

Post-WWI the US military was anxious not to lose its chemical warfare programmes.[14] Chlorine gas was therefore touted as a common cold cure. President Calvin Coolidge and his wife allowed themselves to be used as guinea pigs to show the benefits of breathing low levels of Cl_2.[15] As far as we know they survived the experiment unscathed. Similarly the UK biological warfare centre at Porton Down is now characterised as a medical research facility.[16]

UK nuclear weapons work at Aldermaston is similarly justified in part by its advocates because it is related to transparency and nuclear disarmament verification. Iran justifies its work to enrich uranium to levels greater than 10% U-235 by reference to the production of medically important radiochemicals. We do have a partial nuclear weapons possession ban, the Nuclear Non-Proliferation Treaty (in force since 1968!), but it is flawed because it provides no time frame for the agreed nuclear disarmament by the five recognised nuclear weapons states (USA, Russia, China, France and the UK). There is no current legally binding ban on the *use* of nuclear weapons although the 1996 advisory opinion of the International Court of Justice has some force. *De facto* if not *de jure* the military use of such weapons is banned. Had the possibility of nuclear weapons been foreseen by those who negotiated the Geneva Conventions of 1925 they would almost certainly been placed in the same category as chemical and biological weapons.

The medical 'defence' often has some validity which means that all of us in the chemical and biochemical

research business need to remain vigilant. Some poisons do have beneficial effects at low concentrations – a kind of scientifically accepted homeopathy. There are even those who think this applies to radiation (the hormesis theory). But certainly sulphide, carbon monoxide and nitric oxide (breathing of which probably eventually killed its discoverer Joseph Priestley) all show beneficial hormonal 'gasotransmitter' action at low levels while acting as respiratory inhibitors at higher levels. The commonest respiratory inhibitor, cyanide, was ineffective as a military poison gas but came to be of practical use starting during WWI as an insecticide, a defence against vermin in the trenches. It was also adopted as a US execution device, and ultimately by the Nazi's as the reagent of choice for the Holocaust under the name of Zyklon B. Some early twentieth century physicians recommended very low cyanide levels as therapeutic in some respiratory ailments. (It is not available on the NHS!)

We have become more cautious about laboratory use of volatile poisons (see Box 2) and their availability is controlled by cautious risk assessment. Does the ongoing chemical disarmament of Syria presage a corresponding control and subsequent removal of chemical weapons? We hope so but we still await ratification of the Chemical Weapons Convention, not only by Syria but also by states such as Israel and Egypt. Disarmament of all kinds remains a slow process.

Peter Nicholls was a Visiting Professor at the School of Biological Sciences, University of Essex, UK. Sadly, this was his last article for SGR before his death. His obituary can be found on p5.

Update

According to the latest update (20 October 2014) from the Organisation for the Prohibition of Chemical Weapons, over 97% of Syria's stockpile has now been destroyed. See: http://www.opcw.org/special-sections/syria/destruction-statistics/

References (an incomplete listing)

1. Hersh S (2014). The red line and the rat line. London Review of Books, vol.36, no.8, pp.21-24.
2. Levi P (1984). The Periodic Table. Schocken Books.
3. Nieuwland J (1904). Some Reactions of Acetylene. PhD thesis, University of Notre Dame. Notre Dame, Indiana.
4. Vilensky J (2005). Dew of Death - The Story of Lewisite, America's World War I Weapon of Mass Destruction. Indiana University Press.
5. Tucker J (2002). Scourge: the once and future threat of smallpox. Chapter 2: The 1763 'Indian' wars: letters between Lord Amherst & Henry Bouquet. Grove Press.
6. Spiers E (2010). A history of chemical and biological weapons. Reaktion books.
7. Cornwell J (2004). Hitler's scientists: science, war and the devil's pact. Penguin Books.
8. Charles D (2005). Between genius and genocide. Jonathan Cape.
9. British Manual of Military Law (1914).
10. Churchill W (1919). Departmental minute. Churchill papers: 16/16, 12 May. War Office.
11. Haldane J (1925). Callinicus: a defence of chemical warfare. Kegan Paul et al.
12. Convention (II) with Respect to the Laws and Customs of War on Land; and its annex: Regulations concerning the Laws and Customs of War on Land. The Hague, 29 July 1899. Article 23.
13. The Guardian (2007). Military scientists tested mustard gas on Indians. 1 September. http://www.theguardian.com
14. Jenkins D (2002). The final frontier: America, science, and terror. Verso.
15. Faith T (2010). As Is Proper in Republican Form of Government: Selling Chemical Warfare to Americans in the 1920s. Federal History (on line), pp.28-41.
16. Hammond P, Carter G (2002). From Biological Warfare to Healthcare: Porton Down, 1940-2000. Palgrave.

Box 2. Personal experience: the Janus faces of biochemistry

Academic biochemistry comes with spin-off dangers as well as benefits. As a graduate student in the late 1950s I had industrial contacts, but chose to stay academic. Like Nieuwland (see main text) I came across a strong enzyme inhibitor.[i] But the enzyme involved, catalase, is not immediately required for life by the organism. It plays a long term role in controlling 'reactive oxygen' species and thus has consequences for health and longevity. And my inhibitor, sodium hypophosphite, is not volatile so could not be used as a gas weapon. But I thought for a moment about possible similarities to the organophosphate analogues that led to the development of nerve gases.

Later, in research on cell respiration, I used of 'British antilewisite', BAL, ($HSCH_2$-CH(SH)-CH2OH), an antidote developed by UK World War II chemical warfare defence research chemists.[ii,iii] There was a real fear during WWII that lewisite would be used as a weapon, either in battle or as a terror device against civilians. Chemically reactive 'gas warning' boards were set up on posts quite widely in town and country, and children were trained in gas mask use. I had to carry mine to and from school for a while. My baby brother had one with a Mickey Mouse 'face'… BAL is something of a kill or cure antidote. Effective in alleviating lewisite poisoning it is itself a respiratory inhibitor.[iv] Many UK scientists were involved, with a large Cambridge contingent, notably Peter Mitchell (later a senior colleague in my field, Nobel 1978). They made a significant contribution by creating a BAL version less toxic than the original.[v] Fortunately the antidote was never needed in WWII, and its research role as respiratory inhibitor was later replaced by more specific compounds.

I am still in the poisons business – using cyanide, nitric oxide and sulphide as research tools in studying the mechanisms and control of oxidative enzymes. My PhD supervisor David Keilin would cheerfully mouth pipette cyanide and one day 'froze' his tongue by taking a small aliquot into his mouth. His co-worker Ted Hartree used to prepare the 8% HCN constant boiling solution (Scheele's acid) by distilling HCN from KCN and acid. There was a useful large bottle of this immensely toxic acid stored in the refrigerator. Using it neat for a few minutes gave me a headache. Casual attitudes to laboratory safety reflected a more general lack of concern about dangers, both to researchers and others. Today the university is obligated both under health and safety laws, and by national legislation (Chemical Weapons Act 1996 and subsequent regulations) due to UK ratification of the Chemical Weapons Convention, to maintain careful control of and report on toxic chemical holdings. 'COSHH' assessments are in place everywhere and we are obligated to train students and other new workers in correct handling and usage. Some chemicals are banned. Much of this was unthinkable when I was a research student. The past is indeed another and harsher country.

References

i. Nicholls P (1961). The action of anions on catalase peroxide compounds. Biochemical Journal, vol.81, pp.365-374.
ii. Peters R, Stocken L, Thompson R (1945). British anti-Lewisite (BAL). Nature, vol.156: pp.616-9.
iii. Ord M, Stocken L (2000). A contribution of chemical defence in World War II. Trends Biochem. Sci., vol.25, pp.253-6.
iv. Slater E (1948). A factor in heart muscle required for the reduction of cytochrome c by cytochrome b. Nature, vol.161, pp.405.
v. Danielli et al (1947). BAL-INTRAV: A new non-toxic Thiol for intravenous injection in Arsenical poisoning. Biochemical Journal, vol.41, pp.325-333.

CapGlobalCarbon: A global response to a global problem

John Jopling argues that a radical addition is needed to the international system for curbing carbon emissions.

The current international system for addressing climate change – set up in 1992 via the UN Framework Convention on Climate Change (FCCC) – relies on negotiation between national governments to reach agreements for reducing carbon emissions. It has never worked effectively, and global carbon emissions have continued to rise. With governments pursuing a narrow, short-term economic agenda – strongly encouraged by vast corporations – this is unlikely to change as we move towards the next major climate conference in Paris in late 2015.

If the existing institutional arrangements cannot be relied upon to achieve the level of emission reductions indicated by climate science, we need a back-up plan. The remedy proposed here was developed by members of the Foundation for the Economics of Sustainability (Feasta), based in Ireland.[1] It would be an add-on, started and developed outside the existing process, but designed to work in close cooperation with the players within that process, namely the producers and users of fossil fuels, including national governments. It uses the scheme commonly known as 'cap and share'.[2]

CapGlobalCarbon: the main features

The main features of the new arrangement would include: a mechanism for controlling carbon emissions; clear institutional structures; and a method for the fair distribution of funds.

The key to controlling carbon emissions would be a limit on the total global extraction of fossil fuels from the ground – an 'upstream' cap. This cap would be reduced year on year, based on climate science. It would be implemented via a global licence scheme, under which a licence would be required to bring fossil fuels onto the market anywhere in the world. There would be a free market for licences – they would be issued by auction and then traded.

A new institution would be needed to establish and operate the scheme, acting on behalf of humanity – a 'global climate commons trust'. This would cooperate with national governments whose role it would be to police the scheme within their respective jurisdictions by banning the exploitation of fuels not covered by a licence.

Funds generated by the annual auction of the licences would be used for the benefit of people equally, so that those living a low carbon lifestyle would benefit.

Making it happen

It is clear that such a scheme is very unlikely to emerge from the UN FCCC process. Comparable proposals by Peter Barnes and others,[3] by Oliver Tickell[4] and most recently by Mutsuyoshi Nishumura[5] have not been taken up. The initiative will have to come from the public through grassroots/ civil society organisations.

Is this realistic? I believe it is, if two key conditions are met: a shared purpose;[6] and shared principles/ values.

The shared purpose would be the achievement of the necessary emissions reductions to avoid catastrophic climate change, in ways that benefits those in poverty. The shared principles/ values would include equality, respect, cooperation, participatory democracy, transparency, accountability and the rule of law. All processes would be clear and enforceable though the courts.

We can learn from and build on well-used models, for example, the concept of public resources, i.e. 'commons', and cooperatives. The atmosphere is a common resource that requires cooperative management.[7]

Some broader concepts are important too. These include: human society viewed as a subsystem of the natural 'Gaian' environmental system;[8] the world seen not as a collection of nation-states but as a single global human society;[9] power seen not as domination but as a facility to "enable things to happen";[10] and the 'great transition' – the realisation that nothing less than transformation of economics and politics will do.[11] Could the climate crisis be an opportunity to add momentum to the movements for fundamental social change?

Who will be the main players in our new arrangement? I think young people and women – neglected by the present system – will take a leading role. For example, young people are at the forefront of harnessing real-time communications technology and open-source software systems, such as Linux and Wikipedia, which open up numerous positive possibilities when many people contribute cooperatively.

I believe it can be done. The cap and share proposals, coupled with some of the ethical, institutional and economic changes that I have outlined, offer an alternative that can be developed within the mainstream market economy and in cooperation with sympathetic governments and entrepreneurs. It will not need mass support initially. We can build that as we go along. If necessary, legal actions can be taken against fossil fuel corporations as well as governments to enforce compliance with the scheme.[12]

If you are interested in helping Feasta promote this initiative more widely, please contact John Jopling at <johnj@thevillage.ie>

John Jopling is a retired barrister and a founder member of Feasta.

References

1. www.feasta.org
2. www.capandshare.org
3. Barnes P et al (2008). Creating an Earth Atmospheric Trust. Grist.
4. Tickell O (2008). Kyoto2: How to Manage the Global Greenhouse. Zed books. www.kyoto2.org
5. Mutsuyoshi N (2014). A new market-based climate change solution achieving 2°C and equity. Wiley Interdisciplinary Reviews: Energy and Environment. onlinelibrary.wiley.com/doi/10.1002/wene.131/abstract
6. Hock D (2000). Birth of the Chaordic Age. Berrett-Koehler. p.67.
7. Bollier D, Helfrich S (eds) (2012). The Wealth of Commons. Levelers.
8. Crist E, Rinker H (eds) (2009). Gaia in Turmoil: Climate Change, Biodepletion, and Earth Ethics in an Age of Crisis. MIT Press.
9. Allott P (2002). The Health of Nations, Society and the Law beyond the State. Cambridge.
10. Allen J (2010). Powerful City Networks: More than Connections, Less than Domination and Control. Urban Studies, vol.47, no.13, pp.2895-2911. usj.sagepub.com/content/47/13/2895
11. Great Transition Initiative (2014). greattransition.org
12. Wij Willen Actie (2014). The Urgenda climate case against the Dutch Government. www.wijwillenactie.nl/?page_id=1097

UK household energy policy: another fine mess

Philip Webber describes the recent string of failures in the government's home energy efficiency programmes and what needs to be done about them.

Last autumn, Energy Secretary Ed Davey announced that there would be another change to the flagship Green Deal programme for home energy efficiency. This was the latest in a series of legislative changes and new incentive funds since 2012 concerned with how energy use in the domestic sector could be reduced. This article reveals how government policy has virtually been a case study of how not to create an environment where energy saving and carbon reductions take place efficiently and effectively.

Government policy changes since 2012

First, some background. In 2008, the Climate Change Act was established as a legally binding framework to reduce UK carbon emissions by 80% by 2050, using 1990 as the base year. Almost a quarter of all carbon emissions in the UK currently result from energy use in domestic and commercial buildings.[1] In addition, most of the existing housing stock, which currently has poor thermal standards, will still be in place in 2050. Hence a major retrofit programme in the domestic sector should be a crucial part of the action necessary to meet the target.

At the end of 2012, the Coalition government made major changes to how home energy improvements were funded and incentivised. All of the home energy saving schemes set up by the previous government were cancelled and replaced with two new ones: the Green Deal; and the Energy Company Obligation (ECO). The Green Deal is a loan paid for out of energy bill cost savings. The ECO provides subsidies for specific measures and helps those in low-income households and other priority groups. Subsidies are funded by 'green energy levies' imposed on the largest ('big six') energy companies through carbon reduction targets set by government.

Energy companies do not directly install the energy saving measures. They offer work via tenders and contracts to a range of smaller companies and installers across the UK. Coalitions of sub-contractors are formed to bid for work and in turn may employ their own sub-contractors to install measures. This is a complex chain of relationships. Whenever the government changes the subsidy levels or the operation of scheme with little notice, considerable uncertainty results.

In practice the main driver of energy efficiency improvements has been ECO funding. To qualify for ECO, a Green Deal energy assessment has to be carried out to estimate the cost and recommend appropriate measures. The ECO programme worked well and formed the bulk of new insulation work in 2013 and 2014.

But the Green Deal process proved lengthy and complicated, and the 7.5% interest rate for loans was a major disincentive. The Green Deal had extremely low take-up – around a few per cent of original targets.[2]

Also while previous schemes sold energy saving on the basis that it would save you money, the Green Deal's selling point was that it would not cost you any more. It aimed to reduce your fuel bills slightly, a much weaker selling point. Also, with rising and fluctuating energy prices, and confusing energy tariffs and billing financial savings are hard to see (e.g. against a rising bill).

The very poor take-up of the Green Deal was viewed as a political problem. It also created a large cash flow problem as customers who would contribute some of their own finance (termed 'able-to-pay' in the industry jargon) were simply not installing energy

Dates	Events
December 2012 – March 2013	Extreme uncertainty in home energy efficiency markets as government consultation paper on new schemes not yet published, but previous funding schemes (CERT, CESP etc.) have stopped.
April 2013	Green Deal and ECO subsidies start – but details still not yet published. Big six energy companies cautious about issuing new contracts, limiting duration and scale of work.
Summer 2013	Green Deal and ECO details now clear. Prices for energy efficiency work drop dramatically. Some sub-contractors relying solely on ECO go out of business.
December 2013	Green Deal take-up is extremely low so ministers announce a new short-term subsidy – the Green Deal Home Improvement Fund (GDHIF). Companies develop marketing to attract customers with the new £4,000 cashback scheme for May 2014.
December 2013	Chancellor's Autumn Statement announces ECO funding to change from 1st April 2014, particularly for external wall insulation (EWI).
December 2013 – April 2014	Extreme pressure to get EWI on the books before the cut-off date; a mad rush ensues to get work done. In April, many workers are laid off after an intense period of work.
May 2014	Ministers announce that the GDHIF cashback will be £6,000 not £4,000, but they fail to make it clear when this will happen. Chaos reigns. All customers who signed up wait for new larger incentive. No firm dates are given until the DECC releases details in June.
June 2014	More confusion. The scheme is pulled after 2-3 days operation. All the £70m seems is committed in the form of 9,000 cashback vouchers. No-one understands how it happened so quickly. Foul play is suspected. Some sub-contractors don't get paid; some customers don't get the cashback they expected and are left with large unexpected bills.
September 2014	House of Commons Committee on Energy and Climate Change recommends that home retrofitting needs an injection of new life, suggesting incentives from Council Tax and Stamp Duty. They label DECC communications "confusing".
November 2014	£24m of new funds for Green Deal programme released. The scheme closes the same day as being opened - all the money had been allocated in vouchers. An even worse fiasco than in the summer

Table 1. Timeline of key events in the UK home energy efficiency sector, 2012-14
(Compiled from a range of government and industry sources)

saving measures. Ministers at the Department of Energy and Climate Change (DECC) intervened with several small incentive funds to try to get the Green Deal to take off. But over the same period the Treasury made fundamental changes to ECO funding. All these interventions are summarised in the timeline in table 1. Funding changes to the ECO that originated from the Treasury were intended to be populist by providing short-term savings in household energy bills – but at the cost of future funding and larger long-term savings.

The large number of government interventions during 2013-2014 had the overall effect of destabilising the operation of the energy saving market. Funding for carbon reduction (£/tonne) fell to around 20% of levels at the start of 2013.[3] Only short term contracts – typically lasting six months – or specific project contracts are now being issued for energy saving by the big six energy companies. This makes it hard for the small sub-contracting energy installers to plan ahead and stay in business.

How is the energy saving industry responding?

While any new incentives for home energy efficiency are welcome, the funding released – some £30m at a time – is completely insufficient to meet the scale of action needed properly insulate the UK's housing stock in the short or longer term.

Estimates by researchers at the University of Leeds[4,5] indicate that programmes to install insulation and carry out other carbon reduction measures, across a city region equivalent to Leeds (with a population of about 10m), would require an initial funding pot of about £5bn, but would pay for themselves in under 5 years. According to a review by climate economist Nicholas Stern,[6] translating that to the UK level would require up to £25bn per year. Once this funding pot was set up it could then become self-funding via payback through cost savings made in energy demand.

A better way forward

In my view, the problems with UK housing stock and inefficient energy systems represent a major opportunity. The government is providing tens of billions for projects such as the High Speed 2 (HS2) train route and Hinkley Point C (HPC) nuclear power station.[7] The domestic and commercial energy efficiency sector needs investment at a similar scale. It is unrealistic to expect energy reductions to be completely self-funding from a standing start. This is especially the case after the failed Green Deal which will unfortunately have acted to undermine future efforts to get householders to take up energy saving loans. An initial investment in energy saving through providing incentives and funding at the £5bn scale at realistically low interest rates, would regenerate the housing market, create many jobs and help get the UK back on track to meet its carbon targets. The only reason this is not happening is the lack of understanding and vision in government. Labour has recently proposed a policy of underwriting interest-free loans up to £1m to get the Green Deal working properly.[8] This would be helpful but is still at too limited a scale to have much impact. And ironically, this announcement has had the effect of reducing funding even further from energy companies as they await the outcome of the General Election in May 2015.

If the energy saving sector were to be incentivised to become a large-scale activity, this would pave the way for major private sector funding. Key potential sources are pension funds, which are struggling to find places to invest their multi-billion portfolios to secure interest rates greater than 1% in the wake of the recession. Their need for a long-term interest stream over 10-15 years matches well with the energy saving market.

During my time at Kirklees Metropolitan Council, in West Yorkshire, and afterwards at the University of Leeds, I met several fund holders who had several billion to invest. The snag is that they don't want to invest sums smaller than a £1bn, so there is a significant gap between what one pension fund manager called a "wall of money" (waiting to be invested) and current UK activity to invest in.

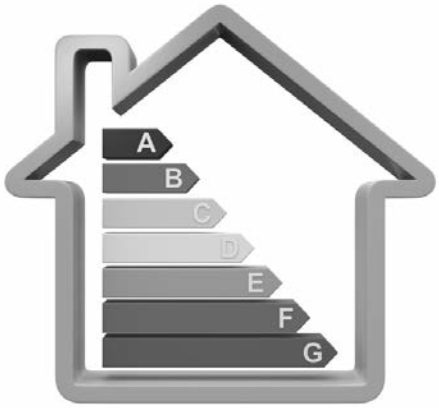
In addition, to really tackle climate change requires more widespread taxation of higher carbon emitting activities with the income being used to further reduce non-renewable energy use.

These are the challenges for any politician willing to take it up and positively transform the UK economy.

Dr Philip Webber, Chair of SGR, is also a non-executive director of Yorkshire Energy Solutions (YES) – an energy company with a social purpose – which has given him an insider's view of the current energy markets.

Notes and references

1. DECC (2014). Energy Consumption in the UK. www.gov.uk/government/statistics/energy-consumption-in-the-uk
2. Left Foot Forward (2014). leftfootforward.org/2014/02/the-coalition-falls-way-short-of-green-deal-sign-up-target
3. Personal communication with CEO of YES; October 2014.
4. Gouldson A, Kerr N, Topi C, Dawkins E, Kuylenstierna J, Pearce R (2012). The Economics of Low Carbon Cities: A Mini-Stern Review for the Leeds City Region. Centre for Low Carbon Futures.
5. Sullivan R, Gouldson A, Webber P (2012). Funding low carbon cities: local perspectives on opportunities and risks. Climate Policy, vol.13, no.4, pp.514-529.
6. For example, see the 2006 'Stern Review' on the economics of climate change. webarchive.nationalarchives.gov.uk/20130129110402/http://www.hm-treasury.gov.uk/d/Executive_Summary.pdf
7. For HS2, large investment funds are coming directly from government. However, for HPC, the investment will come from the private sector, but major financial support mechanisms will be provided by government.
8. Labour Party (2014). An end to cold homes: One Nation Labour's plans for energy efficiency. www.yourbritain.org.uk/agenda-2015/policy-review/policy-review/an-end-to-cold-homes-labour-s-energy-efficiency-green-paper



Scientific publication in peril: the Séralini affair

Eva Novotny discusses the controversy surrounding an academic paper showing health problems in a feeding trial of a GM crop – and what it says about corporate influence in this field.

In September 2012 a new study on the potential health effects of a diet containing a herbicide-tolerant genetically modified (GM) crop and/or its associated herbicide was published in a peer-reviewed journal. It provoked a bitter debate. Fourteen months after the publication of the paper, it was retracted by the Editor-in-Chief of the journal because it was "inconclusive" — an unprecedented criterion for retraction. This article recounts the history of the paper, and why many believe that the real reason for its retraction was that the study found evidence of serious health problems resulting from consumption of the GM crop and also of the herbicide, thereby putting Monsanto and the whole GM food and feed industry at risk.

Two papers: Monsanto vs Seralini *et al*

In 2004, scientists employed by Monsanto had published a paper[1] in the journal *Food and Chemical Toxicology (FCT)* describing a feeding trial of Monsanto's GM maize NK603. "Statistically significant differences" were found in various health parameters between the GM-fed rats and the control rats consuming the same amount of non-GM maize. These differences were deemed by the researchers to be not "biologically meaningful", and NK603 was declared to be "as safe and nutritious as existing corn hybrids". The duration of testing was 13 weeks (90 days).

Concerned by the Monsanto paper, a predominantly French team led by Prof Gilles-Eric Séralini undertook a two-year (over 700 days), feeding trial,[2] which was otherwise similar. Their work was published in September 2012, also in FCT. The early warnings that had been dismissed in the Monsanto paper developed into serious illnesses, including damage to liver, kidneys, pituitary gland and, most notably, early deaths and development of large tumours in females. In addition, the study included trials of minute amounts of Monsanto's Roundup, the herbicide to which tolerance has been genetically engineered into NK603, in the rats' drinking water.

Avalanche of criticism

Immediately after the Séralini *et al*. paper was published, pro-GM scientists sent hostile criticisms to the journal's Editor. The most frequent complaints were that the strain of rat used was wrong and, above all, that not enough rats had been used. The criticisms arose from implicit insistence by the critics that this was a carcinogenicity study, which it was not. At the same time, many other scientists wrote to the journal in support of the paper.

The European Food Safety Authority (EFSA), which had previously approved the maize, was now responsible for passing judgement on a paper that found it harmful. The review[3] concluded that "The study as reported by Séralini *et al.* was found to be inadequately designed, analysed and reported." Many members of the Authority, however, have conflicts of interest with the industries they are meant to regulate.[4]

A new editor

Some months after the publication of the Seralini paper, a new post of Associate Editor for Biotechnology was created at FCT, and Dr Richard Goodman was appointed to fill it.[5] Dr Goodman was one of the critics who had written to the Editor-in-Chief of FCT to complain about the Séralini paper. He had formerly been employed by Monsanto and has long been involved with the International Life Sciences Institute (ILSI), which is partly funded by Monsanto and other GM seed companies and has a history of influencing governmental risk assessment for the advantage of the funding companies.[6]

A letter[7] initiated by myself and signed for SGR by Philip Webber, Chair, as well as five other scientists and one Research Director, was sent to four staff of *FCT* and its publisher, Elsevier, urging that the appointment be rescinded. This led to an invitation to nominate a candidate for a new editorial post at *FCT* to balance Richard Goodman; but, after the retraction of the Séralini paper (see below), no further communication about the post ensued.

Before the arrival of Dr Goodman at FCT, a Brazilian paper also finding potential harm to health from toxins produced in some GM crops was in press and already published by FCT online. Shortly after the arrival of Dr Goodman, the paper was withdrawn. The authors submitted it to another academic journal and it was republished[8] essentially intact.

Richard Goodman is, in fact, not the only editor at FCT with a conflict of interest: several members of the editorial board also have conflicting connections with the GM, chemical or pharmaceutical industries.[9]

Retraction of Séralini paper — but Monsanto paper stands

Following a second peer review of the Séralini paper, lasting many months and (unusually) examining the raw data, the Editor-in-Chief declared that "Ultimately, the results presented (while not incorrect) are inconclusive, and therefore do not reach the threshold of publication for Food and Chemical Toxicology." Thus, on 28 November 2013, over a year after the paper had been published, the Editor-in-Chief retracted[10] the paper on the basis that it was inconclusive — a reason not recognised as valid by the Committee on Publication Ethics (COPE).[11] The paper was considered to be inconclusive because, allegedly, there were too few rats and they were of the wrong type to make the claim that the GM maize and/or Roundup cause cancer. However, no such claim was made; in fact, the word 'cancer' never appears in the paper, and not all the tumours were cancerous. The paper was being regarded as a carcinogenicity study, which it was not: the title itself declared it to be a toxicity study.

Prof Séralini and colleagues wrote a detailed 'Answer to Critics', later published[12] in FCT, and a Letter-to-the-Editor of FCT[13] on 'Conclusiveness of toxicity data and double standards'.

Meanwhile, the 2004 Monsanto study remains in publication in FCT despite its very short duration of testing and other faults.

Independent scientists protest at retraction

Following the retraction, hundreds of scientists and others wrote comments and letters or signed petitions in protest against the irrational and unprecedented retraction.[14] Many scientists committed to a pledge of boycott against publishing their work in the journals of the publisher, Elsevier.

The following extract from a press release[15] by the European Network of Scientists for Social and Environmental Responsibility (ENSSER) conveys the general sentiments of the protests, applicable to all critics and not only EFSA. "EFSA did not apply these same standards retrospectively to the original rat feeding study by Monsanto,. … Use of such double standards is a common response from [pro-GM scientists and government bodies]. Only those studies that find problems are subjected to excessive scrutiny and rejected as defective."

Re-publication in another journal

In June 2014, the Séralini et al. paper was re-published with open access in the Springer Group journal *Environmental Sciences Europe*. Again, there was an immediate outcry by GM supporters. In addition, the researchers have published for open access all their raw data — something the GM companies have always refused to do.

A new paper from the GM industry

The flawed process by which FCT has selected some papers for publication is emphasised by its acceptance of a new study[16] from scientists working in the GM industry. A rat-feeding trial of a GM canola, a type of oilseed rape, by six DuPont scientists found the GM crop to be as safe as non-GM varieties. This conclusion has been challenged by the Seralini team in a Letter-to-the-Editor of FCT,[17] on the grounds that (a) having analysed the diet (obtained from the named company), they found that the diets of the control rats contained large proportions of two GM maizes and also glyphosate residue; (b) the usual 3-month duration was too short to show long-term effects; and (c) additional 'control' groups fed 'reference canola varieties' were used. The same strain of rat was used as by the Seralini researchers with 12 rats per sex per group, compared with 10 by the Seralini team. Three rats died or had to be put down during the study. As usual in industry studies, statistical differences were regarded as being "of no biological relevance". The results were said to "support the conclusion" that the canola is safe. To add further insult to injury, the DuPont scientists declared at the end of the paper that they had "no conflicts of interest". Moreover, the lead author is a Managing Editor of the journal.[18]

Conclusion

The 'Séralini affair' illustrates the pervasive influence and power of major corporations over biotechnology publications and research. Evidence of harm to health caused by products during testing by companies can be hidden under 'commercial confidentiality' or by a poor experimental design. A once-respected journal can no longer be relied upon to be objective, with studies showing harm from GM crops rejected without good reason, while studies finding safety in flawed experiments are published. It is difficult not to conclude that science is being corrupted to suppress legitimate questions about the safety of GM crop technology.

Dr Eva Novotny has been independently researching issues related to GM crops since 1999. She was a member of SGR's National Co-ordinating Committee from 2001 to 2005.

References

1. Hammond B, Dudek R, Lemen J, Nemeth M (2004). Results of a 13 week safety assurance study with rats fed grain from glyphosate tolerant corn. Food and Chemical Toxicology, vol.42, pp.1003-1014. www.sourcewatch.org/images/8/87/Hammond_Study_NK603.pdf
2. Séralini G E, Clair E, Mesnage R, Gress S, Defarge N, Malatesta M, Hennequin D, Spiroux de Vendômois J (2012). Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize. Food and Chemical Toxicology, vol.50 (11), pp.4221-4231 (November). www.sciencedirect.com/science/article/pii/S0278691512005637
3. EFSA Journal (2012). Final review of the Seralini et al.(2012) publication on a 2-year rodent feeding study with glyphosate formulations and GM maize NK603 as published online on 19 September 2012 in Food and Chemical Toxicology, vol. 10, Issue 11, Pages 2986-2995. www.efsa.europa.eu/en/efsajournal/pub/2986.htm
4. Corporate Europe Observatory (2013). Unhappy meal: The European Food Safety Authority's independence problem. corporateeurope.org/efsa/2013/10/unhappy-meal-european-food-safety-authoritys-independence-problem
5. Robinson C, Latham J (2013). The Goodman Affair: Monsanto Targets the Heart of Science. Independent Science News. independentsciencenews.org/science-media/the-goodman-affair-monsanto-targets-the-heart-of-science/
6. See for example: NRDC (2006). www.nrdc.org/media/pressreleases/060131.asp
7. Open Letter re: Appointment of Richard Goodman (1 October 2013) www.sgr.org.uk/resources/open-letter-pro-gm-bias-academic-journal
8. Mezzomo B P, Miranda-Vilela A L, Freire I de S, Barbosa L C P, Portilho F A, et al., (2013). Hematotoxicity of Bacillus thuringiensis as Spore-crystal Strains Cry1Aa, Cry1A2, Cry1Ac or Cry2Aa in Swiss Albino Mice. J Hematology & Thromboembolic Diseases, vol. 1, issue 1, pp. 104-112 esciencecentral.org/journals/hematotoxicity-of-bacillus-thuringiensis-as-spore-crystal-strains-cry1aa-cry1ab-cry1ac-or-cry2aa-in-swiss-albino-mice-2329-8790.1000104.pdf
9. Testbiotech (2013). Economic interests quashing scientific controversy? New round in the dispute on the NK603 rat-study. www.testbiotech.de/en/node/972
10. Elsevier (2013). Elsevier Announces Article Retraction from Journal Food and Chemical Toxicology. 28 November. www.elsevier.com/about/press-releases/research-and-journals/elsevier-announces-article-retraction-from-journal-food-and-chemical-toxicology
11. COPE (2009). Retractions: Guidance from the Committee on Publication Ethics. publicationethics.org/files/u661/Retractions_COPE_gline_final_3_Sept_09__2_.pdf
12. Séralini G E, Mesnage R, Defarge N, Gress S, Hennequin D, Clair E, Malatesta M, Spiroux de Vendômois J (2013). Answers to critics: Why there is a long term toxicity due to a Roundup-tolerant genetically modified maize and to a Roundup herbicide. Food and Chemical Toxicology, vol.53, pp.476-483 (March). www.sciencedirect.com/science/article/pii/S0278691512008149
13. Séralini G E, Mesnage R, Defarge N, Spiroux de Vendômois J (2014). Conclusiveness of toxicity data and double standards. Food and Chemical Toxicology, vol.69, pp.357-359 (July).
14. Open Letter on Retraction and Pledge to Boycott Elsevier (still open for signatures) (4 December 2013). Institute of Science in Society. www.i-sis.org.uk/Open_letter_to_FCT_and_Elsevier.php#form
15. ENSSER (2013). End double standards in evaluating GMO safety studies — say scientists. Press release. 17 December. www.ensser.org/media/0813/
16. Delaney B, Appenzeller LM, Roper JM, Mukerji P, Hoban D, Sykes GP (2014). Thirteen week rodent feeding study with processed fractions from herbicide tolerant (DP-Ø73496-4) canola. Food and Chemical Toxicology, vol.66, pp.173–184. www.sciencedirect.com/science/article/pii/S0278691514000568
17. Mesnage R, Defarge N, Spiroux de Vendômois J, Séralini G-E (2014). Letter to the Editor regarding "Delaney et al., 2014": Uncontrolled GMOs and their associated pesticides make the conclusions unreliable. Food and Chemical Toxicology. Published online, 2 July. www.sciencedirect.com/science/article/pii/S0278691514003226
18. Food and Chemical Toxicology Editorial Board (accessed 23 October 2014). www.journals.elsevier.com/food-and-chemical-toxicology/editorial-board/

Challenging the mindset of war – *continued from front page*

the region. Other Western military deployment is being contemplated. Another long war – which will likely last years – is in prospect.

The UK's role has so far been relatively small, but it is increasing. Dozens of air-strikes have been carried out by Tornados and Reaper drones since October[7] and in December the government announced several hundred more troops will be sent to carry out training.[8]

One problem with the West's military response is how it is being used by IS and other extremists for propaganda purposes. Footage of Western aircraft again bombing in Muslim countries is being posted on social media to recruit new foreign jihadists to fight for their cause. There is evidence that the resultant influx of new fighters is more than offsetting the number killed.[9] Meanwhile, radicalisation can also, of course, lead to terrorist acts within Western countries themselves – not least the Charlie Hebdo murders. So the West's military strategy seems likely to prolong rather than shorten the wars in Iraq and Syria and fuel violence further afield.

War in Ukraine

The current crisis in Ukraine dates back to early 2014 when President Yanukovych was pushed out of power following pro-Western protests against his decision to build closer links with Russia rather than the EU.[10] Within days, pro-Russian insurgents took control of government buildings in the region of Crimea – home to Russia's Black Sea fleet. A hastily arranged public referendum then resulted in a vote in favour of joining Russia, and Crimea was duly annexed by its neighbour. Western countries protested and imposed economic sanctions. Pro-Russian protests spread to other Russian-speaking regions in Eastern Ukraine, and armed insurgents took control of regional government buildings there. The Ukrainian military began an offensive against the insurgents and the fighting has, at the time of writing, led to over 5,000 deaths despite repeated attempts to implement a ceasefire.[11] Evidence that the Russian military is providing support to the insurgents is hard to deny.[12] Commentators have begun to talk of a 'New Cold War'.

While many have been quick to blame Russia solely for the conflict, it is important to bear in mind NATO's role in fuelling Russia's security fears. At the end of the Cold War in 1991, the Warsaw Pact – the Russian-led military alliance – was dissolved. However, NATO responded simply by expanding east. 13 new countries in Eastern Europe have since joined, and military exercises have been conducted with other non-NATO countries, including the Ukraine.[13] With the Ukraine sharing a 2,000km border with Russia, this has proven especially controversial. Added to this, NATO countries have had a combined military budget of approximately $9,700,000,000,000 over the last decade – more than 15 times that of Russia.[14] So it is no surprise that Russia feels very vulnerable.

Gaza and beyond

UK and Western involvement has also been key in recent trouble spots in other parts of the world.

Israel's seven-week military attack on the territory of Gaza – after tensions had risen, and Hamas had fired rockets into Israel – left over 2,100 Palestinians dead (mostly civilians including over 500 children). 71 Israelis (mostly soldiers) also died in the conflict.[15] Both sides claimed a victory of sorts – but the UN High Commissioner for Human Rights was very critical of both sides, especially Israel for disproportionate action and possible war crimes.[16]

Israel mainly imports military equipment from USA. However, since 2008, the UK government has also issued over £8 billion of export licenses for components for a range of military systems and dual use technology to the country.[17]

Western countries also provide much military equipment to Arab countries in the Middle East – which fuels regional rivalry. For example, after Israel, the UK's second and third largest customers are the United Arab Emirates and Saudi Arabia.[18] Added to this is the recent expansion of Western military bases in both the Middle East and Africa. One recent example is a 'permanent' base in Bahrain for Royal Navy activities.[19] This despite the brutal suppression of pro-democracy protests there in 2011.

Meanwhile in Libya, the country has fallen further into chaos in the wake of the NATO-backed toppling of Gaddafi's regime in 2011. Militia groups affiliated to IS are now gaining ground.[20]

Key themes

There are some key themes arising from the above:

1. That the West is seen to have double-standards – condemning IS for killing many civilians, while doing little to prevent Israeli's killing of civilians or curbing the supply of weapons to brutal Arab governments;
2. That the West's actions are doing little more than perpetuating cycles of violence – and this is clearly not working; and
3. That sufficient effort/ resources are not being put into tackling underlying injustices – which is essential if we are to bring about peace.

An important and controversial development within the Western military approach is the rise of 'remote control warfare'.[21] This is the attempt to counter threats at a distance without the deployment of large military forces. This involves:

- drones – both unarmed surveillance craft and those capable of launching weapons;
- special forces – which can covertly attack 'enemy targets';
- private military contractors – who are less accountable and whose deaths are attract less public sympathy; and
- cyber-warfare – which can damage and disrupt 'enemy' computer systems.

The military role of UK engineering and science

Although total military spending in the UK has fallen since 2010, the budget for military equipment has not been reduced. The most recent Defence Equipment Plan has a budget of more than £160bn over the next 10 years.[22]

The first thing to note is the prominence of Britain's traditional 'big ticket' weapons systems. These include new nuclear-armed submarines, planned to succeed the current Trident system, and with a similar capability to cause destruction on an unprecedented scale. Billions of pounds' worth of 'preparatory work' for this system is being carried out by a British consortium led by BAE Systems, Rolls-Royce and Babcock. Secondly, there are the two new 'Queen Elizabeth' class aircraft carriers – the first of which was named last July and which is due to become fully operational by 2020. They will be the largest ships in British naval history: three times the size of the previous class of Royal Navy aircraft carriers.[23] The main industrial partners responsible for this project are BAE Systems, Thales and Babcock. A third major programme is the new Lightning II fighter-bombers – built mainly in the US (and called F-35's there).

Another thing to note is the growing resources being devoted to equipment for remote control warfare. Both drones and cyber-warfare are being given rapidly increasing budgets. This trend follows on from increased military R&D spending in these areas in recent years – identified by SGR in our report, *Offensive Insecurity*.[24]

Of course, all these technologies have a clear offensive capability, and the export potential of military technologies remains a government priority.

Alternative strategies

There are many alternative strategies to tackling these security problems which do not prioritise

military action. The most obvious action Western governments could take would be to end military exports to countries with poor human rights records, such as Israel and Saudi Arabia. Other international action includes:

- more concentrated effort to enforce arms embargoes in regions of conflict, as well as much stricter controls more generally of the international arms trade;
- improving international financial controls to shut down funding routes for groups such as IS;
- stricter border controls to prevent new combatants entering conflict zones, e.g. in Turkey;
- continued negotiation to create more humanitarian corridors to help refugees fleeing from war zones;
- providing adequate funding and resources for refugee camps, food aid and other support services;
- rapid reaction mediation teams (composed of neutral parties) to help defuse political conflicts before fighting breaks out;
- defusing international tensions by reducing military exercises, co-operating in arms control and disarmament programmes, and cutting military spending;
- more national and international processes for tackling underlying grievances, such as political exclusion, human rights abuses, inequality, poverty, and environmental damage.

Some of these options are being pursued at a limited scale – with the essential involvement of science and technology professionals – but they need to be expanded and/or provided with more resources. It is particularly shocking that the UN's World Food Programme was forced to halt its food voucher scheme for Syrian refugees in early December due to lack of funds.[25] This meant aid for 1.7 million refugees was put in jeopardy as the harsh winter weather set in. Given the huge military spending summarised above, nothing illustrates the distorted set of priorities better.

No one is under any illusions about the difficulty in solving the security problems in the Middle East, Ukraine, Africa or elsewhere, but it is clear there are many alternatives to military action and these remain poorly funded.

Signs of hope

There are some hopeful signs which, with concerted political pressure, could lead to a more promising future.

Global military spending has fallen from its recent peak, with NATO military spending 12% lower than its peak.[26] Continuing international economic problems are helping to curb military spending in countries as diverse as the UK and Russia – and this could restrict international military deployments. In addition, the most recent statistics on annual R&D spending by the Ministry of Defence show that it has fallen below £1.5bn – its lowest level on record (in real terms).[27] Meanwhile, the UK government continues to protect overseas aid from cuts, and has pledged over $1bn for the Green Climate Fund, aimed at helping developing countries adapt to climate change.[28]

There are also some less well-known statistics from academic research that show marked declines in the rates of violence and war in many parts of the world in the last few decades and, in some cases, longer. Psychologist Steven Pinker has gathered a wide range of datasets in a recent book[29] showing that, once factors such as population growth and the patchiness of historical records are taken into account, clear downward trends can be seen. Although the reasons for the trends are complex, he highlights the importance of factors such as the spread of democracy and a growing humanitarian ethic.

But, as current international events show, there is no room for complacency. One particularly challenging problem for the science and engineering community is their role in the exponential increase in the destructive capability of weapons which occurred over the last century – not least due to developments in the nuclear field.[30] Ongoing modernisation of nuclear weapons, coupled with new developments in areas such as military robotics and artificial intelligence, show that this problem continues to be urgent. And, at the same time, we are failing to apply sufficient scientific and technical effort to tackling global environmental problems which threaten the security of all.

Highlighting these problems and arguing for change continues to be an important focus for SGR activities – as the news section on pp.2-6 shows. Your ongoing support is vital in enabling this to happen.

Dr Stuart Parkinson is Executive Director of SGR, and lead/ co-author of several SGR reports on science, technology and militarism.

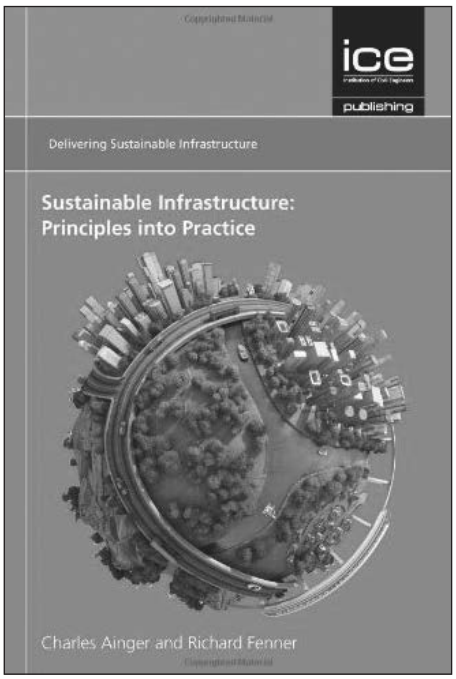
References

1. Cobain I et al (2014). The Guardian, 11 February. www.theguardian.com/uk-news/ng-interactive/2014/feb/11/britain-100-years-of-conflict
2. UN (2014). Security Council Committee, Report S/2014/815. November. www.un.org/en/ga/search/view_doc.asp?symbol=S/2014/815
3. See, for example: Amnesty International (2012). Iraq: Annual Report. amnesty.org/en/region/iraq/report-2012
4. As note 2.
5. The Guardian (2014). 11 September. www.theguardian.com/world/2014/sep/11/barack-obama-tv-speech-on-isis-full-text
6. BBC News online (2014). 3 December. www.bbc.co.uk/news/world-europe-30306106
7. Ministry of Defence (2015). Latest: air-strikes in Iraq. www.gov.uk/government/news/latest-iraq-air-strikes
8. BBC News online (2014). 13 December. www.bbc.co.uk/news/uk-30464272
9. Rogers P (2014). The Evolution of the Islamic State Conflict. Oxford Research Group. November. www.oxfordresearchgroup.org.uk/publications/middle_east/paul_rogers_security_briefing_evolution_islamic_state_conflict
10. BBC News online (2014). 13 November. www.bbc.co.uk/news/world-middle-east-26248275
11. UN OCHA (2015). Ukraine – situation report, no.24. January. reliefweb.int/sites/reliefweb.int/files/resources/Ukraine%20Situation%20Report%20-%20final.pdf
12. The Guardian (2015). 19 January. http://www.theguardian.com/world/2015/jan/19/russia-official-silence-for-families-troops-killed-in-ukraine
13. NATOwatch (2014). Enlargement and Partnerships. www.natowatch.org/enlargement
14. SIPRI (2014). SIPRI Military Expenditure Database. http://www.sipri.org/research/armaments/milex/milex_database
15. Wikipedia (2014). 2014 Israel–Gaza conflict. (accessed 28/12/14) en.wikipedia.org/wiki/2014_Israel%E2%80%93Gaza_conflict
16. BBC News online (2014). 23 July. www.bbc.co.uk/news/world-middle-east-28437626
17. Campaign Against Arms Trade (2014). UK Arms Export Licences database: January 2008 to June 2014. www.caat.org.uk/resources/export-licences/region
18. As note 17.
19. Reeve R (2014). East of Suez, West from Helmand. Oxford Research Group. tinyurl.com/n6spy9a
20. BBC News online (2014). 15 July. www.bbc.co.uk/news/world-africa-24472322
21. Remote Control (2014). remotecontrolproject.org/
22. MoD (2014). Defence Equipment Plan 2013. 13 February. www.gov.uk/government/publications/the-defence-equipment-plan-2013
23. Wikipedia (2014). Queen Elizabeth-class aircraft carrier. (accessed 28/12/14) en.wikipedia.org/wiki/Queen_Elizabeth-class_aircraft_carrier
24. Parkinson et al (2013). Offensive Insecurity. SGR. www.sgr.org.uk/publications/offensive-insecurity
25. The Guardian (2014). 1 December. www.theguardian.com/world/2014/dec/01/syrian-refugees-food-crisis-un-world-programme
26. As note 14.
27. ONS (2014). UK Government Expenditure on Science, Engineering and Technology, 2012. July. www.ons.gov.uk/ons/rel/rdit1/science--engineering-and-technology-statistics/2012/stb-set-2012.html
28. The Guardian (2014). 20 November. www.theguardian.com/environment/2014/nov/20/countries-pledge-93bn-for-green-climate-fund
29. Pinker S (2011). The Better Angels of our Nature: The decline of violence in history and its causes. Penguin.
30. Lemarchand G (2007). Defense R&D policies: fifty years of history. Presentation to INES Council Meeting, Berlin, 4 June. www.inesglobal.com/education.phtml#cpid356

Sustainable infrastructure: principles into practice

Charles Ainger and Richard Fenner; Institution of Civil Engineers Publishing, 2014, 327 pp., £37.50, ISBN-13: 9780727757548 (paperback)

Review by Jan Maskell



As a non-engineer, with a background of working in the design of the built environment, and now a social scientist, I initially found it surprising that a book such as this would be necessary – given the plethora of standards, codes of practice, guidance and tools relating to sustainability available for professionals in this field. Reading this book has highlighted that, unfortunately, the traditional approach of 'design and defend' may still be prevalent in the industry.

This book sets out to provide a practical and accessible handbook for engineers and built environment professionals to address key principles of sustainability, and it achieves this in a number of ways. As one would expect from a book written by engineers for engineers this volume has a strong, clear structure making it easily accessible and immediately useful. Being able to go straight to the stage of your project for information and guidance means practicing engineers can readily access relevant ideas as well as what questions to ask and when. Focusing on questions that engineers can ask of themselves and others is both useful and challenging.

The authors' extensive practical and academic experience combine to offer practitioners a handbook that outlines the critical changes needed to deliver more sustainable infrastructure solutions and also offers techniques to embed these as best practice. The unique aspect to this approach is, throughout the book, the constant challenge to engineers to rethink their approach – through the synthesis of well-known principles and tools and their application to the civil engineering discipline.

The four-part format takes the reader through: Principles; Practice; Change; and Tools.

Part I: Principles introduces the key issues and concepts needed to develop sustainable infrastructure, followed by the core principles that need to guide engineering decision making. The new kind of thinking that engineers can and must bring to their projects is presented in a way that clearly shows the impact that infrastructure has on the environment and society in the short, medium and long term. Readers are advised to read Part I to make sense of what follows and this is sound advice. It is possible then, for those with limited time, to turn to the project stage that is most immediately relevant to their work.

Part II: Practice is potentially the most practically useful section for new and experienced engineers as it follows the typical stages of project delivery (taken from Chapter 2 of the ICE Client Best Practice Guide). At each stage the question 'What can engineers do?' signals the choices they have, and helps them to choose the right time to ask each question. The previous models are referred to throughout – to remind readers and to reinforce the sustainability theme. The usual focus, and comfort zone, of many engineers on the design aspects of their work, is challenged through the encouragement to engage with project stakeholders and collaborate with multi-disciplinary teams, as well as with communities. Recognising these opportunities for innovation and change leads nicely into the next section.

Part III: Change covers two aspects – understanding the opportunities and constraints offered by the organisation or project and the ways that engineers can develop themselves as change agents. All professionals should consider the implications of this section and how they can personally influence change – whatever role they have in delivering infrastructure.

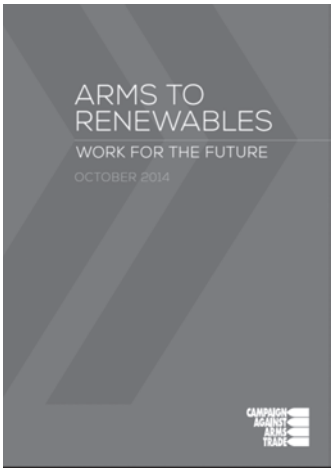
Part IV: Tools is a useful reference point for approaches that can define, test and measure sustainability in infrastructure. Each tool is summarised with an objective account of its application, key issues and, most importantly for those wishing to decide which is appropriate, criticisms and drawbacks. A thorough reading of this section will indicate which tool to choose for a particular project or application.

I found the appendix a really helpful summary of common sustainability principles relating to the areas of: Environmental sustainability – within limits; Socio-economic sustainability – 'development'; Intergenerational stewardship; Complexity; and Cross Cutting Principles.

This volume offers civil engineering and infrastructure professionals a sound route map to follow to enable engagement with stakeholders and decision makers from the early stages of infrastructure projects through to stages of maintenance and use in order to put sustainability principles into practice. There is also much here that would be extremely useful for those commissioning and procuring to read, understand and apply to encourage the collaborative working advocated by the authors.

Dr Jan Maskell is Vice-chair of SGR

Recommended reading



A new report by Campaign Against Arms Trade. Available online at: arms-to-renewables.org.uk

Living within environmental limits: From science to practice

SGR conference and AGM, 4 October 2014 Halton Mill, Halton, Lancaster, UK

Summary by Paul Marchant and Stuart Parkinson

About 65 people attended SGR's 2014 conference and AGM in October at Halton Mill – SGR's new home – an eco-renovated industrial building at Lancaster Cohousing.

The case for urgent and radical carbon emission reductions

The first main speaker was Dr Maria Sharmina, a research fellow at the Tyndall Centre for Climate Change Research, University of Manchester.

She began by highlighting how decisions made now to reduce carbon emissions will determine the extent of future climate change: the earlier and faster we reduce emissions now, the less adaptation will be needed in future. International policymakers accept that a temperature rise of 2°C above the pre-industrial level marks the threshold between 'acceptable' and 'dangerous' climate change. Even so, a 2°C rise is likely to have serious effects, causing widespread mortality of corals, an increased risk of extreme weather events, and hundreds of millions of people affected by coastal flooding. Annual global carbon dioxide emissions have almost doubled since the early 1980s and current policies are in line with 4°C-6°C rise by 2100, a very dangerous prospect.

Sharmina outlined the problem of energy system 'lock-in' because of infrastructure lifetimes, e.g. power stations generally last up to 50 years. So to make an immediate impact we need to look to the demand side. She said wealthy countries like the UK need to make rapid reductions and even undergo a period of 'planned austerity', which could allow poorer countries to increase their emissions as they develop and improve human welfare.

If the world misses the 2°C target, the consequences are likely to be severe. A 4°C rise will reduce maize and wheat yields in tropical regions by 40%. Eco-systems would be devastated and the climate system is unlikely to remain stable. In short, adaptation would not be possible. But to prevent such a scenario only a small percentage of the global population needs to change. Less than 5% of the world's population produces 40%-60% of global carbon emissions: it is this group that needs to take immediate, radical action.

One route to emissions reductions is through using less energy at the demand side, which ramps up markedly through the energy system. Sharmina showed how a domestic fridge requires 13 times more primary energy (typically fossil fuels) extracted from the ground than the final energy used to cool food, due to losses and inefficiencies in the system. These include inefficiencies associated with extracting the fuel, generating electricity, transmission and distribution, and the appliance itself.

Sharmina questioned the conventional notion of economic growth. Using a sum of money similar to the billions used to bail out our banks during the financial crisis to insulate homes and purchase efficient electrical appliances could reduce fuel poverty in over five million homes, and provide mass employment, as well as reduce emissions and increase our resilience to a changing climate.

To meet our commitment to a below-2°C rise, Britain and other industrialised countries must reduce carbon emissions by at least 10% per year. We need to escape conventional economic dogmas and acknowledge that a reallocation of wealth towards decarbonisation will help bring about a low-carbon society.

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Maria Sharmina speaking on carbon emissions reduction

© Harry Tsoumpas

Sue Riddlestone speaking on One Planet Living

How can we live well within natural limits? Case studies of 'One Planet Living'

The second main speaker was Sue Riddlestone OBE, chief executive of the sustainability charity, BioRegional. She pointed out that if everyone on Earth consumed resources at the UK's rate, we would need three planets to provide for us. She showed how planetary resource requirements have increased over the last 40 years, and the vast differences in per capita consumption in different countries: lifestyles in the USA require the equivalent of six Earths, while many poor countries need only a fraction of one Earth.

We want a world where people can live happy, healthy lives within the Earth's natural limits, taking a fair share of the world's resources while leaving space for wildlife and wilderness. A good living for seven billion people within our planet's limits is possible, but those demanding too much of the Earth need to change. This is the idea behind One Planet Living.

Riddlestone described the Beddington Zero Energy Development (BedZED) eco-village in south London, where she lives, whose design and construction is based on principles of sustainability. Through design the project aims to make it easy to do the right thing and difficult to do the wrong thing. For example car

parking is some distance away, and the 100-home settlement has narrow roads to encourage cycling.

BedZED's residents report a high quality of life and a strong sense of community. They use significantly less energy for heating and electricity than the local averages (77% and 45% lower respectively), half as much water, and are less likely to own a car. Further lifestyle changes arise through the strong sense of community, including high recycling rates and largely sustainable food choices. Overall, personal carbon emissions are 71% lower than the national average.

The ten principles behind One Planet Living include: zero carbon energy use in buildings; zero waste to landfill; sustainable transport; sustainable food and other goods; protecting wildlife; equitable economies; and health and happiness. BioRegional encourages organisations and communities to adopt these principles by following a three-stage process, starting with information gathering, then development through workshops to create an action plan; and finally implementation, with annual reports on progress.

One Planet Living projects have been adopted by 17 organisations and communities in the UK and across the world. These include the London borough of Sutton, where BedZED is situated, and projects in Brazil, Tanzania, and the United Arab Emirates. B&Q has also taken on One Planet Living targets. BioRegional plans to reduce its own carbon emissions by 90% by 2023.

Sustainable living: what does it look like?

The afternoon comprised of three workshops that ran twice in parallel. Stuart Parkinson's workshop focused on reducing personal carbon emissions. He noted that the average Briton emits the equivalent of 12 tonnes (t) of carbon dioxide per year, a figure which includes some indirect emissions from items sourced abroad. These emissions must be cut by at least 75% to be consistent with a maximum 2°C global temperature rise.

There are four main areas of concern associated with sustainable living: home energy; transport; food; and other/ indirect emissions. Parkinson looked at each of these areas in turn, assessing how emissions could be reduced to a sustainable level using current technologies and changes in behaviour.

Emissions from home energy use can be brought down from over 2t to nearly zero by living in an eco-housing project such as Lancaster Cohousing (see below), where houses are designed to the 'Passive House' standard and electricity is produced by local renewable energy technologies. As this option is not yet widely available, Parkinson presented evidence that retrofitting an existing house with energy efficient and renewable energy technologies can reduce emissions by about 70%. Other options include living in a smaller home or sharing with others.

Considering transport, the big issue is flying. Average annual emissions from flying are over 1t in the UK: the equivalent of a return flight to Rome. This could be avoided or greatly reduced by holidaying close to home, or by rail or cycling. Emissions from car use can be reduced by about 1t through a combination of an efficient car, using public transport more, cycling, walking, and lift-sharing.
Regarding carbon emissions from food, dietary changes arguably have the biggest benefit, especially cutting consumption of animal products. Changing to a (near) vegan diet can save about 1t.

Parkinson highlighted other actions with an indirect benefit. For example, buying electricity on a renewable energy tariff helps generators invest in low carbon technologies. Buying less, or second hand items, can have significant impact. Investment choices for savings or pensions can have a large benefit, as conventional financial options often fund carbon intensive projects. Limiting family size also leads to major savings for a household.

Living sustainably can have significant quality of life benefits. For example, insulated houses are more comfortable, while joining a car club frees you from worries about maintenance. Diets low in animal produce are healthier, and sharing things with friends and neighbours is more sociable and generally cheaper too.

Community renewable energy: overcoming obstacles

This workshop was led by a panel of speakers: Anne Chapman, from Morecambe Bay Community Renewables (MORE Renewables); Philip Webber, from Yorkshire Energy Services (YES); and Kevin Frea, from Halton Lune Hydro (HLH).

Chapman summarised her experiences with the co-operative MORE Renewables. It is developing a range of renewable energy installations in the Morecambe Bay area to reduce carbon emissions, provide a return for its investors, and gain funding to help people reduce their energy use and live more sustainably. The organisation has to identify suitable projects, which must be technically suitable, have a willing site owner and be financially viable, as well as likely to get through the planning process. A key difficulty has been fluctuating government policy and regulation, making it hard to implement projects. There also needs to be more recognition of the value of community ownership in the planning process. A peer mentoring scheme is now available to help new community energy projects get off the ground.

Webber described his experiences overcoming obstacles while implementing energy conservation and renewable energy projects in West Yorkshire. One problem is that home insulation can be badly installed, giving it a poor public image. This is compounded by its perceived low social status, and its dependence on erratic government programmes. Expensive products like cars and solar photo-voltaic (pv) panels are sold on 0% finance, and seem easier to sell. He said supportive government policies and funding schemes were critical.

Frea discussed his experiences with community renewable energy and energy efficiency projects in Lancashire and elsewhere. He discussed a range of obstacles, such as obtaining permissions from the Environment Agency for a micro-hydro project, and how these could be overcome with persistence.

Tours of Lancaster Cohousing

In parallel with the workshops, there were tours of Lancaster Cohousing and local renewable energy projects. Residents Jan Maskell and Steve Wrigley led the tours, visiting an eco-house, shared community facilities, and the micro-hydro plant, which is nearing completion. The eco-houses are built to the exacting 'Passive House' standard, to minimise the amount of heating they need, and have energy and water-saving measures installed. Hot water is provided by a biomass boiler fuelled by wood chips from local sustainably-managed forests, and solar hot water panels. Electricity is generated onsite by solar pv panels and – by the end of the year – the hydro plant.

SGR's Annual General Meeting

As usual, the event included SGR's AGM. The annual report and accounts were presented, with SGR staff and volunteers reviewing the highlights. The National Co-ordinating Committee for the coming year was then elected (see p2), and the session concluded with discussion of current and planned activities.

Videos, powerpoint presentations and other material from the conference can be downloaded from:
www.sgr.org.uk/events/living-within-environmental-limits-science-practice

Breaking the frame: a gathering on the politics of technology

2-5 May 2014; Unstone Grange, Sheffield

Review by Alan Cottey

This gathering, deliberately so called as being less formal than a conference, attracted about 60 participants. It was created to bring together single-issue activists directing their efforts against the gung-ho and unjust application of particular new technologies. It was a felicitous idea, and it worked well. It was organised as part of the bicentenary studies and commemorations of the Luddite activism of 1811-1816. The principal organising group was Luddites200 and, of numerous others, SGR was prominent. SGR was also well represented in the participants and the scheduled contributors – Wiebina Heesterman on climate change, Stuart Parkinson and Dave Webb on militarism and technology, and myself on 'dismantling the frame'.

There were two panel discussions, with representatives covering environment, peace, women, anarchism, luddism and socialism. Other plenary sessions saw presentations by Simon Fairlie on agricultural robots and Helena Paul on genetic modification. Numerous other presentations added up to a wide range of special topics providing cases for grounded thought about the politics of technology. Good food (provided by Veggies), DIY entertainment and the weather complemented the serious proceedings to make a most successful gathering.

Sometimes an apparently tiny detail, even a single character, makes a vital difference. In P G Wodehouse's humorous poem *Printer's Error*, "was now" is turned by a hapless printer into "was not", so reversing the author's intended meaning. Something like this – not a reversal and not a printer's error but still a profound change of meaning – occurs with the Breaking the Frame project. It is obvious from the context that breaking the frame is intended to have a double significance. One is a reference to the machine breaking activism of 1811-1816. The other must be a call for change today. But what kind of change? The answer, given on the Breaking the Frame website,[1] is that the aim of the gathering is "to develop a broader perspective of technology and to 'break the frames' that keep campaigners in their single-issue boxes". In my opinion, this is a most valuable aim. The gathering was successful in that it made a contribution to this.

The overall ambition of eliminating the 'hurtful to commonality' uses of technology is a long-term project. Sometimes, now and two centuries ago, progressives find the penetration of their values and insights into mainstream thought to be unbearably slow. I suggest that some of this lack of penetration derives from a lack of clarity about what is being proposed. In this case, there is a fundamental difference between 'breaking the frames that keep campaigners in their single-issue boxes' and 'breaking the frame'. For us today, in the context of politics of technology, breaking the frame suggests an abrupt destruction of what frames all politics and technology, that is, our entire culture. Presumably few are really calling for that, for it would have dire consequences. The more limited aim of breaking the frames that keep campaigners in their single-issue boxes is practical and necessary.

Theo Simon, opponent of the proposed Hinckley Point C nuclear power station and lead singer in the band Seize the Day, engagingly summed up of the gathering. He started in the role of a police informer who reported to his masters that these activists were harmless as long as they could be kept divided but an eye should be kept on them in case they should unite, especially with the labour movement.

Dr Alan Cottey is a Fellow at the School of Chemical Sciences at the University of East Anglia, and a former Secretary of SGR.

Reference

1. Report and Videos from Breaking the Frame Gathering (2014). http://breakingtheframe.org.uk/?page_id=335

Letter

Open all the way

Peter Wilmshurst has given us a shocking account (SGR Newsletter 42) of scientific misconduct in medical research, driven by corporate interests. The problems also apply, although possibly to a lesser extent, to all branches of science and, wider again, to knowledge production.

Many of the obstacles to the generation of reliable knowledge, free of the distortions due to narrow interests, would be absent in a culture of radical openness.[1] Discreet and secret investigations would still occur but they would not even be considered for direct incorporation into the body of public reliable knowledge. While the call for openness in recent decades has become something of a mantra, a major reason for the lack of progress has, I believe, been insufficiently noted. This is that the production of reliable knowledge is a long process. Using a biological image, we may think of conception, gestation, birth, development, maturity, old-age and – ancestorhood.

If this long process is to be in the public interest, and not distorted by sectional interests, it must be funded in ways that require openness. This means, for example, that the costs to institutions (including publishers) and personnel must be funded by public and philanthropic bodies acting in the general interest and not by sectional interests. This implies a significant transfer of costs from the private sponsorship model to a public interest model. The road to reliable knowledge will however be shorter and smoother than the present crooked path.

Dr Alan Cottey, University of East Anglia

Reference

1. Cottey A (2014). Knowledge Production in a Cooperative Economy. Policy Futures in Education, vol.12, no.4, pp.469-481. http://www.wwwords.co.uk/pfie/content/pdfs/12/issue12_4.asp#2

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

- Stuart Parkinson
- Sophie Hebden

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