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SGR Newsletter

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New SGR report exposes offensive weapons R&D

By using freedom of information requests, SGR has uncovered for the first time detailed project-specific data on the extent of UK government funding of R&D for 'offensive' weapons systems. The data is presented and analysed in SGR's latest report entitled *Offensive Insecurity: The Role of Science and Technology in UK Security Strategies.*

The report concludes that 76% of the R&D funded by the Ministry of Defence is focused on military technologies with an offensive capability, i.e. the ability to 'project force' far from British shores. This includes long-range strike aircraft, attack helicopters, long-range submarines – armed with either nuclear weapons or conventional weapons – and unmanned aerial vehicles or 'drones'.

The report also examines publicly funded civilian R&D in the UK that contributes to understanding and tackling the roots of conflict, including stabilisation strategies in fragile states, the mitigation of climate change, and the conservation of natural resources.

More details of this report can be found on p.4.

SGR moves into eco-village

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SGR's office in the eco-renovated Halton Mill

SGR has moved its office into Halton Mill, an eco-renovated, community-run building near Lancaster. The building is part of an eco-development built by Lancaster Cohousing, including 41 eco-homes, community facilities and Halton Mill.

Halton Mill itself is a decades-old former industrial building that used to house an engineering company supplying components for the military and nuclear industries. It has now been refitted as office and workshop space. The insulation has been markedly improved and its energy is now provided almost entirely by renewable resources. Heating and hot water is supplied by a combination of solar thermal panels and a biomass boiler, fuelled with sustainably sourced wood chips from the local region. (This heating system also supplies the houses.) Electricity is currently provided by solar photo-voltaic panels, supplemented by grid-based electricity from renewable sources from the company, Good Energy. A micro-hydro plant is planned to come into operation by the end of 2014, and this will produce enough electricity for the whole eco-development and part of the local village.

For more details of the eco-development, see p.6.

Contents

SGR News

A few words from the Director

It's been a particularly busy time at SGR. As you'll have seen from the front page, we have both launched a major new report and moved office.

The report – see p.1 and p.4 – is the latest in our programme assessing and challenging military influence on science and technology in the UK. With defence ministers openly pushing for increases in funding for military R&D, our report reveals detailed new information from freedom of information requests to expose just how much R&D is focused on 'offensive' weapons systems – doing nothing to improve UK and international security. It also reveals how R&D funding could be redirected towards helping to tackle the roots of conflict.

We have also moved office (see p.1) to an eco-renovated, community-run building near Lancaster, which better reflects the organisation's ethos and saves us money! With the latest report from the Intergovernmental Panel on Climate Change re-emphasising the need to reduce carbon emissions rapidly (see p.14), we are demonstrating our commitment to action in a way that few other scientific or engineering organisations are willing to do. The office move is also one of the reasons for a number of staff changes, including the departure of our long-serving office manager, Kate Maloney (see below).

SGR has also been updating and publicising its analyses of the nuclear weapons threat (see below), feeding into key policy debates.

As a result of this high level of activity, the newsletter is shorter than usual, but all of the recently published material, including the new report, is available to download from our website, http://www.sgr.org.uk/

As SGR reaches its 21st anniversary, we now have the foundations in place for the next stage of the development and expansion of the organisation.

Stuart Parkinson

Update on SGR activities

There's been no let-up in our research, education and campaigning activities, despite our office move and change of staff.

Early in the year, Philip Webber co-authored two new briefings on the catastrophic humanitarian consequences of nuclear weapons. The first focused on the devastation, including massive climate disruption, should the UK's Trident weapons ever be used. The second examined the nightmare scenario of a nuclear weapon being exploded over Manchester. Both briefings were launched at a House of Commons seminar, and are being used by ICAN (the International Campaign Against Nuclear Weapons) to help support intergovernmental negotiations on a new treaty to ban nuclear weapons. The next round of these negotiations will take place in Mexico in February 2014.

At the end of March, an SGR-authored article was published on the *New Left Project* website, criticising sponsorship by major arms and oil corporations of *The Big Bang* science fair in London. The article was widely disseminated through other websites and social media.

At the end of the summer, a new US book, entitled *Peace Engineering: When Personal Values and Engineering Careers Converge*, was published, including a chapter by SGR's Stuart Parkinson.

In early October, the Movement for the Abolition of War launched a new DVD, *Conflict and Climate Change*, for distribution within schools. The DVD featured Stuart Parkinson, as well as Mary Robinson (former UN High Commissioner for Human Rights), Caroline Lucas (Green Party MP), and Vandana Shiva (leading Indian environmental campaigner). The teaching pack accompanying the DVD includes internet links to several of SGR's presentations and articles in this area.

Over the last few months, SGR speakers have given presentations to a range of audiences. Barnaby Pace spoke at the national conferences of Campaign Against Arms Trade and ForcesWatch, both in London. Meanwhile, Dave Hookes gave a talk on military drones in Liverpool, Philip Webber spoke on nuclear weapons in Manchester, and Stuart Parkinson gave presentations in Leeds and York on military R&D and the alternatives.

Staff changes

There have been some important staff changes over the last few months at SGR.

First of all, in the spring, our long-serving office manager, Kate Maloney stepped down. She had been with us since SGR was founded in 1992, and before that with Scientists Against Nuclear Arms. She put in a huge amount of hard work over the years, working well beyond her paid hours. At SGR's AGM last year, she was warmly thanked by the National Co-ordinating Committee, Director and members, and was made an honorary life member.

With the office moving to temporary accommodation in Lancaster in the spring, we took on Serena Mansfield as office manager. She upgraded SGR's accounting systems and membership database, which led to some efficiency improvements. Once our new permanent office was ready for occupation in late summer, we welcomed Georgina Sommerville who took over from Serena.

We also said goodbye to Barnaby Pace, researcher for our new report, *Offensive Insecurity* (see p.1), whose contract came to an end this year. He carried out some very valuable work extracting important new data from the Ministry of Defence, amassing data from other government departments and research councils, and synthesising this information in early drafts of the report.

SGR's new address is...

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Lancaster
LA2 6ND

Tel: 01524 812073

Our email address and website are unchanged – see back page.

George Finch, 1930-2013

George Finch, who was a Committee Member of Architects and Engineers for Social Responsibility (AESR) and then SGR for many years, was a life-long socialist. His socialism and modernism were forged in his working class upbringing and the crucible of the Architectural Association.

George was determined from an early age to become an architect and, after a short spell in an architect's office, he won the single available county scholarship to the Architectural Association School. He graduated in 1955 into a profession dominated by public-school educated, upper-middle-class men.

Like so many young, left-wing architects of his generation, he joined the London County Council, where he was encouraged to innovate at a time when standard plan types and bland tower blocks were the norm.

When the London Boroughs were granted responsibility for housing in 1964, Ted Hollamby, who was appointed chief architect to Lambeth, invited George to join the new Architect's Department.

That period produced some of George's most mature work, teaming up with Ted Happold, then of Ove Arup. The absence of large vacant sites led Lambeth to adopt a policy of surgical interventions. Slim point blocks were inserted on tight sites but always with communal provision at the base. These were the days of government insistence on industrialised building. George's designs for the heavily articulated Wates towers remain exemplars when many of the much-derided tower blocks of the period have since been demolished. His designs resisted the rigid, technologically driven agenda of most 'system-building' to create site-specific designs that were filled with light and air, and a sense of place.

This playful articulation reached its apotheosis in Lambeth Towers. The ingenious section of stacked maisonettes gives each dwelling dual aspect and its own balcony. With a softer aesthetic than the Wates blocks, the building remains lovely and much loved by its occupants today.

George's last design for Lambeth was the Brixton Recreation Centre. Its stepped internal atrium connects all of the sporting facilities, achieving a sense of openness and variety, as envisioned by George. This much-valued facility was untouched in the riots of 1981 and recent popular local campaigning saw off plans for its demolition.

In 1976, George met Kate Macintosh, then working for the adjoining borough of Southwark. Their common commitments to raising living standards for the ordinary Londoner and shared political outlook soon lead to a personal and professional partnership that lasted until George's death.

Both George and Kate were founder members of Architects for Peace, started in 1981, which merged with Engineers for Social Responsibility in 1991 to become AESR. George edited AESR's newsletter from 1996 to 2001.

His work was recently re-assessed in Tom Cordell's documentary film *Utopia London*. The appreciation of his work by colleagues, critics and most of all the occupants of his buildings did a lot to relieve the pain he felt at seeing the commodification of the housing he designed to dignify the lives of everyone.

Kate Macintosh

Howard Liddell, 1945-2013

Professor Howard Liddell, a long-standing member of Architects and Engineers for Social Responsibility and then SGR, was a very influential 'green' architect, pioneering the concept of 'eco-minimalism'.

Howard was born in Yorkshire, and studied architecture at the University of Edinburgh. He became interested in sustainable architecture and actively promoted the concepts from the early 1970s. He became director of the Sustainable Technology Group at the University of Hull in 1975 and also chaired the Architecture and Ecology Group at the Royal Institution of British Architects from 1975-79. While still teaching at Hull, he and his family moved to Aberfeldy, in the Highlands, and became closely involved in the community he was designing for.

He took up a post as a guest professor at the University of Oslo in 1978 and his cohort of students was inspired by him to found a new organisation, Gaia Norway. He also made links with sustainable architects across the world with whom he founded Gaia International. He left academia to set up Gaia Architects, and designed one of the first 'eco-houses' in the UK, the timber-and-glass Tressour Wood, which won UK House of the Year. In 1991, he set up the Scottish Ecological Design Association. His academic involvement continued as visiting professor at Robert Gordon University, Aberdeen, and guest professor at the Oslo international summer school.

Howard was involved in designing numerous groundbreaking buildings, introducing a variety of new materials and techniques. His buildings included Callander Leisure Centre, Glentress Visitor Centre, Acharacle School, Glencoe Visitor Centre and Plummerswood Active House. Information on his projects is available at http://www.gaiagroup.org.

He was critical of the tendency to use micro-renewables as add-ons, rather than prioritising high quality 'fabric first' design, and championed the use of 'building physics' over building technologies. He set out his case in the 2008 polemic, *Eco-minimalism: The Antidote to Eco-bling*.

Central to Gaia's philosophy is the need to use natural, non-toxic construction materials to minimise pollution and the health problems related to poor air quality inside buildings. For example, to avoid the use of glue, he introduced Brettstapel construction to the UK. This is where pieces of low-grade timber are bonded with dowels to form a load-bearing element.

He was passionate about community involvement in the design process. This was exemplified by his involvement in the 15-year re-development of Hunter Crescent in Perth, an estate renowned for its social problems. Liddell helped the residents to found a housing co-operative, which became the UN Habitat Award-winning Fairfield estate. He was also a founder of the Eco-City Project that involves children and their communities in planning their environment.

He retired in 2013, and died very shortly afterwards of skin cancer. An OBE for services to ecological design and charity was presented at his funeral.

Stuart Parkinson
(with thanks to Sandy Halliday)

Offensive insecurity: the role of science and technology in UK security strategies

Stuart Parkinson, Barnaby Pace and Philip Webber summarise the findings of SGR's latest report, which uncovers detailed new data on the funding priorities for new military technologies and compares these with funding for civilian R&D that helps to tackle the roots of conflict.

UK government funding of military research and development (R&D) has long been among the highest in the world. However, up to now, there has been limited publicly available information on the key programmes that have been funded, or analysis of what alternative R&D spending patterns might provide increased security in the short and long term. SGR's new report – entitled *Offensive Insecurity*[1] – attempts to fill these gaps.

UK military policy and R&D spending

According to official statistics, the Ministry of Defence (MoD) spent on average £1.8bn per year on R&D in the three-year period, 2008-11. While this is significantly less than Cold War budgets, it still represents more than one-sixth of UK public spending on R&D – a fraction that is about three times higher than that of the major industrial nations of Germany and Japan. The main reason for this comparatively high spend is that the UK, unlike these other countries, has much more aggressive military policies and continues to develop major offensive weapons such as strike aircraft, long-range submarines and nuclear weapons.

This approach is, however, increasingly out of step with certain key government strategy documents. For example, the 2010 National Security Strategy (NSS) states that the UK's security is dependent on a much wider range of factors than just conventional military threats. Indeed, the risk of a conventional military attack on the UK was classified at the lowest level – 'Tier Three' – of the new risk hierarchy. The document also acknowledges that more action is needed to tackle the root causes of security problems.

Nevertheless, the Strategic Defence and Security Review (SDSR) – released in tandem with the NSS – made it clear that, while cuts to some major military technology systems were to be undertaken to help the government's budget deficit, a main military task would continue to be "defending our interests by projecting power". This was despite the major failings of recent 'military intervention' involving UK forces – especially the very large numbers of civilian casualties and huge refugee crises in Iraq and Afghanistan, and the way in which such consequences provide a fertile ground for recruitment and development of terrorist groups.

Also apparent was the short time-horizon considered, especially in the SDSR. A longer-term view of security risks should lead to greater emphasis being placed on preventative action.

The 'projecting power' perspective is also the backbone of the 2012 *National Security Through Technology* white paper. This document is almost entirely focused on the development of new military technologies and the industries that provide them. It strongly supports the export of arms and other military technologies to try to help lower the costs to the UK government of procuring new equipment. The document downplays the security problems, despite strong evidence that UK arms exports fuel insecurity and oppression overseas. R&D to help understand and tackle wider security problems is virtually ignored.

Analysing new military R&D data

We obtained new data from the MoD on its R&D programmes using several freedom of information (FOI) requests. This data provided a breakdown by technology programme of approximately £1.3bn per year (out of about £1.8bn/y) of MoD R&D spending for the three-year period, 2008-11. Rather disturbingly, the MoD could not give a breakdown by programme level for £500m per year. The FOI data is summarised as follows.

Table 1 shows the MoD's R&D spending for its top six technology areas over the three-year period. All six technology areas are an integral part of the military capability to 'project force' over long range.

Based on policy analysis of military technologies and force structures – taking into account concepts such as 'non-offensive defence' – we classified the £1.3bn per year of documented military R&D spending from 2008-11 into three categories: offensive, defensive, and general. This analysis concluded that approximately 76% was spent on offensive systems (including sub-systems). Only 24% was spent on systems whose main application could be said to be defensive or general. This analysis demonstrates that the development of military technologies with an offensive, long-range capability dominates the MoD's R&D priorities, contrary to what advocates often claim.

Considering the alternatives

Given the failings of the UK's current military and foreign policy, a key focus of this study has been to estimate the R&D spending that helps to understand and tackle the root causes of insecurity. For this, we used the concept of 'sustainable security', which identifies four main long-term drivers of insecurity: climate change; competition for resources; global militarisation (including the arms trade); and the marginalisation of the majority world (including international poverty and social inequality).

We examined security-related R&D spending by civilian government departments and the seven

Box 1. Main findings

NB: All data is based on the three-year period 2008-11

- The UK government's military R&D spending is heavily focused on developing 'offensive' weapons systems. We estimated that 76% of this spending was on technology programmes whose main role is to 'project force' far from British shores.
- The six largest areas of military R&D were: strike planes; attack helicopters; long-range submarines; nuclear weapons; nuclear propulsion (for submarines); and unmanned aerial vehicles (drones).
- Savings of at least £1 billion per year could be made in public R&D spending by taking steps to move to a less aggressive defence policy, where the development of the main offensive military technologies was cut.
- The MoD was unable to provide a breakdown by programme of about £500 million per year – over one quarter of its R&D spending, despite repeated questioning.
- The MoD's annual spending on R&D was between two and seven times the civilian public spending on R&D that helps to tackle the root causes of conflict (depending on which civilian sources are counted within the assessment).
- To further illustrate this imbalance, comparative examples of total R&D spending over three financial years are:
  - Offensive weapons systems: £1,565m on combat aircraft; and £991m on long-range submarines (including their nuclear weapons);
  - Sustainable security: £626m for international development, and £179m on renewable energy.

Military technology area	Total R&D spending, 2008-11 (£m)
Combat (strike) planes (including Typhoon/Eurofighter, Joint Combat Aircraft/F-35, Tornado)	771
Combat (attack) helicopters (including Lynx, Apache, Merlin)	599
Long-range submarines (hunter-killer and nuclear-armed)	392
Nuclear weapons (carried by submarines)	317
Nuclear propulsion (for submarines)	282
Unmanned aerial systems (drones)	195

Table 1. Total Ministry of Defence R&D spending on the top six military technology areas for the three-year period, 2008-11 (cash terms)

research councils. Within our estimates, we included R&D spending on a wide range of activities, including international development and poverty alleviation, sustainable energy technologies, food security, international relations, natural resource management, biodiversity, environmental hazards, sustainable consumption, and other measures to mitigate and adapt to climate change. The average annual total spending during the three-year period was £961m.

Despite including a very broad range of public R&D within our classification, the total spending related to sustainable security is still only equivalent to about half of the government's annual military R&D spending during this period, as shown in Figure 1. This Figure also shows the breakdown of annual military R&D spending according to the three classifications – offensive, defensive and general – discussed above (assuming that the breakdown of the MoD's total R&D spending is the same as that estimated from the data from the freedom of information responses). This again demonstrates the dominance of traditional military approaches – especially offensive weapons systems – within public funding of security-related R&D in the UK.

It should also be noted that all the military R&D spending comes directly from a single government department (the MoD) with strong ties to central government decision-making, whereas most of the sustainable security R&D funding (74%) is spent by research councils, and does not have such a strong link with policy decisions (also shown in Figure 1). If we compare only the annual R&D spending that comes *directly* from government departments, we find the military spending is *seven* times larger than that related to sustainable security.

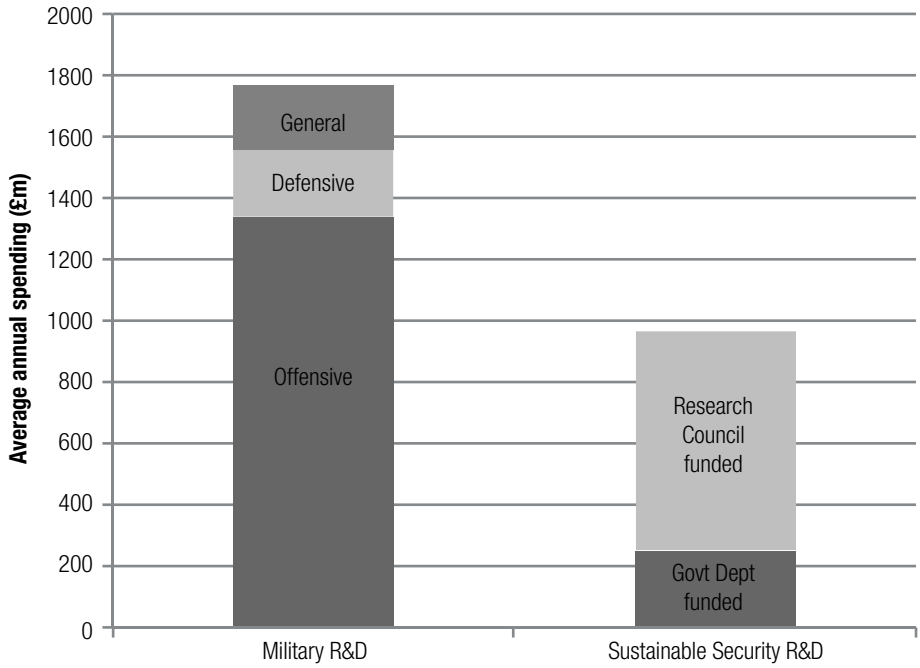

Figure 1. Comparison of average annual UK public spending on military R&D and sustainable security R&D, 2008-11 (cash terms). Military R&D is broken down by application; sustainable security R&D is broken down by funding source (see text).

By moving to a less aggressive defence policy, funding for the development of major offensive weapons systems could be cut by at least £1 billion per year. Some of these savings could be redirected to R&D that contributes to sustainable security.

Other issues

The report also discussed two other issues related to military R&D. Firstly, as mentioned earlier there were still areas of spending that were opaque – amounting to about £500m per year. This undermines public accountability. Secondly, the report briefly examined the economic and employment issues related to military R&D. In short, we found very little evidence to justify military R&D spending on economic and employment grounds. For example, analysis of a broad range of alternative civilian sectors, including clean energy, education and health care, indicates that employment benefits are much greater in the civilian areas.

A major shift in R&D spending

In our view, there is a very strong case for a large cut in military R&D – especially that focused on nuclear weapons, long-range strike aircraft, aircraft carriers and long-range submarines. Equally, there is a strong case for increasing spending on R&D related to tackling the roots of conflict, such as arms control and disarmament, poverty alleviation, energy conservation and renewable energy. Using this R&D more widely in policy-making would galvanise deeper, positive change in the UK's approach to insecurity. We need to push the government to pursue this option. There would be economic, social and environmental benefits – and it would provide a path towards genuine security.

Dr Stuart Parkinson is Executive Director of SGR. Barnaby Pace MEng was SGR's researcher for this project. Dr Philip Webber is Chair of SGR. All are co-authors of *Offensive Insecurity*.

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Environmental cohousing: a contribution to sustainable living

Jan Maskell discusses the potential of environmental cohousing to encourage and support sustainable living. She describes the recently completed Lancaster Cohousing project as an example of what can be achieved.


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Children play at Lancaster Cohousing's new eco-development

According to the Carbon Trust, the energy used by domestic buildings in the UK accounts for approximately 25% of the UK's total greenhouse gas emissions.[1] One government policy to help reduce these emissions is the target for all new buildings to be carbon neutral by 2019. Lancaster Cohousing (LCH), a recently completed housing development in the North of England, has been built following the model of environmental cohousing.[2] Through its physical design and communal practices, it aims to be one example of how carbon neutral housing can be carried out, while also making a contribution to the wider goal of sustainable living.

Introducing environmental cohousing

The concept of cohousing began in Denmark in the 1960s. It has been developed in the US and is now taking off in the UK following the success and example of LCH and other projects. Cohousing is typified by four characteristics:[3]

1. designing in order to create intentional neighbourhoods;
2. a minimum provision of essential private and common facilities;
3. a size and scale suitable to foster and sustain the necessary community dynamics; and
4. cohousing residents have the final say about all aspects of their neighbourhood.

Environmental cohousing adds the element of eco-build and a desire for environmental sustainability to the values shared by residents, evident in the LCH vision to: "create an intergenerational cohousing community… built on ecological values… enabl[ing] sustainable travel… designed to facilitate... a full neighbourly community… The project will be a cutting edge example of sustainable design and living. It will act as a catalyst and inspiration for significant improvements in the sustainability of new development".[4]

What then are the design and community aspects of environmental cohousing that enable it to contribute to sustainable living and differentiate it from other forms of development?

Site location

The site of the LCH project meant that the design could take advantage of a south-facing aspect over the river Lune for solar panels and heating through 'passive solar gain'. A 160 kilowatt (kW) hydro-electric plant will also take advantage of the river, contributing to the carbon neutral aspirations of the project, eventually exporting electricity to the national grid. These design aspects could have applied to any eco-build development on this site, so what makes this different? At LCH, the difference is the contribution the residents make to the choice of location and design and then sharing the benefits of renewable energy generation across the community, rather than for an individual dwelling.

Site design

The site design and layout of the homes have been developed in ways that maximise social interaction and emphasise community. The overall design concept combines individuals' requirement for private space in their own homes with shared common facilities. LCH has a total of 41 homes from one-bedroom flats to three-bedroom, three-storey houses each costing a similar amount to local comparable properties.

Creating intentional neighbourhoods that encourage community dynamics was a key issue for the design at LCH. The pedestrian street that runs through the site means that residents have to walk past each other's homes and in so doing will interact with their neighbours – contrast this with the usual walk from front door to car. The project has car-free, open spaces between houses which means that children can play safely outside.

The 'common house' is at the heart of cohousing design with communal cooking and eating facilities, laundry and a children's room. The development at Lancaster also benefits from a refurbished mill building offering environmentally-friendly office and work space. Advantageous rents are offered to residents to encourage working close to home and reducing the need to travel.

Homes design and construction

At Lancaster the decision was made very early in the project to work towards achieving the PassivHaus standard and Level 6, the highest level, of the Code for Sustainable Homes (CSH).

PassivHaus design focuses on three aspects:

- minimising heat loss through super insulation, triple glazing and compact form;
- minimising ventilation heat loss, heat recovery ventilation and airtight construction; and
- optimising solar gain for winter heat.

Through careful attention to these factors, energy use for heating is planned to be 15 kilowatt-hours per sq. metre per annum (kWh/m^2.a). The average for UK housing stock is around 200kWh/m^2.a with new build ranging from 50-100kWh/m^2.a so the savings

are considerable. Hot water and the one radiator in each home are supplied from a central biomass boiler via a district heating network, with locally-sourced woodchip as the fuel, and water pre-heated using solar thermal panels. This offers economies of scale with only one pump and control system needed rather than one for each house. A priority was reducing the energy used in the homes as it is a significant component of their environmental impact.

The U values of the design – the measure of heat loss from the elements of a building – are between 0.09 and 0.89 watts per sq. metre per Kelvin (W/m^2K). These are much lower than building regulations requirements, partly through high levels of insulation and partly through careful design to minimise 'thermal bridging'. For example, service pop-ups were taken through the floor rather than the walls and sealed with grommets. Mechanical ventilation, using low power fans, provides fresh air day and night, warmed to room temperature by a heat exchanger transferring the heat from the exhaust air from kitchens and bathrooms. This gives a comfortable and healthy indoor environment with no draughts or cold spots.

Lancaster has also achieved Level 6 of the CSH with 100% of the available credits awarded under this scheme in the mandatory areas of energy/CO_2, water, surface water run-off and waste. 71% of the available credits were awarded for materials due to the 'educated guesses' needed for non-standard construction. The materials used at Lancaster include recycled aggregate and 'ground granulated blast furnace slag' as a cement substitute in the strip foundations' concrete, and recycled glass soft mineral insulation.

The private homes are well designed with open plan living areas. One of the aims of a lighter footprint is to downsize and de-clutter through sharing facilities and resources. Not only is there less need for personal storage but there is less need to purchase new items, such as tools, as a neighbour is very likely to have what you need. For example, why would each household need to own a drill that would only get used for an average of eight minutes a year, when the community can own one that gets used more efficiently?

Residents have participated in the design of their homes, working with the design team to meet the standards they required. This was achieved through consensus decision-making processes, workshops and value engineering. A recent Technology Strategy Board 'building user survey' (BUS) was undertaken which revealed that the residents were very positive about how well their houses perform. Responses for

© Luke Mills

The pedestrian street

all eight main categories – air quality, comfort, design, perceived health, lighting, needs, noise, and temperature – were all higher than the UK 2011 BUS Housing benchmark. In five of the categories the project was either the highest or second highest performer when compared with other studies.

Policies

Consensus decision-making applies to all the policies that have been established at the Lancaster project and is a fundamental part of cohousing, contributing to community involvement.

LCH, in spite of being three miles away from the city, has an ambitious travel plan, acknowledging that transport is a significant proportion of most people's carbon footprint. Cars have been kept to the edge of the site with low or no car ownership levels complemented by car and lift sharing schemes, ample cycle storage, cycle paths to the city centre, and increased use of public transport. Having fewer parking spaces also means more green space on the site.

Vegetarian and vegan communal meals are prepared by residents four times a week – contributing to a lower carbon diet. A food co-operative enables bulk buying for these meals and residents' use: reducing packaging and shopping trips, as well as keeping food costs down. Long term, the aim is to grow much of their own food but this is currently hindered by the contaminated soil – a legacy of the oil cloth manufacture on the site.

Community benefits

According to Meltzer, the sharing and support dimensions of the social relationships in cohousing significantly improves residents' pro-environmental practices.[5] Sharing is a defining feature of cohousing – facilities, cooking, eating, cars, and decisions – as well as the informal sharing of personal possessions. All serve to reduce consumption. Support comes from valuing each other, being useful to one another and sharing a commitment to the common vision. Social, practical and moral support combine to influence practices.

There are personal benefits for residents through sharing that equate to savings in time, money and resources. A sense of belonging to the community helps to meet affiliation needs and contributes to subjective well-being.[6]

Conclusion

It is clear that in order to achieve the reductions in greenhouse gas emissions at the individual, household and community level needed for a sustainable environment, significant changes must happen. Environmental cohousing offers a viable solution that can reduce impacts through high quality design and construction of homes, considered use of onsite renewable energy technologies, and the communal sharing of resources. For residents there are the benefits of saving time, money and other resources, and the feeling of well-being that comes from knowing that you have made a key contribution to environmental sustainability.

Dr Jan Maskell is a Director of Lancaster Cohousing and a member of SGR's National Co-ordinating Committee. She holds a PhD in educational research and her professional background includes occupational psychology and architecture.

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Other references are available on request from the author at: <jnmskll@gmail.com>

Arctic ice cap melt: when will we reach the tipping point?

Recent climate research points to grim prospects for the Arctic ice cap. Vanessa Spedding reports on current scientific opinion.

It's hardly news to say that things are changing quickly at the Arctic ice cap. Since the start of research for this article there have been a dozen or so announcements of new results, each updating the understanding of the state of the region.

The idea that the rate of change of a 15 million km^2 swathe of ice might be outpacing the rate at which our finest minds and instruments can observe it sends a very strong message. It also makes it hard to glean a simple overview of what's going on, especially given the variety of approaches and models being deployed to assess the situation.

This article attempts to summarise the prevailing understanding about the speed of melt at the North Pole, the predictions for the first ice-free Arctic summer, and the implications of this dramatic change.

Arctic ice loss to date

According to satellite data from the US National Snow and Ice Data Center (NSIDC), the averaged Arctic sea ice extent during March 2013 (the month at which it reaches its annual maximum), at 15.04 million km^2, was 710,000 km^2 below the 1979-2000 average extent. The linear rate of decline for March ice extent is 2.5% per decade, relative to the 1979-2000 average, representing an average rate of decrease of 39,800 km^2 per year; roughly twice the area of Wales.[1]

The trends for summer ice decrease are even more alarming. The September figures, for when Arctic sea ice at its annual minimum, show the sea ice extent declining at a rate of 11.5% per decade, relative to the 1979-2000 average.[2] The decline in the annual minimum of Arctic sea ice *volume* is more alarming still – see Figure 1.

There is overwhelming scientific agreement that the cause of this dramatic retreat is the amplified warming in the Arctic region due to its enhanced sensitivity to the effects of greenhouse gas emissions from human activities. However, there is a range of opinion about the implications of this melt. Are we past the point of no return on the road to an ice-free Arctic? When might such a situation prevail? Will such a state change represent a tipping point in the global climate system? Is anything we can do about it?

When will the Arctic ice cap disappear?

The most conservative ice-melt predictions come from computer simulations, and give us another 40 or so years under current conditions before we can expect ice-free Arctic summers (defined as a September ice extent of 1 million km^2 or less). The prediction from the UK Met Office is slightly more pessimistic, suggesting "an earliest plausible date for an ice free summer in the Arctic [of] 2025-2030".[3]

More pessimistically still, Peter Wadhams, Professor of Ocean Physics at Cambridge University, suggests we should expect ice-free Arctic summers by 2015.[4]

Prof Wadhams uses a different approach, basing his predictions on trends in the measured retreat of the total volume (not just area) of Arctic ice; he has spent many summers in submarines tracking its ever diminishing thickness. His predictions come from an extrapolation of the plots of sea-ice volume as a function of time. These are mirrored by outputs from a new, regional Arctic climate computer model written by Wieslaw Maslowski of the Naval Postgraduate School, Monterey, USA, which simulates future values from trend data, incorporating couplings between ocean, atmosphere and sea ice in the same way that global climate models do. Maslowski predicts an ice-free Arctic summer by 2016, plus or minus three years.[5]

Other research groups propose dates somewhere between these two extremes (of 2015 and 2060) for ice-free summers, and the variation appears to be roughly correlated with the modelling method used. Professor James E. Overland, at the National Oceanic and Atmospheric Administration (NOAA) in the USA, investigated three methods of predicting the point at which the Arctic will be nearly ice free in summer.[6]

He defines the first of the three methods, the 'trendsetters' approach, as that using observed sea ice trends. Results from these investigations show the total amount of sea ice to have decreased rapidly over the previous decade – faster than computer models had predicted – and extrapolate on average to a nearly sea ice-free Arctic by 2020.

The second method, termed the 'stochasters' approach, is based on assumptions of future multiple, randomly timed, large sea ice loss events such as occurred in 2007 and 2012. Research using this method suggests an ice-free Arctic by about 2030, but with large uncertainty.

Finally, the 'modellers' approach refers to the use of global climate models to simulate geophysical conditions over time. These models show the earliest

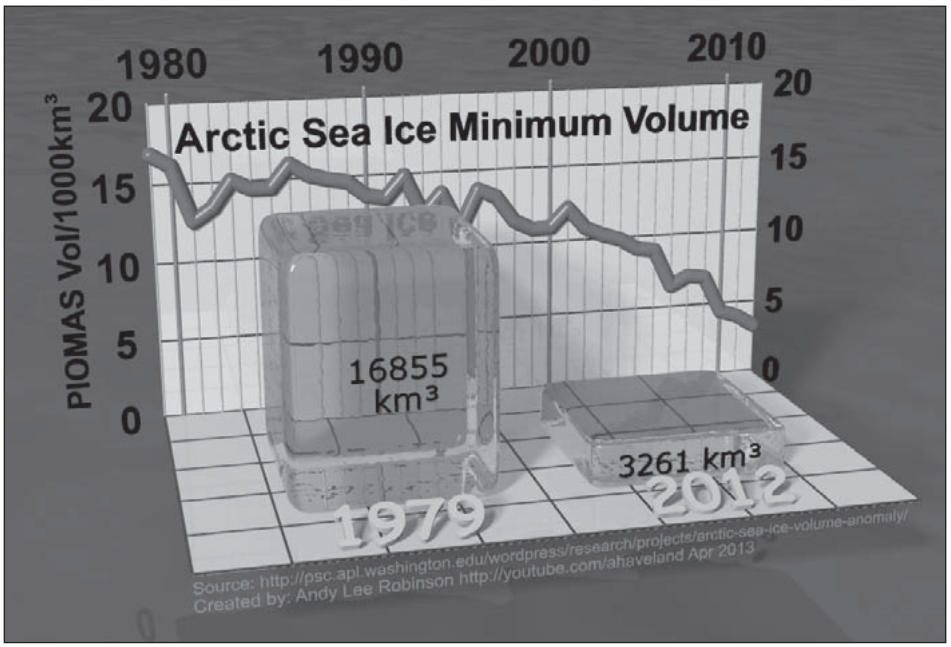

Figure 1. Decline in Arctic sea-ice minimum volume, 1979-2012

loss of the ice cap to be around 2040 with a median time closer to 2060. Overland believes this to be too late but nonetheless values the importance of the modelling approach because of its ability to take account of a wide variety of factors.

A version of the 'stochaster' approach is used by Professor Tim Lenton, Chair in Climate Change and Earth Systems Science at the University of Exeter, and his team. Their research, currently in press, uses sophisticated statistical analysis and time-series propagation methods and suggests we will see regularly and consistently ice-free Arctic summers in the 2030s. But Prof Lenton told SGR: "I wouldn't claim our model is any sense the 'right' one, and I would not rule out Peter Wadhams and others being correct."

Have we passed a tipping point?

While the finer detail is still to play out, the majority of research points clearly to ice-free summers before the middle of the century, and very likely within the next decade or two. Given the sense of inevitability, and the fact that it will be the first time it's happened in 13 million years, quibbling over the most likely particular year seems increasingly academic.

The inevitability issue brings up the question of tipping points. There has been some debate as to the significance of this transformation, not to say some confusion over the definition of the term tipping point.

Prof Wadhams told SGR that he uses the definition shared by the Intergovernmental Panel on Climate Change (IPCC). "A tipping point for an element of a system is passed when the forcing on that element has taken a parameter so far from its original value that if you remove the forcing, the parameter does not return to its original value but assumes a different state," he explained.

"So the question is, if you remove the forcing on the ice-melt, will it come back? I think it won't. I think we are past the tipping point. Even if we took CO_2 back to 280ppm, the changes we've set in motion will produce warming for another 100 years. And as the climate does come gradually back, the Arctic Ocean will be more firmly established as an ice-free summer ocean; the water structure will be changed."

While some models show that the ice cap could refreeze given the right external conditions,[7] other research suggests otherwise, including some by Prof Lenton and his team. "I have been arguing for a while that the loss of summer sea-ice could involve a tipping point in a scientific sense," he explained, referring to a recent paper.[8]

Overall there appears to be increasing agreement among scientists that we are committed to a fast trajectory of sea-ice loss by virtue of our emissions to date, whether or not ice returns at some distant future time. The broader question is whether the Arctic ice cap is itself a key element in the global climate system, such that its state change will cause the latter to pass through a tipping point of its own. Some claim the whole tipping point debate is a distraction from more pressing issues but many hold the view that, even if the ice-melt were reversed, its state change will have pushed other parameters out of their equilibrium range such that the whole climate system will move to a new state.

The implications of these dramatic developments and their potential global effects are cause for great consternation. Jennifer Francis, Research Professor at the Institute of Marine and Coastal Sciences at Rutgers University, USA, argues that rapid warming at the Arctic is altering the jet stream over North America, Europe, and Russia to produce more persistent and extreme weather.[9]

In a commentary in *Nature Climate Change*, Professors Lenton and Wadhams set out the evidence for a number of 'discontinuities' in the system that will be triggered by the Arctic melt, and the catastrophic effects these will have.[10] As well as the reduced albedo effect, these discontinuities include the destabilisation of the Greenland ice sheet, peat-fires in the sub-Arctic region, methane emissions from thawing methane hydrates, slowed global thermohaline circulation and reduced oceanic CO_2 uptake. Each of these has further destabilising effects on the climate, and between them they are leading us into a time of dangerous change, say the authors, which will be characterised by unpredictable ecosystem shifts, disrupted food webs, rapidly declining ocean life, more extreme weather, risks to unique ecological and social systems and likely a global food crisis.

Prof Wadhams is on record as recommending geo-engineering to help avert these catastrophes, but his views on this have since shifted. "I do still think we need urgent research into geo-tech but I don't think anything will bring back the Arctic ice. And it is very difficult to see how there could be international agreement on geo-engineering. So I'm pessimistic about that as well, and there really isn't anything else in the locker."

There is little if anything heartening to be taken from this survey of Arctic science, except for those motivated by the short-term economic gains resulting from the new shipping and extraction opportunities. However, Prof Lenton did make the point that this dramatic and visible planetary change might wake us up to the delicacy and importance of our climate system. "I do think that the loss of summer ice cover will be a tipping point in public and policy perception of climate change," he said.

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Update

Since this article was written, the 2013 Arctic ice minimum was reached (on 13th September). While not as low as in 2012, it still rates among the lowest ever recorded and is consistent with the trend of long-term decline.

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The UK's role in nuclear proliferation: then and now

David Lowry examines the historical role of Britain's civilian nuclear exports in the weapons programmes of countries like North Korea, and fears that the latest government initiatives will lead to history repeating itself.

The veteran Labour politician, Tony Benn, who was responsible for the British nuclear power programme in the late 1960s, was asked by The Times if he had made any political mistakes in his life. He responded: "Yes, nuclear power. I was told, when I was in charge of it, that atomic energy was cheap, safe and peaceful. It isn't."[1]

Since the 1950s there has been widespread sympathy and support – by both political and scientific leaders – for nuclear power. This is despite clear evidence that the spread of civilian nuclear technologies and materials has contributed to nuclear weapons proliferation. This article looks at some examples from Britain's nuclear history, and questions why our government is, once again, ramping up its support for nuclear exports.

Atoms for Peace?

Following the detonation of the two atomic bombs over the Japan in August 1945, many nuclear scientists wanted to put their intellectual expertise to the public good, so horrified were they over the scale of destruction. One of the key focuses was the pursuit of electrical power from nuclear fission.

Just over a year after Britain first tested its own atomic bomb, US President Eisenhower delivered his infamous 'Atoms for Peace' speech to the UN General Assembly in 1953. It proposed the conversion of 'atomic swords' into 'nuclear energy ploughshares'. He stated: "It is not enough to take this weapon out of the hands of the soldiers. It must be put into the hands of those who will know how to strip its military casing and adapt it to the arts of peace."[2]

He proposed the creation of an international atomic energy agency, whose responsibilities would include bringing "abundant electrical energy" to "the power-starved areas of the world." This was the start of a huge promotional drive which led, in 1957, to the creation of the International Atomic Energy Agency (IAEA) as a United Nations agency in Vienna.

The UK was at the forefront of the new technology. In 1956, four 'Magnox' reactors at Calder Hall on the Sellafield site – then called Windscale – were opened by the young Queen Elizabeth II. She announced that: "It may well prove to have been among the greatest of our contributions to human welfare that we led the way in demonstrating the peaceful uses of this new source of power."[3]

But the double-edged nature of this technology was all too apparent in this facility: it was designed to produce plutonium for military purposes, as well as generate electrical power.[4]

Early UK nuclear technology in Iraq, Iran and North Korea

As the IAEA was being set up, the UK made one of its first forays into international nuclear trade – with Iraq. The Baghdad Pact Nuclear Centre opened on 31 March 1957.[5] It was part of the UK's own 'Atoms for Peace' efforts. According to a parliamentary reply by Michael Heseltine in 1992, "Iraq ceased to participate in the activities of the training centre when it was transferred to Tehran following the revolution in Iraq in 1959."[6]

In light of subsequent geo-political history in the region, that was out of the atomic frying pan, into the nuclear fire!

Around this time Britain also sold a single Magnox nuclear plant each to Japan and to Italy.[7]

There is also significant evidence that the British Magnox nuclear plant design – which, after all, was primarily built as a military plutonium production factory – provided the blueprint for the North Korean military plutonium programme based in Yongbyon. Here is what Douglas Hogg, a Conservative minister, admitted in a written parliamentary reply in 1994: "We do not know whether North Korea has drawn on plans of British reactors in the production of its own reactors. North Korea possesses a graphite moderated reactor which, while much smaller, has generic similarities to the reactors operated by British Nuclear Fuels plc. However, design information of these British reactors is not classified and has appeared in technical journals."[8]

The uranium enrichment programmes of both North Korea and Iran also have a UK connection. The blueprints of this type of plant were stolen by Pakistani scientist, A Q Khan, from the URENCO enrichment plant in The Netherlands in the early 1970s.[9] This plant was one-third owned by the UK government. The Pakistan government subsequently sold the technology to Iran, who later exchanged it for North Korean Nodong missiles.

A technical delegation from the A Q Khan Research Labs visited North Korea in the summer of 1996. The secret enrichment plant was said to be based in caves near Kumch'ang-ni, 100 miles north of the capital, Pyonyang, where US satellite photos showed tunnel entrances being built. Hwang Jang-yop, a former aid to President Kim Il-sung (the grandfather of the current North Korean President) who defected in 1997, revealed details to Western intelligence investigators.[10]

So Britain's civilian nuclear export activity has involved provision of direct technical support to both Iraq and Iran, and indirectly to both North Korea and Iran. Given the subsequent nuclear weapons programmes in Iraq and North Korea, and the international concerns about the current nature of Iran's nuclear programme, this is hardly a positive record.

The UK has also been responsible for export of nuclear material from civilian plants specifically intended for weapons manufacture. Keith Barnham and other SGR colleagues demonstrated in a paper published in Nature in 2000 how military grade plutonium, created in the UK's Magnox reactors, was exported to the United States.[11]

The NPT as a vehicle for proliferation

In 1968, the Nuclear Non Proliferation Treaty (NPT) was endorsed by the United Nations General Assembly to try to put the brakes on the further spread of nuclear weapons. The IAEA was explicitly given an enforcement role. But the treaty involved a 'grand bargain': that non-nuclear weapon states should renounce all possession of nuclear weapons in exchange for civilian nuclear assistance. Indeed, the NPT affirms nations' "inalienable right… to develop research, production and use of nuclear energy for peaceful purposes."[12] To this end, the treaty included clauses aimed at a major expansion of nuclear trade, including scientific and technological cooperation and sales of nuclear equipment and nuclear materials. The risk that this could lead to further proliferation has been downplayed by the IAEA and nuclear exporting countries ever since.

New UK nuclear exports

In the last few years, Britain's main political parties have demonstrated a deeply disturbing interest in a major expansion of the export of nuclear technology. This is despite claiming to be acutely aware of the dangers of proliferation.

In 2009, Chris Bryant, then a foreign office minister, commented during a parliamentary debate on

nuclear proliferation: "It is clearly important that we secure fissile material. One of the greatest dangers to security around the world is the possibility of rogue states or rogue organisations gaining access to fissile material."[13]

Yet, only a few days later, the Labour government published a document which, while claiming to "lay out a credible road map to further disarmament", actually proposed increasing the civilian nuclear trade across the world.[14] The document was aimed at ongoing international non-proliferation negotiations.

In my judgment, whatever its laudable aims on nuclear disarmament, this document was in effect a blueprint for nuclear proliferation, undermining government aims to create a more secure world.

The Coalition government has continued to pursue this nuclear export path. In March this year, the Department for Business, Innovation and Skills (BIS) – significantly, not the Department for Energy and Climate Change – published a suite of documents promoting nuclear power development in the UK and abroad, backed with £31 million of new taxpayers' money.[15]

In one of the documents, Long-term Nuclear Energy Strategy, the government committed to international action, including:

- further increasing its presence and impact in international nuclear forums, "in particular those relating to nuclear R&D";
- working with "like-minded" EU nations to provide "a positive and informed political environment for the civil use of nuclear power both domestically and globally"; and
- working with embassies, industry and academia "to better showcase the UK's knowledge, expertise and facilities to the international market."[16]

While extra funding was being provided to promote nuclear technology, including exports, figures released to parliament this year revealed that the Coalition was simultaneously cutting the budget for nuclear non-proliferation. The 2013-14 spending will be reduced to £23.7m – a cut of £3.5m from 2012-13.[17] The budget for the Capital Global Threat Reduction Programme will also fall: from £6.6m to £5.0m. The Coalition's changing priorities are all too clear.

There is the additional problem of what to do with the UK's current plutonium stockpile, created from the reprocessing of spent nuclear fuel. This currently stands at 110,000 kg.[18] While this is classified as 'reactor grade' because of its high content of heavy plutonium isotopes, it is widely acknowledged – including by the Royal Society[19] – that even reactor grade plutonium can be used to fabricate crude but powerful nuclear weapons. Depending on the isotopic content and the weapon design, a single nuclear bomb could be constructed with as little as 5 kg.[20]

The government's currently preferred option for dealing with this stockpile is to convert it into MOX (mixed plutonium-uranium oxide), which could be used to fuel nuclear power stations both in the UK and abroad.[21] But MOX fuel can be chemically separated into its constituent parts, so the proliferation risks of exporting this fuel are again all too real. Furthermore, to fabricate this MOX fuel, upwards of £1 billion, some suggest as much as £5-6 billion, of UK taxpayers' money would be needed for construction of a new manufacturing plant at Sellafield.[22,23]

The two Cabinet ministers responsible for the UK's nuclear export strategy are Business Secretary, Vince Cable and Energy and Climate Change Secretary, Ed Davey. Ironically, both were elected in 2010 on a Liberal Democrat manifesto that opposed all nuclear power projects.

Nuclear worries

The very real risk is that the UK's promotion of nuclear power – especially the export of nuclear technologies and materials – will lead to more military stand-offs such as those with North Korea and Iran, and will further hasten the day when another mushroom cloud rises above a city with hundreds of thousands lying dead beneath it. The easiest way to minimise the risk of such attacks is stop promoting and distributing the technologies that could be used to undertake them.

Tony Benn regarded his support of nuclear power as a major political mistake – not least because of the problems of proliferation. How long will it be before the current generation of British politicians – and indeed the scientists and engineers advising them – realise they are making the same mistake?

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Obstacles to honesty in science: the case of medical research

Peter Wilmshurst has worked in the medical sciences for over 30 years. His focus has become the investigation of research misconduct which, he argues, is far more common than is publicly acknowledged, and largely due to the power of corporate interests.

Medical research relies on the integrity of investigators, because we accept on trust what they submit for publication. The trust placed on medical researchers by society is founded on the naïve belief that those who gain advancement through publication of medical research are more honest than those who gain advancement in other occupations. This belief flies in the face of evidence – often from investigations by universities, regulators or journalists – that much of what medical researchers publish cannot be trusted.[1,2,3,4]

Industry conceals negative research

Dishonesty in research is not only a matter of publishing false data. It can also involve concealing the truth. We know that much research goes unreported, particularly when industry sponsors consider the results commercially damaging.[5] Industry sponsors are able to prevent publication of commercially damaging findings because their contracts with research institutions often contain clauses that ensure that the sponsors 'own' the data and have all rights over its publication, rather than it belonging to the patients who took the risk of participating in the research, the investigators or society at large. Academic institutions accept these legal clauses because the research contracts are lucrative for institutions and investigators. The latter are often retained as industry consultants and are paid handsomely to lecture provided they continue to propagate the corporate message.[6] Commercial sponsors take legal actions for breach of contract to ensure that damaging findings are kept secret.

Early in my career I was threatened with litigation if I revealed that a new drug for heart failure was ineffective and caused life-threatening side effects.[7] On that occasion I went to The Guardian newspaper to expose the actions of the pharmaceutical company after three major journals had refused to publish the details because of fear that they might be sued for libel by the company.[8] I also know from experience that the libel laws are used in attempts to silence investigators who are prepared to raise concerns about research.[9,10] As a result, the best evidence required for a systematic review of the medical literature, the keystone of evidence-based medicine, may have been deliberately concealed. If one is fortunate, the process known as 'critical appraisal' may provide hints about some of the research that has been performed but has not been published. Critical appraisal is the process of careful, transparent and systematic examination of research to judge its trustworthiness, and its value and relevance in a particular situation.

Journals reject negative research

Editors and researchers also deserve some of the blame for failure to publish research. 'Negative trials' are those that show that a treatment is ineffective. These are valuable for patients, who do not want to take treatment that does not work, and healthcare providers, who do not want to pay for it. Editors, acting in the commercial interests of their publishers, are reluctant to devote space to 'negative trials' when the space in a journal could be given to trials of drugs or medical devices that show products in a favourable light. Such 'positive trials' guarantee that the product's manufacturer will purchase advertising space to accompany the article and buy reprints to give to doctors.[11] For the most prestigious medical journals, an article reporting commercially favourable findings may earn the journal over $500,000 from reprint sales to the sponsoring company.[11] This is a good reason for editors to reject 'negative' research and to ask no questions about whether the claims in 'positive' commercial trials are true.

Reluctance to highlight flawed research

Editors can also be reluctant to publish reports of failed attempts to replicate earlier research, as it might lead to criticism of their earlier decision to publish. On their part, researchers may not try to publish such failure out of concern that critics will say that they cannot do the experiments properly, particularly when there is a large amount of contradictory data already published or even when there is a small amount of contrary data published many times. We think of science as self-correcting, but in practice human frailty and the conflicting interests of those involved means that once a flawed idea becomes established it is difficult to dislodge.

Critical appraisal should detect duplicate publication of data from a single research study. There are some acceptable reasons for re-publication, such as in a different language for a different readership, but it must always be stated explicitly. More often duplicate publication is misconduct because it is performed to give an unwarranted impression of high research output.[12] To achieve the deception it is necessary to ensure that readers do not realise easily that it is a duplicate publication.

Some journals actively encourage duplicate publication by republishing articles in industry-sponsored supplements, sometimes changing the title of an article and the order of the authors, which gives the impression that it is an entirely different research study.[11] Industry pays journals handsomely for these supplements because they allow their sales representatives to supply doctors with a single document containing a number of favourable articles about their product from their chosen opinion leaders without the recipients seeing any unfavourable data or counter opinions. Duplicate publications bias the evidence by suggesting larger numbers of observations than were obtained. One hopes that this type of research misconduct will be recognised during critical appraisal of studies identified, but duplicate publication often goes undetected.

Positive spin

Besides concealing commercially damaging data, industry also ensures that what is published has a positive spin. There are many ways of doing this. Drug studies are often designed to compare a product with a competitor's, but with a dose of the competing drug that is so high that it produces side effects or so low that it is ineffective. If such bias in design does not produce the desired outcome, the predefined endpoints may be altered and the data may be reanalysed until some marketable result is found. Industry employs eminent doctors to add credibility to their message.[6] The most eminent doctors may have had no involvement in industry sponsored research, but are paid large consultancy fees to act as gift authors of research articles and editorials written by company employees. The names of the real authors never appear in the publication: they are 'ghost authors'. This practice allows industry to misrepresent product advertising and corporate messages as the research and views of the opinion leaders, who many readers will believe to be objective scientists rather than members of a corporation's advertising department.

Critical appraisal may sometimes reveal such major inconsistencies in research that they are difficult to explain except by gross carelessness on the part of investigators or by fabrication of data. In either case the research cannot be relied upon. However when misconduct is brought to the attention of a journal that published the research, the editor often refuses to take any action. I accept that an editor of a journal in one country may have difficulty compelling an author in another country to explain their actions. If that happens editors could say that they will never publish work from those authors again. I also accept that editors may not have training or funding to mount their own full investigations. However they should ask authors for an explanation, report the concerns to responsible bodies in the country of origin of the research and publish a notice of concern about the publication. Editors have a moral obligation to patients who might be harmed by flawed data and to the scientific community to do something other than claim that any problem with research that they published is nothing to do with them. Unfortunately editors often refuse to take any action.

Commercial interests before patients' interests

Even when official investigations confirm that there was data fabrication, many journals fail to retract dishonest research, which continues to pollute the literature, bias systematic reviews and harm patients.[13] The reluctance of journals to correct the scientific record is in part because they wish to deny any involvement in misconduct, but more often it is because of fear of being sued for libel by authors whose fraudulent work they retract.

I am a cardiologist and I have published research with implications for the health and survival of patients. No editor of a medical journal has ever asked me to provide evidence for any claim made in a scientific paper. I am also invited to write about research misconduct and when I do the journals' editors require that every statement can be confirmed by supporting documents to the satisfaction of the journals' lawyers to avoid the risk of a libel claim.[11,14] Clearly, for the editors of many medical journals, the finances of the journal are more important than the lives of patients who might be harmed by publication of research that cannot be substantiated.

When I have reported concerns about research articles, journal editors have almost invariably refused initially to consider my concerns. It is a long, hard and thankless task to get concerns about research published. Editors, authors and research institutions usually try to dismiss concerns because they have a conflicting interest in continuing the pretence that what is published in medical journals is honest and accurate. If those involved in research publication admit that much of what is published is neither honest nor accurate, they would have to put in place better measures for scrutiny. That would be costly for them, but it would be cheaper than the cost to society of allowing patients to suffer from ineffective or dangerous treatments and of diverting other researchers up blind alleys.

Dr Peter Wilmshurst is honorary consultant cardiologist at the University Hospital of North Staffordshire.

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Fossil fuels: more than we can safely burn

Martin Quick discusses concerns about tar sands and shale gas in relation to the drastic reductions in fossil fuel use shown to be needed by the latest IPCC report.

The publication of the latest report[1] of the Intergovernmental Panel on Climate Change (IPCC) reinforces the case that drastic and rapid reductions in global carbon emissions are needed to reduce the risk of dangerous climate change. The report quantifies the allowable carbon emissions for a range of probabilities of exceeding 2°C temperature rise. This is the rise generally thought to be the limit above which positive feedbacks could lead to rapidly accelerating climate change. Lord Stern, the highly respected economist working in the field of climate change, states[2] that a large proportion (perhaps three-quarters) of the fossil fuel resources owned by the oil, gas and coal corporations globally would not be able to be used without a large risk of dangerous climate change. His estimate does not take account of some of the unconventional fossil fuel sources, including oil from tar sands and shale gas. A similar case is also made in the recently published excellent book, *The Burning Question*[3].

Tar sands oil

Oil from tar sands has larger carbon emissions per unit of energy than conventional oil (the extraction and processing uses three or four times the energy) and its extraction pollutes large areas of land and water. The potential quantities in Canada and elsewhere are very large. The EU is trying to restrict the import of tar sands oil on the basis of its greater climate change impact, but Canada (supported by the UK) is fiercely opposing this.

Shale gas

There are large quantities of gas, mainly methane, in shale rock in many countries. This can be extracted by 'fracking', deep drilling and the injection of large quantities of water containing chemicals of varying toxicity under high pressure to crack the rock and allow the release of the gas. The USA is extracting significant quantities of shale gas. In the relatively closed market of the USA, this has reduced the price of gas, creating a shift from coal-fired power generation to gas. The resulting surplus coal has been sold on the world market, reducing its cost and encouraging greater coal burn in other countries, including the UK.

The UK is believed to have quite significant quantities of shale gas. A recent report[4] from the British Geological Survey estimated there could be about 1,300 trillion cubic feet in the north of England and Wales, which if 10-20% could be extracted, would supply the UK for several decades. However, given the relatively dense population and stricter planning constraints in the UK, the proportion that can be extracted may be significantly less than this.


© codeEd

A fracking station in Germany

Problems with shale gas exploitation include much local disruption during the fracking process, methane leakage which would add to climate change unless tightly controlled, possible pollution of water sources and problems with treatment of the large amounts of polluted water used. There is naturally much local opposition to potential drilling sites. Because a well only produces gas economically for a limited time, more wells have to be drilled on an ongoing basis to maintain production.

The UK government is giving strong support to shale gas exploitation through tax breaks, and it denigrates people who oppose it as 'nimbys'. This is in contrast to their attitude to on-shore wind, where they are giving more power to local people to oppose wind farms.

Role of gas in the energy mix

There could be some economic and technical arguments for the use of UK shale gas in the short term while in transition to a near zero carbon economy. The UK's main source of renewable energy is wind power, whose output is variable. To complement this on the electricity grid, power stations whose output is flexible and are low in capital cost are required at the moment. In contrast to coal and nuclear stations, gas-fired stations meet these requirements and, assuming low methane leakage from the gas production and transport, these produce about half the carbon emissions compared with coal.

Currently about half the UK's gas is imported by pipeline or sea tankers. There is some gas leakage in these routes, and significant energy use in pipelines from very distant gas fields and in liquefying and re-gasifying gas transported in tankers. Local shale gas could therefore be preferable on these grounds. In the longer term, demand side management could match more closely demand to supply on the electricity system, and stronger grid connections with mainland Europe could allow use of more widely distributed and more varied types of renewable energy, especially solar power, greatly reducing the need for fossil fuel systems on the grid.

Benefits to the UK balance of payments and government tax take from shale gas in the short term could, in principle, be used to fund massive energy efficiency projects, renewables and sustainable transport. However, past experience with North Sea oil and gas is not a hopeful precedent as much of the revenue from this was squandered. Also, the government is currently giving permission for a large number of gas-fired power stations and guaranteeing them a market for their output for a long time.

Conclusions

To prevent dangerous climate change, we need to reduce global carbon emissions rapidly, and this means international agreement to leave most fossil fuels in the ground. Importing oil from tar sands into the UK is not compatible with this need. While an argument can be made that, under certain strict technical, environmental and political conditions, domestic shale gas could make a short-term contribution to the UK's transition to a near zero carbon economy, the signs are that these conditions will not be created.

Martin Quick is a retired Chartered Engineer with a background in the energy industry.

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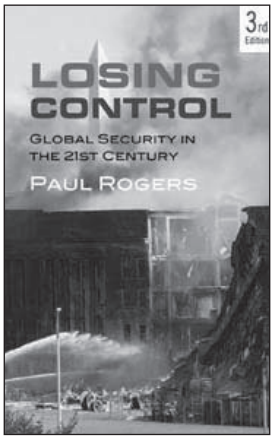
Top books of last 21 years

Stuart Parkinson picks his choice of the best non-fiction books of recent years to mark SGR's 21st anniversary.

It may be a bit presumptuous of me to try to come up with a list of the 'best' books published since SGR was founded in the summer of 1992, but I thought it useful for two important reasons. Firstly, these books (and others like them) have had a strong influence on both my thinking and the direction of SGR's work. Secondly, they deserve a much wider readership among science, design and technology professionals, as well as policy-makers and the public.

Top 10

My top 10 books are listed in the box. Contrary to convention, I am going to start my review with the number one spot!



Losing Control was written by Paul Rogers, Professor of Peace Studies at Bradford University, and you will not find a more insightful and accessible analysis of the security challenges that the world currently faces. The book starts by delving into the Cold War, assessing military and security strategies and policies during this period. Drawing on government documents and academic studies, it details just how close we came to nuclear armageddon as military leaders, in both the East and the West, seriously contemplated how they could try to 'win' a nuclear war. It then tracks how security policies since 1990 have evolved, with military thinking remaining dominant. While the 'dragon' of the Soviet Union had been 'slain', it was argued the West now faced 'a jungle full of poisonous snakes'. The first edition of this book was published in 2000, and Rogers warned then that if the West didn't take action to tackle the roots of conflict – especially the unfair economic system, rapidly growing environmental problems, and the spread of weapons – insurgencies and terrorism would likely grow. The September 11th attacks happened just a year after the book was published. The book is now in its third edition (published in 2010) and, in new chapters, Rogers argues that the militaristic mindset – demonstrated so clearly by the 'War on Terror' – is still dominant. We urgently need to change course if we are to have any hope of improving global security.

Such a perspective is reinforced by the second book on my list, *Collapse* by Jared Diamond, Professor of Geography at the University of California, Los Angeles. This book is an in-depth assessment of environmental and related factors that lead to the collapse of human societies. By drawing on an extensive academic literature, he examines how historical societies such as the Mayans and the Norse Greenlanders collapsed whereas others such as Tokugawa Japan (of the 16th-17th centuries) were able to successfully overcome severe environmental problems and survive. He also looks at more recent examples such as the Rwandan genocide. The key, he argues, is the society's ability to identify the activities that are causing the severe problems – often over-consumption of key resources – and to change course before it is too late. There are clear lessons for today's societies.

The third book on my list, *Frontiers of Illusion* by US researcher Daniel Sarewitz (1997), is a well-grounded and very accessible critique of mainstream science and technology policies. It argues that there are five 'myths' underlying these policies, including the idea that more science and technology necessarily leads to more public benefit, that current systems adequately ensure the objectivity of science, and that science can resolve political disputes. He convincingly challenges each myth, and suggests key reforms based on increasing the diversity and democratic accountability of work in science and technology – in short, reducing the power of vested interests.

Fourth on my list is a book that also challenges deeply ingrained orthodoxies, this time in economics. *Prosperity Without Growth* was written by Tim Jackson, Professor of Sustainable Development at the University of Surrey. The book is based on a report produced by the Sustainable Development Commission, a UK government advisory body. This report sent ripples around UK policy circles following its publication in 2009 because it dared to question the central political idea that a growing economy is beneficial to society and the environment. There have been many books in recent years that have tried to do this, but this is the most thorough, most accessible and most convincing critique that I have seen.

Books on climate change are very common these days, but I've found it difficult to find one that adequately explains the scale of the threat we face, makes the necessary links with other environmental problems and, when discussing solutions, doesn't cop out by focusing mainly on technology. The next book on my list, *Bankrupting Nature*, is rare in avoiding these three pitfalls. Written by Swedish academics Anders Wijkman and Johan Rockstrom, it defines nine 'planetary boundaries'. These are thresholds for key biophysical parameters that, if exceeded due to human activities, would likely lead to disastrous consequences for human society and ecosystems. One of these parameters is, unsurprisingly, the concentration of carbon dioxide in the atmosphere. The authors argue that we have passed 'safe' thresholds, not only for atmospheric carbon dioxide, but also for biodiversity loss and nitrogen emissions. The authors argue for a comprehensive response to this multi-dimensional crisis through a combination of technologies and, critically, fundamental reforms of the economic system.

My sixth choice book goes further, by questioning whether high-technology provides adequate solutions to any of the major problems that humanity

Top 10 books

1. Losing Control: Global Security in the 21st Century – Paul Rogers (2010)
2. Collapse: How Societies Choose to Fail or Survive – Jared Diamond (2005)
3. Frontiers of Illusion: Science, Technology and the Politics of Progress – Daniel Sarewitz (1996)
4. Prosperity Without Growth: Economics for a Finite Planet – Tim Jackson (2011)
5. Bankrupting Nature: Denying our Planetary Boundaries – Anders Wijkman and Johan Rockstrom (2012)
6. Techno-fix: Why Technology Won't Save Us or the Environment – Michael Huesemann and Joyce Huesemann (2011)
7. The Spirit Level: Why Equality is Better for Everyone – Richard Wilkinson and Kate Pickett (2010)
8. Democratizing Technology: Risk, Responsibility and the Regulation of Chemicals – Anne Chapman (2007)
9. How Bad are Bananas? The Carbon Footprint of Everything – Mike Berners-Lee (2010)
10. 60 Years of Nuclear History: Britain's Hidden Agenda – Fred Roberts (1999)

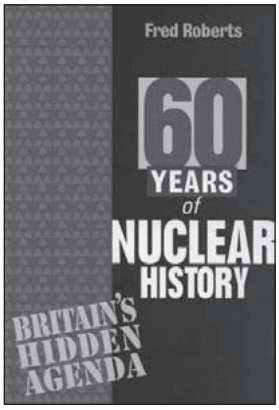
Publication Reviews

faces. *Techno-fix*, written by US scientists Michael Huesemann and Joyce Huesemann, critically assesses the current role of technology in areas such as agriculture, health care, security, transport, and energy, and argues that benefits are generally over-stated and problems often down-played or ignored. It examines a range of major social and environmental problems facing society today, and argues that a range of economic, political and social change, supported by careful use of (e.g.) eco-friendly technologies would be far more successful than a reliance on 'techno-fixes'. This book is a welcome breath of fresh air, given the recent high profile media coverage given to a handful of environmentalists who have changed their minds and now support risky technologies such as nuclear power.

The next book on my list has already become a classic of social science research. *The Spirit Level*, by British professors Richard Wilkinson and Kate Pickett, draws on extensive academic analysis of a wide range of data to make the case that societies that are more equal suffer from markedly lower levels of social and health problems. They look at data from across the industrialised world on issues such life expectancy, mental health, education standards, drug use, obesity and violence. They find that even the wealthier sections of society are better off in more equal societies. They give a range of explanations for these effects. For example, in more equal societies, violence is lower because economic differences are less and thus greater trust is able to develop.

Number eight on my list is *Democratizing Technology* by Anne Chapman. This book is an excellent critique of the risk-based approach to managing technology, so beloved of technological optimists. Chapman explores the theoretical underpinnings of this approach and finds it is based on a range of questionable value-based judgements. She argues that this has allowed economic considerations to dominate in policy decisions on new technologies, and demonstrates this using the case study of synthetic chemicals. She comes up with a range of innovative suggestions for tackling this problem, including defining criteria for assessing the 'riskiness' of new technologies and applying practices from the UK's planning system to allow greater public involvement in decisions on their introduction.

How Bad are Bananas? by Mike Berners-Lee, rapidly became a best-seller upon its release in 2010. Using a range of academic and industrial sources, it estimates the carbon footprint for a selection of common and not-so-common items, from something as tiny as an email to something as large as the world's fossil fuel reserves. Its accessible 'coffee-table' style allows readers to dip in to compare the climate impacts of different aspects of their life. Of all the books that try to help people live an 'eco-friendly life', this is my favourite because it combines robust data (well, about as robust as you can get in this area!) with an entertaining style.



The final book in my top 10 is *60 Years of Nuclear History* by former UK government scientist Fred Roberts. It focuses on Britain, documenting in a very accessible style the parallel developments of nuclear weapons and nuclear power in this country, and the deeply interlinked nature of the two. With an insider's perspective, Roberts is able to highlight the secret decisions and poor management that have led to a costly and dangerous industry. With the current British government absolutely determined to have a new generation of both nuclear weapons and nuclear power stations, the book is a comprehensive and powerful reminder of the folly of these paths.

Other recommended reads

There are several other books that have particularly impressed me in the fields most relevant to SGR.

In the security field, there are three others that have caught my eye. *Beyond Terror*, by Chris Abbott and colleagues (2007), develops the ideas in *Losing Control* (see above), defining a new concept called 'sustainable security', which underpins progressive approaches to tackling the root causes of conflict. Vijay Mehta's *The Economics of Killing* (2012) exposes the power of the military-industrial complex in shaping world affairs. Finally, *Atrocitology* (2011) is a brave attempt to try to document the full extent of war-related casualties throughout recorded history, in contrast to much military history, which so often just focuses on 'who won'.

In the field of climate change, there are four others that I think deserve a particular mention. *Global Warming: The Complete Briefing* by John Houghton – now in its fourth edition (2009) – has become the default reference book in this field, drawing together the latest scientific evidence and policy. *Dire Predictions: Understanding Global Warming* by Michael Mann and Lee Kump (2009) is one of the most accessible books I've read on climate change, giving a good introduction to climate science and policy, and dispelling a few climate myths along the way. *Surviving Climate Change*, edited by David Cromwell and Mark Levene (2007), is a welcome critique of recent national and international policies in this area, highlighting key inadequacies related to economic, political and social change. *Finally, How to Live a Low Carbon Life* by Chris Goodall (2010) is a thorough data-based book that documents which actions are most effective in reducing personal carbon emissions.

In the field of science and technology policy, there are many I'd like to recommend, but I'll focus on the following. Sheldon Krimsky's *Science in the Private Interest* (2003) is a damning critique of the way in which commercial interests distort the biomedical sciences. It helped to inspire the SGR report, *Science and the Corporate Agenda* (2009), and has been followed by numerous other books highlighting similar problems across science, notably *Merchants of Doubt* by Naomi Oreskes and Eric Conway (2012) and *Bad Pharma* by Ben Goldacre (2012).

The last book I want to mention is *Our Final Century* by Martin Rees (2004). Rees – a former President of the Royal Society and an SGR sponsor – warns about a wide range of threats to humans, especially the dangers posed by technology. It is rare to see such a strong critique from someone who has been at the heart of the British science establishment.

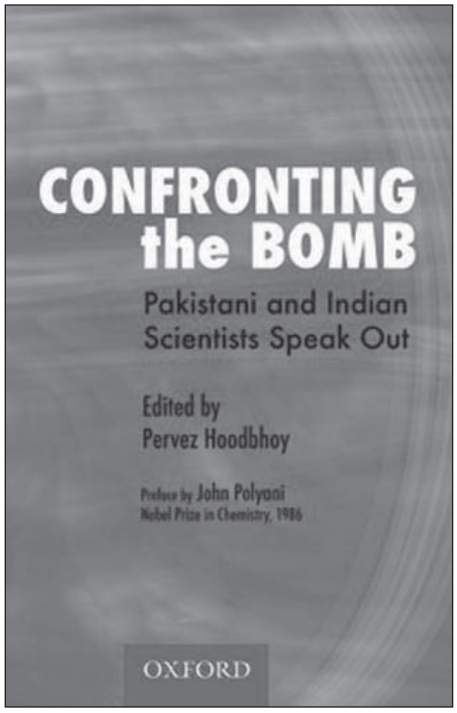
So how do these books compare with your favourite choices? Please let us know via the letters page or our email-list, sgrforum.

Dr Stuart Parkinson is Executive Director of SGR.

Confronting the bomb: Pakistani and Indian scientists speak out

Edited by Pervez Hoodbhoy, Oxford University Press, Karachi, Pakistan, 2013. £25.00/$40.00 (446 pp.). ISBN 978-0-19-906833-3

Review by Sophie Hebden



This book brings together the voices of Indian and Pakistani nuclear scientists to criticise the nuclear proliferation and political brinkmanship that continues to threaten their countries' future. The collection of essays is edited and largely written by leading Pakistani nuclear physicist Pervez Hoodbhoy, who has taught at Quaid-e-Azam University in Islamabad since 1973. Another prominent contributer is Zia Mian, who directs the Project on Peace and Security in South Asia at Princeton University's Program on Science and Global Security and is an expert on nuclear weapons and nuclear energy policy in South Asia.

The authors tell the story of how both countries entered 'the atomic age', giving fascinating insights into the political and social contexts that motivated the weapons programmes and the political role played by some key scientists at the time. As well as seeking international recognition, India's weapons programme was useful to mask the Atomic Energy Department's failure to produce cheap, reliable electricity. This then spurred Pakistan to invest in nuclear science to match India, bomb for bomb. Crucially, Pakistan saw the bomb as key to neutralising India's greater military strength, particularly in relation to the disputed Kashmir region.

To illustrate how naïve India was about Pakistan's capability, Hoodbhoy relates how, two months before the 1998 nuclear tests conducted by India were quickly followed by those carried out by Pakistan, he had been part of a delegation from the Pugwash Movement that met in Delhi with Prime Minister Inderjit Kumar Gujaral. During the discussion he expressed his worry about a nuclear catastrophe. "To my surprise, Mr Gujaral twice assured me – first in public and later in private – that there was no cause for concern…as we prepared to depart….putting his arm around me he confidently and earnestly told me, speaking in Urdu/Hindi, that Pakistan lacked the competence to make atomic bombs."

The book also deals with a number of other issues, including:

- the growing religious and nationalist divisions in Pakistan, such as whether enthusiasm for the bomb could have prevented half the country splitting away in 1971 into Bangladesh;
- the safety and security of Pakistan's nuclear arsenal, and the various threats it faces from Islamic militants such as Al Qaeda and the Taliban;
- how nuclear weapons are commanded and controlled;
- whether early warning of a nuclear attack is possible;
- the risks and consequences of nuclear war in South Asia, including a clinical analysis of the potential damage that detonating a small nuclear weapon would have on a South Asian megacity (easily killing 100,000 people, with the fallout rendering the city uninhabitable for years); and
- an analysis of why building more nuclear reactors is not the right energy solution for India and Pakistan.

It makes agitating reading – rightly so – and is written as a wake-up call for people in India and Pakistan taken in by the cavalier attitudes of the ruling elites to nuclear weapons. The political rhetoric, when tensions rise, is "unconstrained by fear". And there is widespread ignorance amongst the population of the consequences of an Indo-Pak nuclear war. This book goes some way to instilling a healthy fear.

It would have been good if the book had included more about the voices of dissent, which are growing in strength as the India-Pakistan nuclear race continues, unabated. Pakistan's arsenal is now estimated to contain 100 nuclear weapons, deliverable by aircraft and ballistic missiles. India reportedly has about 90 weapons, and is expanding its capabilities including submarines. And both countries refuse to restrict themselves to any specific number of weapons. The book quotes Praful Bidwai, an astute observer of the Indian nuclear scene: "Tactical nuclear war-fighting, once considered escalatory and way beyond minimal deterrence, is said to have been incorporated into current Indian military doctrine…Taken together, Indian military options and Pakistani planning would seem to ensure that any major India-Pakistan conflict would inexorably lead to the use of nuclear weapons."

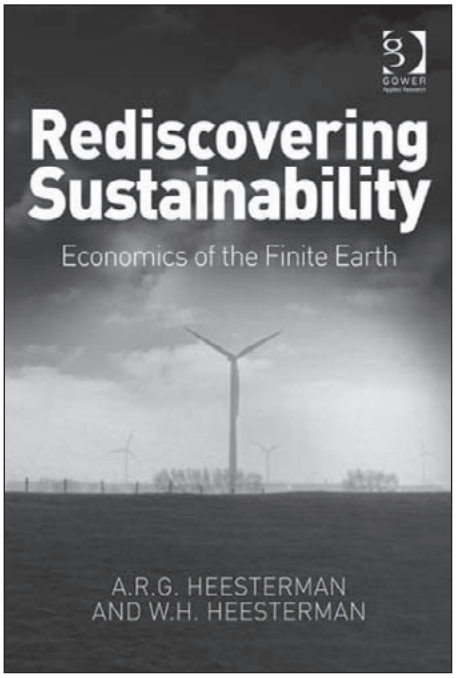
This book is an authoritative and insightful addition to the nuclear debate, written in a style that is accessible even if you are not familiar with nuclear physics or South Asian politics.

Sophie Hebden is a freelance science writer and editor.

Rediscovering sustainability: economics of the finite Earth

A.R.G Heesterman and W.H Heesterman – Gower, 2013, 316 pp., £60, ISBN-10: 1409444562 (hardback

Review by Alan Sloan



Today's globalised economy is complex, energy dependent and interlinked, and Rediscovering Sustainability bravely addresses some of the ideas underlying it.

An attempt to include social, resource and pollution costs within the current body of economic theory has to tackle the traditional omission of these factors. The authors do not explore the fundamental reasons for the development of an unsustainable economics in depth, but they do sketch out some of the middle ground between economics and environmental issues today, making positive suggestions for a way forward.

In the first of the book's three sections, the authors outline some traditional economic principles, a useful and critical primer on how economists see the world, emphasising the need to resolve the current 'tragedy of the commons', the problem of over-exploitation of natural resources when ownership is ill-defined.

The second section deals with the spatial concentration of production and the use of transport, examining the idea of scale-efficiency with mathematics, the complexity of which put this reviewer somewhat out of his depth. They argue for minimising transport links, and point out that transport is seriously under-priced. While they do not attempt to quantify a realistic scale of pricing, they point out that too high a price for transport will bring the system to a halt, so determining the environmentally correct price for energy is seen as crucial.

In this section they also interestingly examine transport in social terms. Migration seen through the economic lens is good for economic growth, but through the social lens it can trigger over-dense urban areas and division. Controlling migration may create more extreme divisions internationally between the haves and have-nots.

The third section of the book looks at the ethical argument for re-configuring 'Business as Usual'. As well as simply appealing to our good nature the authors propose more tangible reasons for changing behaviour. They argue that it is feasible to adjust our inherited economic system to contemporary circumstances, a tough call.

Assuming an ethical starting point, there is a powerful and logical argument for pricing environmental externalities into cost-benefit appraisals. Interestingly, this more rigorous analysis can lead to the creation of an 'upcount' rate (where the economic costs of future damages increase with time) as opposed to the commonly applied 'discount' rate which assumes correct investment today creates future benefits.

Suggestions for funding and supporting the transition to a sustainable economy include using 'special drawing rights' – internationally-held financial assets – to initiate government-backed programmes to expand green sectors of the economy with more international cooperation and regulation. The more practical question of a specific mechanism for setting atmospheric resource prices, for example, is not addressed in this volume presumably due to the need to first establish a correct theory, yet the international negotiation and setting of such prices would have to be a core issue. The authors suggest that global economic governance might be accomplished most easily through the International Monetary Fund and the World Bank, and social issues might be best dealt with through organisations like the UN.

The overall approach could give more consideration to drivers of environmental impact and the role of consumer lifestyle; the 'why' of material turnover is crucial. Advertising and marketing techniques could encourage sustainable consumption and even policy, but this avenue is not explored. The invective that we have to choose a new path still remains poorly mapped, and appealing to international authority alone will not fill the spaces in an open and democratic solution. If a sustainable economics develops, perhaps based on the suggestions in this book, marketing professionals could then set about motivating us to create a more ecologically efficient and technically more elaborate economy instead of simply driving us to consume more.

At the moment, the accounting mechanisms do not exist to allow such a transformation. Many already recognise and respond to local environmental and resource limits, but thinking about them from a global perspective requires more ambition and information than most people have access to. This book provides insights and conceptual tools to economists and environmentalists intent on resolving the big picture.

Projections of the effect of climate change for 2050 in *Rediscovering Sustainability* reminded me of the simple but imaginary economy of the 'Isle of Erg' as described in the classic 1973 review of energy policy, *Fuel's Paradise* (before global warming entered the public consciousness). *Rediscovering Sustainability* represents a real contribution to economic theory today in a world where some of the political and psychological inhibitions are alarmingly similar to those prevalent 40 years ago. This makes it a very welcome and useful volume.

Alan Sloan has been studying and thinking about the interface between human needs and environmental capacity for several years. He holds a BA (Hons) in Architecture.

Letters to the editor should be emailed to <newsletter@sgr.org.uk> or mailed to the postal address on the back page. Letters may be edited for clarity or space.

The debate over Desertec – part 1

Prof Keith Barnham is critical of the international renewable energy programme, Desertec (*SGR Newsletter, no.41, p.7*). He says that much of the energy demand in the EU will increasingly be from air conditioning, which can be met much more easily by using electricity from on-site solar panels. He is particularly keen on 'smart windows' – glazed window panes incorporating solar photovoltaic cells which reduce solar gain and turn it into power. Meanwhile, in North Africa, he argues that solar energy should be used locally and for desalination and, if an export option is needed, to make 'solar fuels' such as methanol (from atmospheric carbon dioxide).

While it is obviously sensible to take up all these options as much as possible, there is surely still some value in exporting any excess electricity from concentrating solar power plants and concentrating photovoltaics to help balance variations in output from wind farms and other renewables across Europe. There is enough solar energy in the Middle East and North African regions for both.[1]

Prof David Elliott, Open University

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The debate over Desertec - part 2

Prof Barnham (*SGR Newsletter, no.41, p.7*) raises the issue of how local populations will view exploitation of the solar resources of desert countries for export to Europe, as promoted by Desertec. This might be a valid point, were it not for the fact that the architects of the programme clearly state that the local energy needs are their first priority.[1] This will in practice mean that the energy produced will only be exported once local needs have been satisfied. In consequence export is not expected to start until the 2030s.[2] He then suggests that it would be better to fund the factories that can provide the wind turbines and solar panels that can power off-grid villages for local water supply and irrigation.

Several comments on this particular aspect of this section are in order. One is simply that export of resources is a normal feature of a global economy. It is called trade. The terms of trade may have been unfair in the past. That, however, is hardly valid grounds for objection against any form of trade and Desertec has a policy of tailoring its investments to the needs of the local economy. Secondly, concentrating solar power has in areas near sea-water the major advantage of being suitable to produce desalinated water as a by product of its cooling system.[3] Making practical use of this capability requires integration with the transport of this water to cultivation and urban use areas. The energy produced by a pilot plant built at Egypt[4] will first be utilised for desalination of seawater (also used for cooling). A comparable capability does not, however, in any practical sense exist for off-grid micro-generation in a dry climate. There already is a problem of over-exploitation of aquifers, causing water tables to fall.[5] Providing some villages with subsidised micro-generating equipment would enable them to extract more than their fair share from underground aquifers. This would inevitably cause wells as well as hand- or animal-powered pumps in neighbouring villages to fail earlier than they would otherwise do. In fact this is not what Professor Barnham suggests. He refers to extracting moisture from the desert air. While basic physics reveals that this is possible in principle, questions concerning its practical applicability arise and are not addressed by Professor Barnham. First of all his suggestion would require some kind of policing regime to stop the subsidised generating equipment being used to power pumps. Secondly, the statement that such devices can be used to extract water from the desert air (the emphasis on the word desert is mine) needs qualifying. The Wikipedia article[6] on this issue relates to *humid* air, a resource which is not that abundant in the desert climate. It appears that "the ideal location for fog collectors are arid or semi-arid coastal regions with cold offshore currents and a mountain range within 15 miles of the coast, rising 1,500 to 3,000 feet above sea level."[7]

Dr Aart Heesterman, Birmingham

References

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3. German Aerospace Institute (2007). Aqua-CSP: Concentrating Solar Power for Seawater Desalination. A report for the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/projects/aqua-csp/AQUA-CSP-Full-Report-Final.pdf
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6. Wikipedia (2013). Atmospheric water generator. http://en.wikipedia.org/wiki/Atmospheric_water_generator
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Note on Desertec

The concept of the Desertec programme is promoted by the not-for-profit Desertec Foundation and commercial Desertec Industrial Initiative (Dii). The two organisations split in early 2013, following ethical differences.

Reference

Der Speigel (2013). http://www.spiegel.de/wirtschaft/unternehmen/desertec-machtkampf-zwischen-stiftung-und-industrie-a-908747.html

SGR conference and AGM 2013

Security and Sustainability: The role of science, design and technology

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