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March

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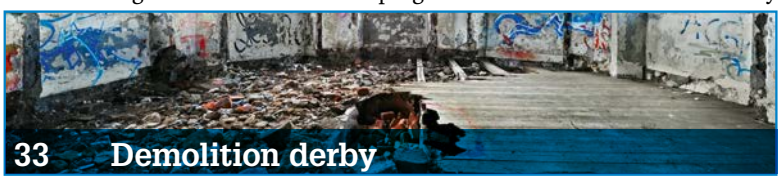

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Conservatism and environmentalism

The Conservative Environmental Network (CEN) has published a collection of essays by "centre-right" thinkers that set out why environmentalists should consider conservative political parties their natural homes. Roger Scruton, senior fellow at the Ethics and Public Policy Centre, writes, for example: "Environmentalists, if they're honest with themselves, should be conservatives." He argues that conservatives naturally want to protect the environment, while the accompanying manifesto from CEN claims that the environment is not a progressive cause but sits within the purview of conservative politics.

In his essay, the estimable environmental journalist Geoffrey Lean reminds us that it has often been conservative politicians, notably Margaret Thatcher, that have shown recent leadership on environmental issues. It was Thatcher who, in 1990, spoke out about climate change and her government that, in the same year, published the first white paper on the environment – entitled *Our common inheritance*. Thatcher also established the Environmental Protection Act, which strengthened pollution controls and introduced heavier fines for non-compliance.

The truth of the matter is not whether a government is right- or left-leaning, but that the economy will always trump the environment when it comes to policymaking

Yet, it is conservatives that generally shy away from regulation, often preferring market solutions to problems. Hence the preoccupation of some coalition government ministers with reducing perceived regulatory burdens on businesses. This obsession is seeing planning controls weakened and important Defra guidance pared back. Markets, however, do not always work for the benefit of the environment. Launching his groundbreaking 2006 report on the economics of climate change, Nicholas Stern described climate change as the "greatest market failure the world has ever known". Although CEN largely agrees with Stern's observation, it argues that such failures are best fixed, not by regulation, but by allowing markets to function more effectively. "A proper market … is one in which each agent pursues the benefits and pays the costs of his own activity – including environmental costs," says Scruton.

Most environmentalists would agree that businesses should pay the cost of damaging activities. Yet governments continue to shower the fossil fuel industry with subsidies to extract the last dregs of oil from its wells. Just a few days after acknowledging that climate change was implicated in the recent floods, the conservative prime minister, David Cameron, was in Aberdeen announcing financial support to help recover an additional 3–4 billion barrels of North Sea oil and gas.

The truth of the matter is not whether a government is right- or left-leaning, but that the economy will always trump the environment when it comes to policymaking. That's why environmentalists and businesses have to take the lead.

Paul Suff, editor

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Short cuts

Managing energy rises

A third of chief executives and managing directors responding to a survey by EEF and npower report that they have taken control of energy efficiency decisions in their businesses. According to EEF and npower, the industrial price of gas has increased by 122% since 2002, while industrial electricity prices have risen by 94%. As a result, 96% of businesses surveyed cite reducing energy use and addressing cost as the main reasons for investing in energy efficiency. However, nearly two-thirds of companies responding to the poll also report that reducing their carbon footprint is a reason for implementing or considering energy efficiency measures. The poll reveals that, once company turnover exceeds £20 million, manufacturers turn to specialist energy buyers or managers for help, and that 20% of respondents are looking to suppliers for advice on energy savings and efficiency. Two-thirds of those surveyed claim that payback periods are a key barrier to investing in energy efficiency.

Natural capital hub

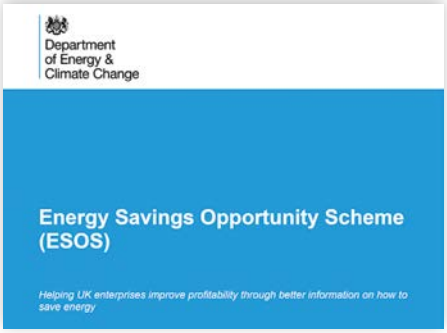
Coca-Cola, Shell and Xerox are among 41 companies sharing on a new free website how they are incorporating natural capital into their business strategies and operations. The Natural Capital Business Hub (naturalcapitalhub.org) aims to help organisations better consider the business value of ecosystem services, such as access to clean water and minerals. The website hosts company case studies, tools designed to help practitioners make the business case for considering natural capital, and frameworks for firms to take action. Its creators hope it will offer opportunities for companies to work together to preserve natural capital assets. "There is not a silver bullet approach to assessing or managing natural capital... but the solutions are within reach," said Amy O'Meara, director of the Corporate Eco Forum. "Right now, too many opportunities for action and collaboration are going unnoticed. We hope the hub will begin to change that."

ESOS risks raising costs

The energy savings opportunity scheme (ESOS) could cost companies up to £17,000 every four years if they fail to prepare properly, consultantcy Ricardo-AEA has warned.

Decc plans to introduce the ESOS in 2015 to meet the requirements of the EU Energy Efficiency Directive. Under the scheme, all large companies – more than 250 employees and an annual turnover exceeding €50 million – will have to complete an assessment of their energy use every four years, with the first audit completed by December 2015. According to the energy department, firms that implement just 6% of the measures identified by the assessments will save a cumulative £1.9 billion during 2015–2030.

However, Christine St John Cox, knowledge leader at Ricardo-AEA, has warned that the ESOS does not compel companies to act on any of the potential savings identified by the audits. She says that the first CRC league table published in 2011 revealed that less than 25% of participating companies took full advantage of the scheme by covering a high percentage of emissions with accreditation for carbon reduction and automatic metering. She fears that many ESOS participants will take a similar approach.



"We're concerned that companies taking a 'make do' approach to the legislation will incur the scheme costs, estimated to average £10,000–£17,000 for each business audit cycle, without any financial gain," said St John Cox. "In our experience of working with companies on CRC, preparation in advance is the key to compliance and unlocking savings in the long run."

She advised companies to explore options that will minimise cost of ESOS, while making the most of the opportunities presented to improve energy efficiency. "In some cases approaches covered in ISO 50001, the energy management standard, could offer a joined-up route to compliance," she said. "Other practical steps that companies can start to think about now include how they address transport."

Commodities price warning

Better resource stewardship is key to protecting the UK economy from the risk of rising global commodity prices, according to Green Alliance. Research by the think tank reveals that world food prices have doubled and metals prices have trebled since 2003, and it warns that upward price pressures are likely to continue, increasing production costs and heightening environmental pressures.

"The only reliable way to reduce our vulnerability to future price rises is to improve how we manage and use resources," said Julian Morgan, chief economist at Green Alliance. "We need to put resource productivity at the heart of economic and business decision making if we want to make the UK more resilient to volatile commodity markets."

The research follows a report from the Ellen MacArthur Foundation, which also warns that the existing linear "take-make-dispose" economic model will put pressure on prices and increase volatility as key resources become scarcer.

"Without a rethink of how we use materials, elements such as gold, silver, indium, iridium, tungsten and many others vital for industry could be depleted within five to 50 years," it says.

According to the report, the business case for moving to a circular economy is now compelling and is the best way to avoid these risks. It suggests, for example, if manufacturers make mobile telephones easier to take apart and users were offered incentives to return devices that are no longer needed, the cost of remanufacturing a phone could be cut by 50%. Closing material loops and regenerating natural assets are practical business strategies to "hedge" against the complex and interconnected risks of resource competition, commodity price volatility and changing consumer demands, says the report.

Firms face stiffer penalties for environment offences

Large companies guilty of serious waste, pollution and nuisance offences in England and Wales face fines of up to £3 million from 1 July, under new guidance from the Sentencing Council.

The first guideline of its kind for environment crimes significantly raises the starting point for fines above that historically imposed for pollution and waste handling or disposal offences, such as fly-tipping and sewage spills. In particular, it increases fines for offences committed by large corporations, repeat offenders, and those causing significant environmental harm.

The guidance introduces a tariff system, whereby the size of fine imposed is decided by the level of harm caused, the culpability of the offender – whether the offence was committed negligently, recklessly or deliberately – and the size of the organisation. Large businesses (those with a turnover of £50 million), for example, will be liable for fines of up to £3 million per offence if they deliberately breach legislation and cause major harm to the environment. The penalty is 33% more than in the maximum fine proposed by the council in its draft guidance last year, and a similar increase has been applied to all offences after consultation feedback.

Now, the minimum fine a large company can expect to pay for the most minor offence is between £7,000 and £25,000. Meanwhile, a small firm (with a turnover of £2 million–£10 million) that negligently causes minor pollution will be fined between £3,000 and £23,000.

The guideline comes after the Sentencing Council reviewed the penalties being imposed for environment offences and concluded that some fines were "too low and did not reflect the seriousness of the offence". In publishing the guideline, the council confirmed that the changes were aimed at ensuring courts impose fines that are "proportionate" with the means of the offender. "Corporate offenders committing serious offences… are expected to get higher fines," it said. Penalties for low-level offences, meanwhile, are unlikely to change.

Simon Colvin, partner and head of the environment team at Weightmans LLP, said the new guideline will be particularly worrying for firms in heavily regulated sectors, such as utilities. "The guideline makes it clear that relevant recent convictions and a history of non-compliance will be significant aggravating factors. This will be concerning for water companies in particular," he said.

The level of fine imposed on Sellafield for breaching waste rules (£100,000 per offence) could become more common

While organisations, such as the Environmental Services Association, which represents the UK's waste sector, have welcomed the higher fines for environment offences, concerns have been raised over the guidance. Ross Fairley, partner in Burges Salmon's environment law team, warns that the guideline – which is only intended to cover certain types of environmental offences – could have a much broader impact.

"While the guideline is confined to certain offences, and not supposed to be implemented until 1 July, the reality is that magistrates will have it in the back of their minds," he said. "Most magistrates do not come across environment offences very often and look for any guidance on what fines they should award. The new guideline may have the side-effect of increasing fines for environment offences across the board."

With the guideline requiring courts to consider the finances of companies in passing sentence, Fairley reminds firms that they will have to produce evidence of their accounts. "What evidence you produce to the court is important, as the organisation's financial status will significantly influence the fine," he said.

The sentencing guideline also makes it clear that in the case of "very large companies" – those with annual turnovers that far exceed the £50 million threshold – fines even bigger than those outlined "may be necessary… to achieve a proportionate sentence".

For a comprehensive insight into the new guideline and its changes visit: environmentalistonline.com/sentencing.

Short cuts

Energy-efficiency fund

The Green Investment Bank has launched a £50 million fund with Societe Generale Equipment Finance to pay for energy efficiency projects. It will enable organisations to put in place energy efficiency measures without having to fund the finance up front, said the bank. The first project to benefit is Rampton Hospital, a high-security facility managed by Nottinghamshire Healthcare. It will receive £5 million to install of a combined heat and power plant (CHP), dual-fuel boilers, biomass boilers and an effluent treatment plant. The bank estimates that new equipment will save the hospital £1.7 million and reduce CO_2 equivalent emissions by 88,000 tonnes over the lifetime of the project. The CHP plant will generate around 5,000 MWh of renewable heat a year, and the effluent treatment plant will improve wastewater quality and energy efficiency.

Threats to EU seas

Europe's marine habitats could be "irreversibly damaged" if efforts are not made to combat the impacts of the fishing, offshore energy, tourism and transport sectors, according to the European Environment Agency (EEA). The warning comes in a new report, *Marine messages* (lexisurl.com/EEA), which reveals that less than 20% of European marine habitats and species are considered to be of "good environmental status". The report finds that seas often face different issues, with the Baltic and Black Seas affected by eutrophication, for example, while trawling in the North Sea has destroyed ecosystems. The EEA concludes that it is the cumulative effect of impacts rather than a single issue that is the biggest threat to the bloc's seas and calls on member states to implement the Marine Strategy Framework Directive (2008/56/EC) in a more consistent way. In the long-term, however, it states that reducing pressures on the bloc's marine environment will require a fundamental shift to "more sustainable ways of living, producing and consuming".

In parliament

Setting European carbon targets

By a margin of 30 votes or so, the European parliament called in January for a binding 30% renewable energy target for 2030, within the framework of a 40% reduction in CO_2 compared with 1990 levels. Days later the commission published its own energy and climate communication. It endorsed the CO_2 ambition, proposed that renewable energy should supply 27% of EU needs by 2030, and called for member states to draw up national plans to suit their different circumstances. How these plans will be reconciled with the overall EU strategy has yet to be determined.

Nothing is certain about any of this. The parliament is in its "dog days", with elections due on May 22 and no great likelihood that its successor will share its current environmental ambitions. The commission too is throwing its last dice, with internal divisions more apparent. Existing commissioners will see no more legislation carried and can, at best, hope only to secure some positive statements of intent from Europe's governments.

Some energy ministers will insist that a 40% CO_2 reduction should not be agreed in the absence of an international agreement. Others, led by UK energy secretary Ed Davey, will challenge the setting of a new renewable energy target, arguing – rightly in my view – that each country should reduce emissions in whatever way is most appropriate.

With the European Environment Agency claiming that the EU has already reduced its emissions by 24%, the proposed 2030 target is certainly within reach. But the bigger goal, achieving an 80%–95% reduction by 2050, will require long-term planning and significant investment.

The commission is fearful that some member states will shy away from the 2030 goal, so it is not asking governments to explain their long-term strategies. That may be good politics, but I'm not so sure it's good sense.

Chris Davies MEP is the Liberal Democrat environment spokesperson in the European parliament.

Fashion sector to cut impacts

High street chains, supermarkets and fashion labels have pledged to reduce the environmental impacts of the clothes they manufacture by 15% by 2020.

Twelve UK firms, including Stella McCartney, John Lewis and Sainsbury's, have agreed to cut the carbon emissions generated and water used throughout the lifecycle of their clothes, as well as reduce the amount of waste sent to landfill by 15% on 2012 figures.

The companies, which represent 40% of the UK's clothing sector, are signatories of Wrap's sustainable clothing action plan (Scap). If the scheme's new targets are met, the firms will be saving more than 1.2 million tonnes of CO_2 and 420 million cubic metres of water each year by 2020.

The signatories have also agreed to reduce the waste generated during the manufacture of their clothes by 3.5%, which, Wrap claims, equates to 16,000 tonnes annually.

The scheme aims to encourage clothing makers to use "lower-impact fibres", such as organic cotton, work to extend the life of clothes, and encourage consumers to recycle and reuse garments. According to Wrap, retailers can achieve payback on setting up clothing buy-back schemes in two years.

Launching the Scap 2020 targets, Liz Goodwin, Wrap's chief executive, said: "By working across the lifecycle and mobilising industry and consumer action, we can achieve amazing results."

Meanwhile, budget fashion chain Primark and luxury designer Burberry have become the latest labels to pledge to remove all hazardous chemicals from their products and manufacturing processes under Greenpeace's "Detox" campaign. The commitment requires firms to remove the chemicals from their supply chain by 2020, and ensure that all manufacturing facilities and suppliers are disclosing data on discharges by the end of 2014.

Decc aids Scots CCS project

Peterhead power station will receive UK government funding to help develop a carbon capture and storage (CCS) facility. The Scottish plant will share £100 million from Decc's £1 billion CCS commercialisation programme with the Yorkshire-based White Rose project. Peterhead aims to become the world's first commercial-scale CCS operation at a gas-fired power station.

The project, a joint venture between Shell and SSE, involves retrofitting a post-combustion capture installation at the power plant and store the captured carbon in a depleted North Sea gas field. The new funds will support the next phase of project, known as front-end engineering design (FEED). The White Rose project, which proposes an oxyfuel CCS process to capture emissions from a new 304 MW coal-fired power station, received the go-ahead from Decc in December 2013 to start its FEED phase.

The Peterhead announcement follows the publication of a report from the TUC and the CCS Association, which concludes that the rollout of CCS technology in the UK would create a market worth £15–£35 billion by 2030, and reduce wholesale electricity prices by 15% a year. It estimates that the total annual economic benefits of CCS to the UK could reach £2–£4 billion by 2030.

MEP Chris Davies said more needed to be done to support the deployment of CCS technology in the UK and Europe. Speaking at the Platts annual CCS conference in Brussels, Davies said 2014 would be a milestone year for CCS, with the first commercial plant at a coal-fired power station due to come on stream. "It's just a shame that it will be in Canada rather than in Europe," he told delegates. He called on the European CCS industry and energy sector to build more political support for the technology.

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Interface promotes new industrial model

European manufacturing firms could increase annual profits by 9% on average if they invested in renewable energy and being more energy and resource efficient and, according to a new report by consultantcy Lavery/Pennell for carpet tile company Interface. The changes would also create around 168,000 new jobs in energy efficiency and renewables, and reduce Europe's total annual greenhouse-gas emissions by 14.6%.

Described as a new industrial model, the three-stage continuous improvement process in the report focuses on: improving non-labour resource efficiency; investing in sustainable inputs, such as using recycled and bio-based materials; and commercialising competitive advantage by developing new products to displace ones with a high evironmental impact.

Launching the report, Greg Lavery, CEO of Lavery/Pennel, said the model would help companies address supply constraints and resource scarcity issues. "The price of metals is now three times higher than in 2002, while energy costs have increased sixfold," he said.

If the model were introduced across Europe, profits would rise collectively by €100 billion a year, according to Lavery. UK manufacturers alone could increase annual profitability by €9.4 billion by improving energy and transport efficiency, reducing waste, optimising packaging and recycling or remanufacturing products. Lavery advised manufacturers to start cutting costs by reducing the use of raw materials with the highest price, greatest supply risks and biggest environmental footprint. "Often the payback is rapid," he said, revealing data showing that, in most cases, firms can recoup the cost of installing equipment to reduce the energy intensity of a product in less than 12 months.

Interface has halved resource use over the past decade

The model builds on the approach that Interface has adopted since the mid-1990s. According to Lavery, innovative firms like Interface have halved resource use by per unit of production over the past 10 years, while most others have achieved levels of only 10%–15% . He highlighted the development by Interface of a carpet tile that uses around 50% of the yarn of a conventional tile. Another example is Toyota Motor Europe, which since 1993 has reduced by 70% the amount of energy and water it uses a produce a vehicle.

From environmentalistonline.com…

EIA Directive

Members of the European parliament's environment committee have voted overwhelmingly in favour of passing into law the draft text of the new Environmental Impact Assessment (EIA) Directive. Following negotiations between the European commission, parliament and member states in November and December, amendments were made to the commission's proposed text. On 12 February, members of the environment committee voted 46 to eight in favour of adopting the text, which will introduce new requirements on developers to consider impacts on biodiversity and climate change in scoping EIAs. It also requires developers produce screening reports for annex 2 applications above national thresholds and that competent experts undertake EIA. The text was due to be voted on by the full European parliament during its 10–13 March meeting.

environmentalistonline.com/EIADir

EU influence

Defra and Decc have published the results of their "balance of competencies" review, which examined the impact of EU environment legislation on the UK's economy, and asked whether elements of regulation would be better managed at the national level and what improvements could be made. Representatives from industry, academia, NGOs and parliament contributed to the review. Overall, they agreed that EU rules had improved environmental standards in the UK, raised the ambition of national policies aimed at mitigating climate change and helped to provide the long-term certainty needed for investment in low-carbon technologies. However, concerns were raised over the administrative and cost burden EU regulations place on UK companies, particularly small businesses and those in energy-intensive industries. Compliance with REACH and planning requirements were cited as key areas of concern.

environmentalistonline.com/BoC

CSR reporting

The European parliament and council have agreed the text of a new Directive that will force around 6,000 large businesses to include information on their environmental performance and impacts, as well as data on diversity, in their annual financial reports. The new rules, which are expected to be formally adopted by the European parliament and member states in April, apply only to "large public interest entities" – which the EU defines as "mainly listed companies and financial institutions... companies that are so designated by member states because of their activities, size or number of employees". The text does not require a detailed report on environmental and social issues. Rather firms will be require to publish "concise, useful information" to help stakeholders understand the "development, performance, position and impact" of the company's activities.

environmentalistonline.com/EUCSR

EMS budgets set to rise

Large companies are set to increase spending on environment, health and safety (HSE) initiatives in 2014, according to a poll of senior practitioners.

Research firm Verdantix surveyed 250 heads of HSE at companies with annual turnovers of more than $250 million and which operate in countries, including Germany, China, Russia, the UK and the US, as well as the Middle East.

More than 60% confirmed their firm would be spending more on environment management initiatives in 2014 than in 2013. Half of those reporting that their firm will invest more in their HSE budget revealed that the increase will be at least 10% up on last year's figures, with spending expected on software, environmental reporting, auditing and product sustainability. More than half of respondents said they plan to increase investment in HSE software this year.

Spending on pollution control, permitting, waste, water and reducing greenhouse gases was also predicted to rise.

Firms expect to increase spending on environmental software in 2014

"Compared with spend on energy management and sustainability, the HSE market looks much more attractive," said David Metcalfe, CEO at Verdantix.

The research also revealed that 43% of HSE budgets are, on average, earmarked for consultation, implementation and support services. Risk management was cited as the key driver for rising budgets, with more than half of respondents confirming that financial, regulatory and operational risks had the most influence on additional money being allocated.

Lawyers turn to control orders

The Law Commission is advocating the introduction of control orders to manage invasive non-native species as part of its proposals to simplify and modernise the law on protecting and managing wildlife in England and Wales.

The proposal, which is similar to that introduced in Scotland by the Wildlife and Natural Environment Act 2011, will enable the Environment Agency and Natural Resources Wales, among other bodies, to make a species control agreement with, or species control order against, the occupier of land or premises. The commission says such a move should ensure the eradication or control of an animal or plant that is likely to have a significant adverse impact on biodiversity or another environmental, social or economic interest.

The commission explains that the agency, for example, should first offer a species control agreement to the owner or occupier of the land or premises in question. Only when an agreement proves impractical or is not being properly performed should an order be imposed. In most cases, the law does not allow those charged with the management and control of wildlife to enter privately owned land or premises to carry out operations to manage or eradicate invasive non-native species without consent. However, the proposed change provides powers of entry to enable regulators to investigate or monitor a site, or to allow an order to be carried out.

The impact assessment accompanying the recommendation estimates the financial benefit of introducing control agreements or orders will total £91.6 million through the avoidance of costs in managing or eradicating invasive non-native species, such as damage to property. It also suggests that the change will reduce the potential for considerable damage to biodiversity and the provision of ecosystem services, particularly those services needed for critical infrastructure, such as watercourses.

There are around 1,900 non-native species in Great Britain. Of these, 109 plants and 173 animals are considered to have a negative ecological or human impact. The annual cost of such species to the economy is estimated at £1.3 billion in England and £125 million in Wales.

To see the commission's proposals in full visit lexisurl.com/iema17757.

Short cuts

14001 edges forward

The latest meeting of the working group developing the new edition of ISO 14001 took place between 25 February and 1 March. The meeting discussed comments and suggested amendments from national mirror groups on the second committee draft, which is set to become a draft international standard (DIS). The meeting focused on tightening the language in the standard, ensuring consistency and making sure the annex focused on points of interpretation rather than guidance on implementation. Progress was also made on the risks and opportunities section. The group was unable to deal with all of the comments raised, however, so a second meeting is planned. Martin Baxter, IEMA's executive director of policy and the UK's representative on the working group, confirmed that the DIS is expected to be published for comment and ballot between September and November this year.

$10bn for green ideas

GE is to invest a further $10 billion in its "ecomagination" research by 2020. Since its launch in 2005, GE has invested $25 billion in the programme, which focuses on designing and developing cleaner and more efficient technologies. GE chief executive and chair Jeff Immelt outlined some of the projects that would receive research funding at the US energy 2020 summit. He said the money would be spent on: searching for alternative technologies to replace the water that forms the basis of hydraulic fracturing, or "fracking"; cutting the wasteful flaring of natural gas; systems to reduce the cost of wind power, while simultaneously increasing wind turbine output; and ways to make existing power plants more efficient. According to Immelt, ecomagination has generated revenues totalling $160 billion over the past nine years. Meanwhile, he reported that GE operations had reduced overall greenhouse-gas emissions by 34% since 2004, and freshwater use by 47% since 2006.

THE FUTURE OF ISO 14001

In this NQA e-movie briefing, Martin Baxter (Executive Director of Policy, IEMA) reveals his thoughts on the upcoming changes to ISO 14001

To view **scan the QR code**
or go to **www.nqa.com/revisions-14001**

nqa.

NEVER STOP IMPROVING

The big conversation

December 2013 to February 2014 was the UK's wettest winter on record. The rainfall caused widespread flooding and led to debate over who or what was to blame. Much of the discussion focused on climate change and the role of environment professionals. Here are the views of experts and a selection of comments from conversations on the IEMA LinkedIn page (iema.net/linkedingroup).

Future of flood risk management

"Coming from Canada, I just don't see enough trees in this country. There is lots of open pasture land, but grasses and shrubs can only retain so much water. With trees you've got the roots systems and canopies to hold water."

Olivia Tran, postgraduate student, University of Manchester

"I wonder if there is mileage in large-scale rainwater harvesting systems? Or even 'flood cellars' under houses? Having a cellar into which the overflow river water is directed will keep the house dry. I also agree that we need more trees and shrubs, especially in concrete urban areas, and the return of hedgerows and some deciduous woodland on farmland."

Victoria Pitts, IEMA Affiliate, environment consultant, Le Bureau Vert

"Resilience goes way beyond reducing impacts, to focusing on the communities and their own provisions and methods of dealing with certain flooding. It is clear communities need further engagement as to the wider 'catchment' scale work underway and how to better protect homes and properties."

Zebrina Hanly, AIEMA, professional standards manager, IEMA

"Political bickering has been going on over flood defence policies in the UK for quite some time. The latest incidence won't be the last. Flooding will continue to be an issue if developers continue to encroach on flood planes. The water has to go somewhere. If, for instance, flood water is being diverted away from Sweden then a country elsewhere will bear the brunt of it. Similarly, flood management strategies within a country will simply be shifting the water from one part to the other. I suggest that a natural approach to flood management should guide policymakers. We may start by restricting development in flood planes."

Innocent Grandhomme Okorji, lawyer

Expert opinion

In a letter to the *Daily Telegraph* on 20 February, a coalition of construction industry and environment bodies called on the government to listen to flood experts. The signatories, including IEMA's executive director of policy, Martin Baxter, highlighted how water management techniques could have helped prevent flooding. "We need to look at how forestry, land management and soft-engineered flood alleviation schemes can hold back water in the upper reaches of rivers, and how dredging may assist in the lower reaches... We need to fit sustainable drainage systems comprehensively for existing buildings and all new buildings," they wrote. The signatories also offered support to the Environment Agency, which has been criticised by some for its response. "In the Environment Agency there are people experienced in addressing these problems, as there are among the members of all our organisations. We need to mobilise that joint expertise."

IEMA position

IEMA has called for rival MPs to work together on flood protection following criticism of the Environment Agency by some government ministers. Using the floods as a "political football" is unhelpful and should be stopped, said IEMA in a statement, adding: "Cross-party consensus and climate leadership is required to determine the priorities and level of funding needed to provide communities with the protection they need … Building resilience to the challenges of climate change requires government, businesses and society to work together to mitigate impacts and invest in protection." Increasing flood risks mean that government, regulators, business and environment professionals must work together, says IEMA.

UK storms – a catalyst for action on climate change?

"Given the current flooding across the country, is now the right time for government to reconsider scrapping the Code for Sustainable Homes? I think the government can use the storms to take action on climate change by first abandoning its plans to scrap the code – which is part of its review of housing standards. As well as demonstrably leading to lower carbon emissions, the code also requires homes to be protected against flooding. It requires homes not to cause excess surface water run-off and rewards homes protected from flooding from other sources."

Richard Lupo, MIEMA CEnv, sustainability consultant, Sustainable Homes

"Removing the stick from development control with no carrot to achieve better standards and resilience must at best be an uninformed political move and at worst a derogation of duty of care."

Graham Parry, environment consultant, ACCON UK

"I think there has to be a huge shift in attitudes in terms of how we build and where we build, but I suspect it will be back to 'business as usual' once everything calms down. In terms of building in areas susceptible to flooding, the only way builders will make changes is through public policy; house buyers being unable to purchase insurance; and/or house buyers refusing to buy in 'at risk' areas."

Sue Smith, AIEMA, sustainable development coordinator, BAE Systems

Recent prosecutions

Case law

Appeal court interprets "knowingly permit"

The Court of Appeal (CA) has provided a useful analysis of the meaning of "knowingly permit", which is used in the contaminated land regime, as well as in relation to waste and water pollution offences.

The Environmental Permitting (England and Wales) Regulations 2007 (as amended) make it an offence to knowingly permit the operation of a regulated facility without an environmental permit. In *Walker and Son (Hauliers) Ltd v Environment Agency* [2014] EWCA Crim 100, land purchased by the company for redevelopment was used by another firm – Bloom (Plant) Limited, which had been contracted to demolish empty buildings on the site – as a waste transfer station. An investigation by the local council concluded that Bloom was conducting an illegal waste operation without an environmental permit. Bloom pleaded guilty to various waste offences and Walker and Son was charged with knowingly permitting the operation of a waste facility without a permit. It pleaded guilty, but appealed, arguing that it had not been aware of the need for or omission of the permit.

The CA had to decide whether it was necessary for the defendant to have knowledge that the waste operation was not authorised or whether knowledge of waste activities at the site was sufficient for liability. On dismissing the appeal, the court held that the words "knowingly permit" related to knowledge of the facts and not as to the existence of the environmental permit. It also held that the prosecution did not have to show that a defendant knew that the matters of which it was aware were not permitted.

George Hobson

Lexis®PSL

Recycling bosses receive suspended prison sentences

Three directors of a recycling company in Wales who allowed "mountains" of food and plant waste to rot, ignoring warnings of the potential risk to the environment, have each received suspended prison sentences at Newport Crown Court.

Jacqueline Powell, Robert Baynton and Jonathan Westwood were directors of Wormtech Limited, which operated on the site of a former RAF camp near Chepstow. The firm was set up largely to turn household food waste collected by local authorities into compost. In January, Powell, who was the firm's managing director, was found guilty at Cardiff Crown Court of breaching an environmental permit and consenting or conniving with the keeping of controlled waste in a manner likely to cause pollution. Baynton and Westwood each pleaded guilty to three charges of failing to comply with an environment permit at a separate hearing at Newport Crown Court.

Powell's trial was told that the company, which in 2012 was paid £1.8 million, mostly by councils, to dispose of household waste, had received several warnings from the Environment Agency and later Natural Resources Wales (NRW) that the site was one of the worst performing of its kind in England and Wales. The warnings came after Wormtech was fined in 2010 for polluting a local watercourse. The site's licence was suspended in 2012 and Wormtech left the premises.

Tim Evans, prosecuting, said the site was unsuitable for composting. "There had been pollution, [which] they had pleaded guilty to in 2010, but they never sorted it out and eventually the agency, now NRW, said 'enough is enough'," he said.

During sentencing at Newport Crown Court, Timothy Evans QC, for NRW, said leachate from the site posed a risk of harmful pathogens being released into the environment. Judge Neil Bidder said there had been a risk of E.coli and salmonella in the compost being sold. Powell, Westwood and Baynton received sentences of 12 months, 32 weeks and 16 weeks respectively, all suspended for 12 months and to run concurrently.

EU starts action against UK

The European commission has launched legal proceedings against the UK for its failure to cut levels of nitrogen dioxide (NO_2) pollution in line with the limits set by the Directive on air quality (2008/50/EC). The Directive, which entered force in June 2008, sets daily and annual limits for NO_2 in populated areas.

Member states had to achieve the limits by 1 January 2010 unless an extension was granted until 1 January 2015. The commission says extensions have been agreed only with member states that have a credible and workable plan for meeting the standards within five years of the original deadline, and that the UK has failed to provide such a plan. It notes the decision of the Supreme Court last year, which found the government was in breach of its obligations under the Directive.

The court confirmed that the air quality limits were not being met in 43 cities and regions, including London and Glasgow, and that, under Defra plans, 15 areas will continue to suffer levels of NO_2 exceeding EU rules until at least 2020, while the capital would not meet the target until 2025. The commission has sent the government a letter of formal notice that it is taking legal action. The government has two months to respond.

ECHA warns 46 firms over dossiers

Forty-six companies have one month to correct inconsistencies in their registration dossiers or face legal action for failing to comply with the EU REACH Regulation (1907/2007). The European Chemicals Agency originally identified more than 2,000 dossiers that required updating and says the 46 firms that received the legally binding letters are responsible for 118 dossiers that still contain inconsistencies on intermediate chemical substances. Under REACH, chemicals can be registered as intermediates if they are manufactured and used in strictly controlled conditions. Registering a substance as an intermediate means that companies have to supply less information on the hazards. The agency wants to ensure that substances registered as intermediates meet the strict definition and are manufactured in accordance with the rules.

New regulations

In force	Subject	Details
6 Feb 2014	Natural environment	The Plant Health (Scotland) Amendment (No. 3) Order 2013 amends the 2005 Order to revise control measures in order to prevent the introduction and spread of sweet chestnut blight and plane canker stain. lexisurl.com/iema17520
13 Feb 2014	Hazardous substances	European commission Decision 2014/85/EU allows the use of biocidal products containing copper for the control of Legionella bacteria in water for human use – for example, for showering or bathing – and drinking water. This authorisation is due to remain in force until 31 December 2017. lexisurl.com/iema17515
17 Feb 2014	Natural environment	The Prohibition of Keeping or Release of Live Fish (Specified Species) (England) Order 2014 prohibits the keeping or release of certain fish species without a licence. lexisurl.com/iema17516
19 Feb 2014	Planning	The Town and Country Planning (Fees for Applications, Deemed Applications, Requests and Site Visits) (England) (Amendment) Regulations 2014 amend fees for planning applications regarding the "winning" and working of oil and natural gas. The revised fee methodology prevents the application of fees to land used solely for underground operations. lexisurl.com/iema17517
20 Feb 2014	Hazardous substances	The Heavy Fuel Oil (Amendment) Regulations 2014 amend the Control of Major Accident Hazards Regulations 1999 (COMAH) and the Planning (Hazardous Substances) Regulations 1992. Heavy fuel oil is reclassified as a petroleum product rather than "dangerous for the environment", increasing the inventory thresholds for COMAH and planning (hazardous substances) requirements to apply. lexisurl.com/iema17521
1 Mar 2014	Waste	The Environmental Protection (Duty of Care) (Scotland) Regulations 2014 revoke and replace the 1991 Regulations. The new regulations require that all waste transfer notes include the standard industrial classification (SIC) code of the activity generating the waste. The 2014 Regulations also permit the electronic retention of waste transfer notes, supporting the use of the electronic duty of care (edoc) system launched in January 2014. lexisurl.com/iema17522
5 Mar 2014	Waste	The Environmental Permitting (England and Wales) (Amendment) Regulations 2014 make a number of changes to the environmental permitting regime, including: allowing environmental permits for waste and mining waste operations to be issued before planning permission is in place; introducing a registration scheme for low-risk releases to groundwater from ground source heating and cooling systems; and revoking the requirement for local authorities to maintain public registers of permits in addition to those operated by the Environment Agency. Further changes to the permitting regime come into force on 1 October 2014. lexisurl.com/iema17523
5 Mar 2014	Climate change	European commission Regulation 136/2014 revises requirements for reference fuels to be used in emissions tests by vehicle manufacturers against the requirements of the Euro 5, 6 (light passenger and commercial vehicles) and VI (heavy duty vehicles) emissions standards. These changes reflect the increasing use of biofuels. lexisurl.com/iema17518
30 Mar 2014	Planning	The Town and Country Planning (Prescribed Date) (Scotland) Regulations 2013 revoke and replace the 2012 Regulations. They specify the prescribed date for section 26AA(2) of the Town and Country Planning (Scotland) Act 1997, which relates to marine fish farms. lexisurl.com/iema17117

This legislative update has been provided by Waterman's Legal Register available at legalregister.co.uk

Latest consultations

21 Mar 2014
Energy efficiency

Proposals to transpose art 14(5)–(8) of the Energy Efficiency Directive (2012/27/EU) in England and Wales by amending the Environmental Permitting Regulations have been put out for consultation by Defra and the Welsh government. The overall objective of art 14 is to encourage the identification of cost-effective energy efficiency supply options.
lexisurl.com/iema17494

21 Mar 2014
Enforcement and sanctions

Because climate change regimes, such as the EU emissions trading scheme (ETS), the carbon reduction commitment (CRC) and climate change agreements (CCA), are only touched on in its existing enforcement and sanctions guidance (ESG), the Environment Agency is developing more specific guidance for each one. It is now consulting on draft guidance for the ETS, CRC and CCA, which the agency intends to publish as an annex to its existing ESG.
lexisurl.com/iema17500

10 Apr 2014
Wildlife trafficking

As part of its work to identify what is, and is not, working in the EU approach to combating wildlife trafficking, the European commission has issued a public consultation. Contributions are sought from international and regional organisations, governments and enforcement authorities, as well as those in the private sector and civil society who are involved in the fight against illegal wildlife trade.
lexisurl.com/iema17498

25 Apr 2014
Planning conditions

The Welsh government is consulting on a replacement for Circular 35/95 – on the use of conditions in planning permissions. The aim is to provide updated guidance on the effective implementation of planning conditions, as well as provide a revised list of model conditions to promote best practice in Wales. Circular 35/95 is nearly 18 years old and contains references to legislation that has been revised or replaced. The draft text retains much of the content of Circular 35/95, but the structure has been rearranged and new sections introduced, including ones on contaminated land, drainage, fume extraction, "one planet" development, renewable energy and sustainable building.
lexisurl.com/iema17497

28 Apr 2014
Energy efficiency

The European commission is seeking views on the issues related to energy efficiency policies and measures for 2020 and 2030. Opinions will feed into the commission's review of progress towards the 2020 target under art 3(2) of the Energy Efficiency Directive (2012/27/EU) as well as help formulate policy after the publication on 22 January of the communication: "A policy framework for climate and energy in the period from 2020 to 2030". The communication makes it clear that more ambitious energy efficiency efforts will be required over the next 15 years and the commission wants a consensus on the exact ambition future EU energy savings policy should have and the measures necessary to deliver it.
lexisurl.com/iema17499

28 Apr 2014
Regulators' code of practice

The Scottish government has published a draft strategic code of practice for regulators in Scotland. The aim of the code is to describe in more detail how regulators, such as the Scottish Environment Protection Agency, should apply regulatory principles and build good practice to contribute to achieving sustainable economic growth. The consultation document stresses that the duty does not prioritise sustainable economic growth over other regulatory objectives, but requires regulators to take into account economic factors. There are four main themes in the code: regulators as enablers; risk and enforcement; understanding regulated enterprises; and clear and effective communication.
lexisurl.com/iema17496

New guidance

Biodiversity and business	Business in the Community and Natural England have produced a guide (lexisurl.com/iema17505) for companies on the value of the natural environment to their businesses. It also covers how firms can align their ambitions for growth with the conservation of the natural resources on which they depend. The guide uses examples of companies that have successfully combined business performance with conservation. Case studies cover the five priority areas identified by the UK taskforce on ecosystems markets in its March 2013 report. They are: biodiversity offsetting; closing the resource loop; local wood fuel supply chains; nature-based certification and labelling: and water-cycle catchment management.
Waste prevention	Wrap has published a 13-page best practice guide for retailers and manufacturers on reducing waste and cutting costs (lexisurl.com/iema17504). The guide focuses on production-ready packaging (PRP); secondary and tertiary packaging; raw material yield loss prevention; and stock-keeping unit rationalisation. The guide provides examples of where changes can be made and the likely benefits that will accrue. For example, PRP, which Wrap defines as packaging that requires minimal handling before production, can be tailored to a company's requirements, products and ingredients, and will reduce manpower, support buying in bulk, and cut ingredient and packaging waste.

Laying down the law

Supreme Court gets HS2 back on track

Stephen Tromans applauds the UK's highest law court for delivering a 'careful, thorough and far-ranging judgment'

In my column last October, I looked at the Court of Appeal (CA) decision ([2013] EWCA Civ 920) on HS2 and strategic environmental assessment (SEA), and the striking divergence of judicial opinion on the scope of the SEA Directive (2001/42/EC) (environmentalistonline.com/HS2). I predicted that the case would go further and, indeed it has.

The Supreme Court gave its judgment on 22 January – *R (HS2 Action Alliance Limited) v Secretary of state for transport* [2014] UKSC 3. The fact a bench of seven Supreme Court judges rather than the usual five considered the case is an indication of its significance.

At the heart of the case was a document entitled *High-speed rail: investing in Britain's future – decisions and next steps* ("DNS"), which was published in January 2012. The question was whether the DNS was "required by administrative decisions" and whether it "set the framework for future development consent" – so as to be within the scope of the SEA Directive.

Lord Carnwath gave the first judgment and five of his colleagues concurred. Lord Carnwath was prepared to accept as a working assumption that the DNS was "required" by a previous government document on high-speed rail, published in March 2010. He then considered the more controversial question of whether it "set the framework" for the future development consent for the project. On the basis of previous case law, it appeared to Lord Carnwath that the question was how far the plan influenced later decisions. It did not have to be prescriptive in the sense of determining a location, for example, but it did have to be influential to the extent of excluding some environmental effects or categories of effects, from later consideration.

The majority in the CA had viewed this as being a spectrum of influence. Lord Carnwath went back to basics by reminding himself that the SEA Directive had been intended to fill a gap in the regime for environmental impact assessments whereby, at the time of assessing a project, a major effect on the environment may already have been established by a previous plan or programme. He also recalled that the word "strategic" does not appear in the SEA Directive, and that there is no presumption that because a project is strategic in nature that it is subject to the Directive.

Lord Carnwath qualified the test of "sufficiently potent influence", which had been used both by the majority and dissenting minority judges in the CA. Influence over the later decision, however great, is itself not enough. As the counsel for the secretary of state put it: "The influence ... must be such as to constrain subsequent consideration, and to prevent appropriate account from being taken of all the environmental effects which might otherwise be relevant." Applying that test, Lord Carnwath agreed with the majority in the CA that the DNS did not set the framework for development consent decisions made by a sovereign parliament.

It was also relevant to focus on the practical consequences of finding that the SEA Directive did not apply, and here Lord Carnwath found it important to note the conclusions of Mr Justice Ouseley in the earlier High Court hearing ([2013] EWHC 481) that, even if the SEA Directive had applied, it would not have required a more detailed consideration of alternative strategies based on improvements to the existing network.

In his judgment, Lord Reed – with whom six justices agreed – focused more on the detail of the hybrid bill procedure by which the HS2 project would be authorised. This included a detailed and academic consideration of the role and influence of the government's whips and the constitutional principles in the 1689 Bill of Rights governing the relationship between parliament and the courts. Lord Sumption, meanwhile, took a robust stand that the DNS was a proposal and nothing more. It did not operate as a constraint on the discretion of parliament. Four justices agreed with Lord Sumption.

None agreed with Lady Hale's judgment, however. She confessed to not finding the case easy, and expressed sympathy with Lord Justice Sullivan, the minority judge in the CA. While Lady Hale was initially attracted by the idea of referring the case to the Court of Justice of the European Union (CJEU), she eventually agreed with the other justices in deciding that this course of action would not be appropriate.

Lords Neuberger and Mance – with whom the other five agreed – gave a deadly critique of the CJEU's approach in the *Inter-Environnement Bruxelles* case in 2012. In this case, the CJEU had, contrary to the analysis of the advocate general, given the word "required" in the Directive a meaning that the European legislature did not intend.

Taken together, the Supreme Court judgments are an extremely impressive tour de force; a series of learned essays where there is something for all lawyers, whether specialising in the environment, the constitution or the EU. The challenge, therefore, has failed.

Whether one agrees with the practical outcome, jurisprudence has been massively enriched by the decision of the UK's highest court. Critics of the English legal system should read it. I doubt there is any other country in the EU whose highest courts could have produced such a careful, thorough and far-ranging set of judgments of such intellectual integrity.

SEA Directive

The SEA Directive (2001/42/EC) came into force in 2001 and makes assessment mandatory for a wide range of public plans and programmes – for example, on land use, transport, energy, waste and agriculture. It was transposed into domestic legislation by the Environmental Assessment Plans and Programmes Regulations 2004.

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Lessons from the death zone

It was the world's worst nuclear disaster, but have we learned enough from Chernobyl? **Becky Allen** reports

The first official announcement of the Chernobyl nuclear disaster was an understatement of epic proportions. "An accident has occurred at the nuclear power plant at Chernobyl, north of Kiev in the Ukraine," said the Soviet council of ministers. "The accident has damaged the atomic reactor; there were some casualties." The statement confirmed what some already knew: that somewhere in the northern hemisphere a massive radiation leak had occurred. In the afternoon of Sunday 27 April 1986, more than 24 hours before the Soviet announcement, the Swedish National Defence Research Institute recorded a marked rise in radiation over Stockholm.

Registering similar readings next morning, Forsmark nuclear power station, 100km north of the Swedish capital Stockholm, declared a yellow alert, shut down the reactor and evacuated the plant. Within hours, high levels of atmospheric radiation were reported across Denmark, Finland and Norway.

The causes of the Chernobyl disaster can be traced to the night of 25 April. Engineers at the plant's number four reactor were conducting an experiment to find out how well the cooling pump system would work if the auxiliary electricity supply failed. Despite struggling to stabilise the reactor under the low power conditions they had created for the experiment the engineers continued with the tests. At 1.23am on the morning of 26 April – with the reactor's automatic shutdown systems intentionally disabled – power levels surged and the reactor overheated.

At 1.24am, after attempts to control the reactor failed, two explosions blew off the reactor's roof and released its contents. As air was sucked in, it ignited and began to burn. The blast killed one worker, pump operator Valeri Khodemchuk; a second, Vladimir Shashenok, died later in hospital having been doused in boiling water and radioactive steam from burst pipes.

The Chernobyl plant will be entombed in concrete

As firefighters tried to control the blaze, which burned for nine days, helicopters piloted by veterans of the Afghan war negotiated pylons and the reactor chimney to dump thousands of tonnes of sand, clay, boron carbide and lead on to the reactor. Three kilometres away, the town of Pripyat was evacuated of its 40,000 residents.

Some estimates put the amount of radiation released from Chernobyl at 100 times more than the atomic bombs dropped on Hiroshima and Nagasaki at the end of the second world war. Among the radioactive gases and particles released by the blast were caesium-131, caesium-137, strontium-90, plutonium-238 and americium-241. Caesium-137, which has a half-life of 30 years, is still measurable in the soil and food in many parts of Europe.

European fallout

In 2006, a report by UN agencies said that 518,000km^2 of Europe had been blanketed with radioactive fallout and that five million people were exposed – and 100,000 remained exposed – to radiation from their food and the environment.

Thousands of emergency and recovery workers or "liquidators" involved in the cleanup in 1986 and 1987 received radiation doses of more than 100 millisieverts (mSv) – 50 times the radiation the average human is exposed to over a year (2mSv) and the level at which long-term cancer risks increase. A further 270,000 people in the severely contaminated zone received doses upwards of 50mSv. According to estimates from the World Health Organisation (WHO), five million residents in low-contamination zones around Chernobyl received radiation doses of 10–20mSv in the 20 years from 1986.

More controversial – and contested – have been figures on the health effects of Chernobyl. The impact on those most heavily exposed is most certain. According to UNSCEAR, the UN scientific committee on the effects of atomic radiation, of the 600 people working at the plant on the day of the disaster 134 suffered radiation sickness; 28 died within three months and a further 19 between 1987 and 2004.

Outside the plant, the clearest evidence of Chernobyl's health impacts is damage to the thyroid gland, which absorbs radioactive iodine. By 2006, more than 6,000 cases of thyroid cancer had been diagnosed in those who were children at the time of the disaster. Although only nine have died, experts agree thyroid cancer rates will continue to increase. While levels of leukaemia do not appear to have risen in the general population, the WHO says: "Recent investigations suggest a doubling of the incidence of leukaemia among the most highly exposed Chernobyl liquidators."

A major report issued jointly in 2006 by the WHO, the UN development programme and the International Atomic Energy Agency (IAEA) predicted that Chernobyl would eventually claim 9,000 lives – 4,000 among the three most exposed groups and 5,000 among the five million people who live Belarus, parts of the Russian Federation and Ukraine. About 45% of the caesium released by the explosion was deposited in states of the former USSR. Belarus was most affected with more than 23% of its land contaminated. Greenpeace and other anti-nuclear groups claim the final death toll will be significantly higher than 9,000.

Chernobyl's environmental and associated economic effects are less controversial. Agriculture and forestry in the region were hard hit: some 784,320 ha of farmland were taken out of cultivation and timber production was halted in 694,200 ha of forest.

Restrictions were imposed on hunting and farming in many parts of Europe. High levels of caesium-contamination were found in reindeer in the Arctic and sub-Arctic areas of Finland, Norway, Russia and Sweden, and in fish from German and Scandinavian lakes. The second Chernobyl forum report concluded that the water and fish in lakes with no outflowing streams, such as the Kozhanovskoe in Russia, would remain contaminated with caesium-137 for decades.

The German government paid $550,000 in 2009 to hunters whose wild boar meat was too contaminated to sell; in some areas radiation in the meat was more than 11 times the safe limit. And in the UK, more than four million sheep on 9,800 farms were placed under restrictions, the last of which were lifted only in 2012.

Wildlife haven?

The disaster also had consequences for wildlife. Some claim that flora and fauna are thriving in the exclusion zone around the reactor; that there are more wolves, lynx, przewalski's horses, elk, wild boar, deer, eagles and bats than before the disaster. Others disagree, aying that wildlife numbers are increasing simply because there is so little pressure from human activity in the area, and that radiation is having a significant effect on the local environment.

Dr Anders Moller, of the University Paris-Sud, and Professor Tim Mousseau, of the University of South Carolina, have spent the past 15 years studying the long-term ecological effects of the Chernobyl disaster, and found evidence of genetic damage in more than 20 species. One of those studied, the barn swallow, seems particularly sensitive to radiation. "We know that they consume much of their antioxidant reserve during the period of migration, so when they arrive back in Chernobyl they seem to be particularly sensitive to contaminants," explains Mousseau.

Like the debate over the human health impacts of the disaster, discussion over its ecological effects reflect the fact that too little research has been done at Chernobyl

Nuclear meltdown

On 11 March 2011, a major earthquake off the north-eastern coast of Japan triggered a 15m high tsunami, which disabled the power supply and cooling facilities of three reactors at the Fukushima Daiichi nuclear power plant. All three cores largely melted in days immediately after the tsunami hit, while a fourth unit, which had not been operating at the time of the flooding, later became a problem. Two further units were unaffected.

The earthquake caused no significant damage to the Daiichi plant, with units 1–3 shutting down automatically, as designed. Emergency, diesel-powered generators in the basement turbine buildings started because the earthquake had damaged external power supplies. The first tsunami wave hit the plant 41 minutes after the earthquake – a second hit eight minutes later – and submerged and damaged the seawater pumps, drowned the diesel generators and inundated the electrical switchgear and batteries.

At 7.03pm on 11 March a nuclear emergency was declared, and the next day the evacuation order for the region, initially been set for within 2km of the plant, was extended to 20km.

According to the World Nuclear Association (WNA), which represents the global nuclear profession, the design for the Daiichi plant was based on a potential tsunami height of 3.1m – a height derived from a 1960 Chilean tsunami. The power station was therefore built 10m above sea level, while the seawater pumps were 4m above the sea. Despite subsequent research indicating that earthquakes in the region had triggered tsunamis much higher than 3.1m, and the design basis being revised in 2002 to 5.7m above sea level, no countermeasures were introduced.

In December 2011, a mid- to long-term decommissioning plan for units 1–4 was agreed by the Tokyo Electric Power Company, which operates the stricken plant, and Japanese authorities. The three-phase plan involves:

- Beginning the process of fuel removal from the spent fuel pools within two years. This process began on 18 November 2013.
- Starting to remove fuel debris – the solidified fuels and claddings that melted – within 10 years.
- In 30–40 years, completing the fuel debris removal and the processing and disposal of radioactive waste.

Nuclear meltdown

At 4am on 28 March 1979, a cooling malfunction caused part of the core to melt in the second of two pressurised water reactors at the Three Mile Island power station near Harrisburg, Pennsylvania, in the US. The reactor, which at the time was almost new, was destroyed and the accident led to a release of some radioactive gas, though not enough to cause any dose above background levels to local residents.

The incident was the result of what the World Nuclear Association describes as a "relatively minor malfunction" in the secondary cooling circuit. This breakdown resulted in the temperature of the primary coolant rising, causing the reactor to shut down automatically. At this point a relief valve failed to close, resulting in much of the primary coolant draining away. As a result, the residual heat in the reactor core was not removed, causing severe damage.

The $973 million cleanup of the damaged nuclear reactor started in August 1979 and ended in December 1993. In 1991, measurements of the fuel remaining in inaccessible parts of the reactor vessel revealed that around 1% remained. The other reactor at Three Mile Island was restarted in 1985 and continues to generate electricity.

since 1986. "Despite the accident happening 25 years ago, there is a dearth of scientific information available, and what is available often isn't considered if it doesn't fit into a preconceived view of the effects of radiation. We strongly urge scientists to help break this mold," Mousseau told *Geographical* magazine in 2011.

Social and economic disaster

As well as the disaster's health and environmental impact, its social, economic and mental health effects have been "devastating", according to former IAEA director Mohamed ElBaradei. Speaking in 2005, he explained: "More than 100,000 people were immediately evacuated, and the total number of evacuees from contaminated areas eventually reached 350,000. While some of these resettlements were essential to reduce the dose of radiation, the experience was of course deeply traumatic for those involved."

The economic costs are almost impossible to calculate. However, the UN estimates at hundreds of billions of dollars the cost of direct damage, recovery and mitigation, resettlement of evacuees, social and health care, research, monitoring and loss of agriculture and forestry, as well as the cancellation of Belarus's nuclear power programme.

A major ongoing cost is the construction of a shelter to replace the hastily-built concrete sarcophagus covering reactor four, which is now crumbling. The gigantic new concrete shield – 110m high and weighing 29,000 tonnes – will cost $2 billion and is being funded by 24 nations and the EU. Designed to last 100 years and scheduled for completion in 2015, the structure is being built onsite and will be placed over the existing sarcophagus. The long-term plan is to clean up the site by 2065, almost 80 years after the disaster.

Lessons from Chernobyl

As the world's worst nuclear disaster, Chernobyl had a major impact on international radiation standards, nuclear safety, emergency response and mitigation procedures. It also affected public and government attitudes towards the industry. According to ElBaradei: "The accident at Three Mile Island [see panel, left] had already cast doubt on the ability of nuclear power plant operators to prevent severe accidents. Chernobyl had far greater impact; the accident imprinted itself on public consciousness as proof that nuclear safety was an oxymoron.

"Some countries decided to reduce or terminate further construction of nuclear facilities, and the expansion of nuclear capacity came to a near standstill. It took nearly two decades of strong safety performance to repair the industry's reputation."

The Fukushima disaster (panel, p.17) in 2011 put the industry under the microscope again, with Germany deciding to phase out nuclear power altogether.

ElBaradei believes Chernobyl's greatest legacy lies in the multilateral approach now taken to such disasters. He describes the1986 disaster as "a defining moment" in the history of nuclear energy, adding: "The lessons are interwoven with a recurrent theme: namely the importance of international cooperation." Chernobyl revealed a sharp disparity in nuclear design and operational safety standards, and reminded everyone that nuclear risks transcend national borders. "Since [1986], international cooperation has become a hallmark of nuclear safety, [resulting in] a body of globally recognised IAEA safety standards," ElBaradei says. "One of the few positive aspects of Chernobyl's legacy is today's nuclear safety regime."

But at the time of the disaster, the international community failed. "It was the lack of coordination of international efforts in the months and years that followed the Chernobyl accident that helped exacerbate the social effects of the disaster," ElBaradei argues.

Others warn that vital lessons have not been learned because too little research has been done into Chernobyl's long-term health and ecological effects. Dr Keith Baverstock, a former health and radiation adviser to the WHO, argues that research has been frustrated by pro- and anti-nuclear campaigners, who have turned debate over Chernobyl's impact into a battleground. As a result, he says, governments and organisations, such as the IAEA, have missed lessons about responding to nuclear emergencies and communicating with the public.

"[Lobby groups] seek to interpret the effects or absence of effects to their own advantage and are apparently unwilling to find the truth," he told the *British Medical Journal*. "Apart from exacerbating the psychosocial effects on those directly affected, this situation has prevented a comprehensive evaluation of the importance of the event to public health."

Becky Allen is a health, safety and environment journalist.

Recycling CO_2

Julian Jackson discovers alternatives to capturing and storing carbon emissions

There is an obvious problem with human-caused emissions of carbon dioxide in that the chemical compound is a major contributor to the heating of the Earth's atmosphere. That said, this colourless, odourless gas is also quite useful. For years it has been suggested that CO_2 and other pollutants should be "scrubbed" from power station chimneys and pumped into depleted oil wells, such as those in the North Sea. But there are problems with the concept of carbon capture and storage (CCS), notably that it is expensive and energy intensive – it takes energy to power the CCS process, therefore you need to generate more energy to keep it going, which results in more emissions. There is also the risk that the CO_2 might leak out of the oil wells.

Although a lot of money and effort has been put into CCS research it looks unlikely to be a major part of any solution for greenhouse-gas (GHG) emissions at present. According to Peter Styring, professor of chemical engineering and chemistry at the University of Sheffield: "The rate at which CCS projects are currently deployed and the emissions reductions they achieve may be insufficient to reach the 80% reduction in global carbon emissions required by 2050."

However, quietly in the background, scientists and engineers have been working on a different approach: capture the CO_2 and use it as a feedstock. Carbon dioxide is an extremely useful chemical that is vital for the survival of plants, for example. Various scientific projects are developing processes that use CO_2 to create durable objects, which include building materials, polyurethane foam and other plastics, as well as synthetic fuels, which can substitute for petrol or diesel.

The sky's the landfill

The simplest way to think of this use of carbon dioxide is to envisage it as a form of recycling. Instead of recycling solid objects into something new in place of putting them in landfill, such projects recycle carbon dioxide gas, using it productively, instead of sending it into the great landfill in the sky. Putting carbon into building blocks, for example, fixes the gas so it won't go into the atmosphere for a long time, if ever, and renders the product as a valuable building material instead of expensive waste.

One reason that capturing CO_2 and using it productively has not had more exposure is a lack of agreement on what to call it. Terms include: carbon dioxide utilisation (CDU); carbon capture and utilisation (CCU); and carbon capture, utilisation and storage (CCUS – the term favoured by the US department of energy). Whatever the name, using CO_2 in this way is opening a new industrial frontier where the UK and some other countries including Germany are creating novel, financially viable products.

Norwegian risk-management business DNV calculates that the carbon utilisation technologies have, between them, the potential to reduce CO_2 emissions by at least 3.7 gigatonnes a year (Gt/y) – approximately 10% of annual global carbon emissions – either directly or by reducing use of fossil fuels. It also predicts that much greater reductions are possible if the technologies are adopted more widely.

Using CO_2 can help to reduce the UK's dependence on fossil fuels by creating valuable chemicals, fuels and other products, according to the 2011 report *Carbon capture and utilisation in the green economy*, written by Styring and Daan Jensen at ECN, the energy research centre in the Netherlands.

> Research indicates that carbon utilisation technologies could reduce CO_2 emissions by at least 3.7 gigatonnes per year

Researchers at Newcastle University calculated that a CCU plant creating mineral carbonates had a payback time of less than two years and could generate profits in excess of £1.4 billion over 15 years if the carbonates continued to be sold at current market prices. So there are potentially significant financial rewards for the economies that adopt such technologies, in addition to emissions reductions.

Fuelling change?

Several British startups are pushing forward CDU technologies and have created innovative products. One is Air Fuel Synthesis (AFS), which has developed a method of turning carbon dioxide and hydrogen in water into a "sustainable" fuel.

The Darlington-based company uses renewable energy to do what nature does with photosynthesis and geological time: make carbon dioxide into oil. The firm uses electricity to convert carbon dioxide and water into synthetic hydrocarbon liquids from which sustainable fuels or other oil-based products can be made. The fuels it has created include petrol, diesel and aviation kerosene. The creation of alternative fuels obviously does not remove carbon dioxide from the

air permanently, but it is recycling it, so the product is deemed carbon-neutral. "Our main raw material is electricity," explains AFS chief executive Peter Harrison. "When we make petrol from ethanol the process generates heat, so we are working on utilising that heat to power earlier stages of the process."

AFS is focused on making their process a fully functional commercial product without the need for subsidy. Harrison, however, is cautious about the amount of hydrogen that would be needed for industrial scale production, emphasising that it is a new sector and that the supply chain is incomplete.

Carbon8 takes pure CO_2 from a sugar beet factory and captures it in a building block, eliminating waste and removing emissions

Another example of CDU is the "carbon buster" building block from Lignacite. The block, made from 50% recycled material, includes aggregate created by new company Carbon8. The firm, which is based in Chatham, Kent, next to a Lignacite plant, uses carbon dioxide to manufacture pellets of aggregate from waste by combining CO_2 with ashes from industrial incinerators and water. The so-called "accelerated carbonation" technology converts the CO_2 gas into calcium carbonate, a solid material. Carbon8 takes the pure CO_2 output from a sugar beet factory and captures it in the new construction material, eliminating waste from landfill and removing carbon that would normally go into the atmosphere.

This approach creates a triple revenue stream: the sugar beet factory saves on landfill tax; Carbon8 receives a gate fee for handling hazardous wastes; and the blocks made by Lignacite are sold to builders, replacing GHG-emitting ones.

"Carbon8 aggregates have taken a technology developed in a university laboratory through to commercial reality," says the firm's managing director, Dr Paula Carey. "We use accelerated carbonation to produce the world's only carbon-negative aggregate, which in turn is used to manufacture the world's first carbon-negative concrete block."

A third example of CDU technology in the UK is the mineral carbonation process developed by Cambridge Carbon Capture (CCC). The process bonds carbon dioxide molecules to mineral silicates to produce zero-carbon lime and magnesia, and sequesters CO_2 safely.

"Our process reacts directly with power station flue gases and converts them into geologically stable solids," explains CCC founder and chief technology officer Michael Priestnall. The company claims that its electrochemical process releases 15% more energy than it uses, making it potentially a huge leap forward. CCC uses a magnesium silicate called olivine, which is present in the Earth's crust in huge quantities, to capture the carbon. CCC plans to extract residual metals from the waste to provide another income stream. It is also exploring using the process to remove emissions from ships in partnership with exploration company Polarcus, which carries out marine seismic surveys around the world and is aiming to develop a fleet of the greenest vessels on the planet.

Meanwhile, German chemical giant Bayer is also developing ways to recycle carbon dioxide. Dr Tony Van Osselaer, head of industrial operations at Bayer Material Science, says: "Carbon dioxide is too precious to simply let it escape into the atmosphere. We aim to turn this waste gas into a useful and profitable raw material. This makes us a front-runner for an entirely different approach to the production of high-quality foams."

Bayer has already produced a polyurethane foam that incorporates CO_2 for use in mattresses. The foam performs as well in tests as fossil-fuel derived materials, and could have many other applications, including in cars, furniture and as insulation.

In 2010, Bayer launched CO2RRECT, a programme aimed at using surplus renewable energy to produce hydrogen from water by electrolysis. The gas is then combined with CO_2 and used as a feedstock in chemical production. The German federal ministry of education and research is backing the study with €118 million of funding. It is an exciting project in many ways – for example, by using excess renewable energy that cannot be stored when more is produced than needed – but Bayer admits that it is "blue sky" research at the moment and concrete results are not expected before 2020.

Another interesting CDU application currently at the laboratory stage is the production of microalgae for biofuels. Using flue gases from power plants as a nutrient supply and CO_2 source, the cultivation of microalgae in open ponds or photobioreactors could directly capture and use carbon dioxide. Australian firm Algae Tec and the country's largest electricity generator Macquarie Generation agreed a deal last year to construct an "algae carbon capture and biofuels" production facility next to a coal-fired power station near Sydney. The station will feed waste CO_2 into an enclosed algae growth system.

Early days

CDU is a largely nascent technology that could be part of the solution to reducing carbon emissions. There are many difficulties on the road from the laboratory to industrial production, but saving 10% of global GHG emissions is a goal worth aiming for, and there are the additional benefits of creating a new, high-tech industry. "It's like solar power," says Priestnall at CCC. "[CDU] is a distributed, modular technology that you can deploy, make profit from and go through the learning curve at small scale, and then expand the operation while bringing down costs."

The success of carbon dioxide recycling will largely depend on governments following Germany's example and providing funds for research and development.

"The UK government needs to invest in research and development for carbon capture and utilisation, and investors need to be made aware of the potential benefits of the technology so that barriers can be brought down," argues Styring.

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Nature's marketplace

Payments for ecosystem services will produce environmental benefits, argues **Mark Everard**

The deep interdependencies that exist in the natural world between life forms in complex food webs, the climate system and the biogeochemical cycles that make life possible have arisen not by chance but through billions of years of coevolution.

Humanity is no different from any other coevolved species in terms of its interdependence with nature. Yet, the ways humans have used their capacity for innovation to modify and appropriate natural resources for their own ends have stepped beyond the regenerative capacities of the biosphere. And unless we wish to see increasing conflict and declining human potential, our onward evolution has to become a consciously guided process. This is, of course, what sustainable development is all about, but framing it this way adds context and urgency to the easily spoken, if hard-to-realise, mantra of achieving integrated social, environmental and economic progress.

Economic evolution

Contemporary markets are still substantially shaped by the industrial revolution view that progress is synonymous with net wealth creation. At that time, the global population was much lower and there was a perception that nature's capacity to supply resources and assimilate waste was boundless. It is true that laws, subsidies and taxes, as well as shifting values and attitudes, have progressively bound the freedoms of the essentially amoral market. Yet most regulations, for example, act retrospectively on decisions that have already been made and address relatively narrow issues, such as control of specific pollutants, infringements of selected human rights, or impacts on particular habitats or communities.

The rise of frameworks for action, particularly the concept of ecosystem services, has opened our eyes to the need for systemic reform of norms and practices. Perpetuation of yesterday's economic paradigm based on narrow endpoints, such as contribution to GDP, merely reinforces a blinkered view of the wider ramifications of policies and activities on ecosystem services and their human beneficiaries. For example, evaluating the benefits of a large dam based entirely on the provision of water to largely privileged urban, agricultural and industrial users may remain commonplace in business plans, yet only tell part of the story of its net value to society. Broader analysis of the implications of large dams on the disruption of water flows, sediment, nutrients and organisms, and the drowning or erosion of culturally valued and livelihood-sustaining habitats and landscapes, paints a very different picture that raises questions about equity and net economic benefit when all losses and gains are set on the ledger.

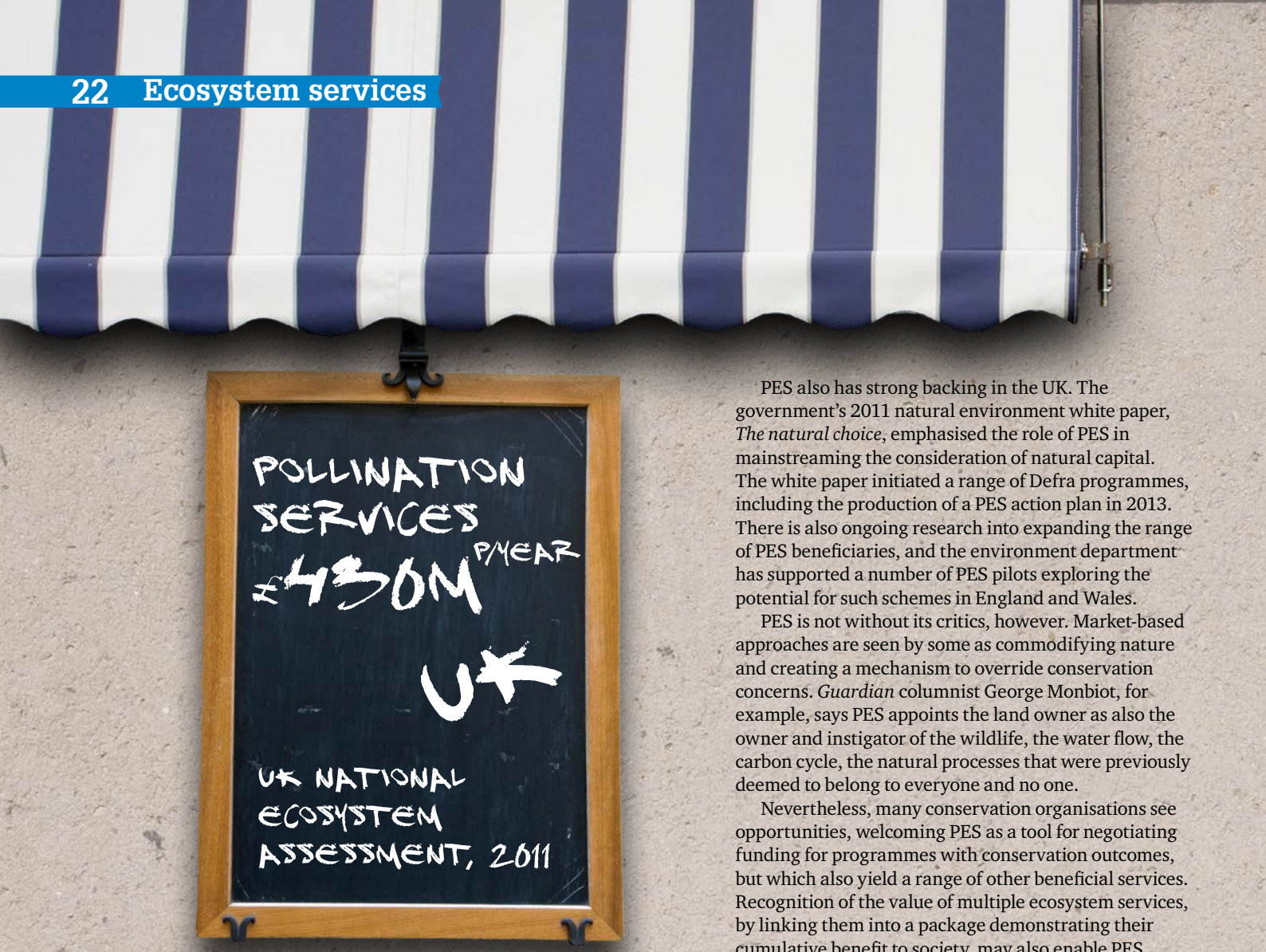
The evolution of economic tools to incorporate the value of natural capital is an absolute necessity if truly sustainable development is to be achieved.

Valuing natural services

Payments for ecosystem services (PES) is an emerging market-based approach with a role to play in bringing into the economy some of the beneficial services of nature that have for too long been overlooked and, as a consequence, often been degraded. Put simply, those whose activities can affect the supply of an ecosystem service may be seen as "providers", while those who benefit from the service are "buyers". This enables trade to be established, generally through some form of broker, whereby buyers pay providers to manage ecosystems to protect or enhance the desired service.

PES projects have a long history in developed countries, dating back to agri-environment schemes in the late 1960s and 1970s in the US, and the early 1980s in the EU. Some of the most obvious and long-established PES markets based on payments by water companies to subsidise or compensate land owners for changing how they manage farmland. Such payments help to protect or improve the quality of water that flows through nearby waterways, which means it is cheaper to clean at downstream abstraction points.

A classic, effective and government-sanctioned example is the "upstream thinking" programme in southwest England, through which a proportion of revenue from water bills is recycled as farm management subsidies by the local utility company, South West Water (SWW). This payment is brokered by the Westcountry Rivers Trust (WRT), which works with farms scattered across water catchment areas in an integrated way to help save the utility company money. For example, the scheme is helping farm businesses to:



- curtail inappropriate agrochemical use;
- partition clean roof water from dirty yard water;
- introduce effective wastewater treatment and slurry management options;
- establish "buffer zones" around wetlands and streams to help reduce stock disease, loss and straying; and
- install a range of other beneficial measures that are simultaneously advantageous to river health.

Upstream thinking is part of an ongoing partnership between WRT and SWW. It gained government consent under the 2010–15 water industry investment cycle and is expected to generate a 65:1 benefit-to-cost ratio, based on savings in water treatment.

PES has strong support internationally. In 2010, the OECD estimated there were already more than 300 PES or "PES-like" schemes in operation globally, including schemes linked to water supply, carbon sequestration and biodiversity conservation. Interest in PES has since increased substantially. A 2013 study identified 457 published peer-reviewed papers on PES.

REDD+, the UN programme aimed at reducing emissions from deforestation and forest degradation in developing countries, is a truly international PES-based market in which richer nations, which have benefited disproportionately in the past from exploitation of carbon-rich energy sources, can pay for retaining carbon sequestered in forest habitats in emerging nations. This provides developing countries with revenue for the conservation of forests, as well as the rich biodiversity and ecosystems services they contain.

PES also has strong backing in the UK. The government's 2011 natural environment white paper, *The natural choice*, emphasised the role of PES in mainstreaming the consideration of natural capital. The white paper initiated a range of Defra programmes, including the production of a PES action plan in 2013. There is also ongoing research into expanding the range of PES beneficiaries, and the environment department has supported a number of PES pilots exploring the potential for such schemes in England and Wales.

PES is not without its critics, however. Market-based approaches are seen by some as commodifying nature and creating a mechanism to override conservation concerns. *Guardian* columnist George Monbiot, for example, says PES appoints the land owner as also the owner and instigator of the wildlife, the water flow, the carbon cycle, the natural processes that were previously deemed to belong to everyone and no one.

Nevertheless, many conservation organisations see opportunities, welcoming PES as a tool for negotiating funding for programmes with conservation outcomes, but which also yield a range of other beneficial services. Recognition of the value of multiple ecosystem services, by linking them into a package demonstrating their cumulative benefit to society, may also enable PES to be used to drive more sustainable management, demonstrating and expanding net public value arising from existing subsidy and investment mechanisms.

Perhaps the most compelling argument in favour of PES, and other mechanisms valuing the services of nature, is that in the absence of valuation the default value in decision making is precisely zero.

Although it may be uncomfortable for some environmentalists to go beyond arguments about the inherent value of nature, a preservationist approach has clearly failed. This is often seen in media outrage about how "a few newts" have halted a prestigious development or, more commonly, that "all this special pleading would be nice if it didn't halt real development". Recognising newts, other organisms, their habitats and the services they provide as beneficial to economic activities, health and wellbeing presents a far more compelling case for action.

Paying for supporting services

Early implementation of PES has opened up markets for a range of services. However, the primary purpose of the ecosystem services framework is not to cherry-pick additional benefits provided by nature. This would simply replicate the errors of the past in that it would overlook implications for the wider spectrum of connected services, associated beneficiaries and supporting ecosystems. Rather, it recognises that ecosystems services are, as the name suggests, a system of interconnections. Further evolution of the PES agenda has to be mindful of the multiplicity of benefits, which are protected, enhanced or degraded as

a result of human activities. It is particularly important to be mindful of supporting services, which include processes that cycle nutrients, form soil, regenerate habitat and otherwise maintain the viability and resilience of ecosystems to provide benefits. An ecosystem approach must aim to optimise net benefit across all services and their beneficiaries, rather than maximising one or a few services at the cost of others, such as the consequential damage wrought by dredging for floodwater conveyance.

Acting at the ecosystem scale is challenging for markets and governance arrangements because they are still mainly focused on narrow interests. Take, for example, a traditional five-year farmland lease under which the tenant has every incentive to maximise crop or grazing yield and none to prevent long-term erosion, or protect the fertility and viability of the soil. Parallels can be drawn with unconstrained opencast mining, which disrupts water flows, releases sequestered carbon, damages landscapes and wildlife, and reduces the net benefit of the habitat to society and the value of the asset to its owner. Even a PES-driven approach has the potential to "mine" ecosystems for a single service if broader ecosystem-wide considerations are not factored into its design. Multi-tier PES considerations must, therefore, be brought to the fore and could involve:

- **bundling** – a single buyer, or consortium of buyers, pays for the full package of ecosystem services;
- **layering** – multiple buyers pay separately for discrete ecosystem services; or
- **piggy-backing** – one or a few ecosystem services are sold, while the benefits provided by other services accrue to users free of charge.

Progressive examples of PES around the world are beginning to use the language of "environmental services", recognising that all services, or at least a significant core of them, such as biodiversity, water quality and carbon storage, can be maintained through common management practices. This is increasingly seen in tropical forest conservation where a key "anchor" service, for example water quality, is paid for as a basis for the conservation of forested uplands, achieving many additional ecosystem service benefits. The upstream thinking example in southwest England is similar, with SWW having a primary interest in water supply, yet measures brokered by WRT encourage land use practices that are equally beneficial to fish health, biodiversity, regional character, ecotourism value and farm viability.

What PES can and cannot do

PES is a useful new tool to bring more ecosystems services into markets. It is no panacea, however. It does not replace statutory regulation protecting the environment – rigorous enforcement of which is necessary to ensure obligations are met – since PES is inherently a voluntary market approach over and above that baseline. A more cynical – but perhaps accurate – view is that PES is a "sticking plaster" for more profound market failure, introducing new elements for consideration as we move towards a market that genuinely integrates economic progress with protection or enhancement of ecosystems essential for social wellbeing. As the tenant farmer example demonstrates, the market itself has to evolve radically to ensure that land managers and other players in society are rewarded for their contributions to multiple services, or constrained from damaging them.

PES has a role to play not merely in securing the narrow interests of buyers and sellers in ecosystem services-based markets, but as a potential path towards a new economic paradigm. In particular, PES provides a mechanism through which fragmented policy areas, and their ring fenced budgets, can be combined to invest in ecosystem protection or restoration. Policymakers increasingly recognise, for example, that green infrastructure techniques can offer a range of benefits simultaneously, including: enhanced drainage; more green spaces for nature and recreation; mitigation of noise pollution and visual blight; reductions in airborne pollutants with substantial public health benefits; and enhanced aesthetics, all of which increase real estate values.

PES may provide an opportunity to combine management and financial resources to achieve greater cumulative benefits by optimising ecosystem services outcomes through cheaper, low-input solutions. PES may also become a powerful mechanism to accelerate the necessary integration of traditionally "siloed" interests, helping shift cultural norms so that the scythe of natural selection will sweep less harshly on our pathway to a sustainable future.

Dr Mark Everard is associate professor of ecosystem services at the University of the West of England and an author.

Resetting climate

Injecting sulphuric acid into the stratosphere could should humanity take that step? Academics

Scientific evidence suggests that we could reduce some of the effects of the accumulation of greenhouse-gases (GHGs) in the atmosphere by adding particles of sulphur into the stratosphere. Such a move would, similar to the impact of volcanic eruptions, increase the Earth's reflectivity, deflecting more of the sun's rays and resulting in a cooling that has the potential to restore the climate, in most places, to that of pre-industrial times.

We could, for example, roughly halve the rate of manmade climate change by the end of 2070 if we begin introducing sulphuric acid into the stratosphere in small amounts in 2020, and slowly increase the amount over the next 50 years. In 2070, we would be putting close to 1 million tonnes of sulphur into the stratosphere a year, which equates to just 2% of the sulphur currently in the lower atmosphere caused by burning fossil fuels. The next step would be to decrease injections of sulphur down to zero over the following 50 years.

Taking such action would considerably slow climate change, giving us more time to adapt, as well as reduce the impact of climate change during that time – decreasing risk of crop failures, for example. Currently, the whole of our built infrastructure is designed to sustain industries that emit carbon dioxide and CO_2 has a very long footprint; if we halted global emissions today, CO_2 already in the atmosphere would continue to have an impact on our climate in 1,000 years. It's not possible for us to magically make the CO_2 problem go away.

Climate engineering is not a new idea; it's been around since the 1960s. But a taboo emerged around it because of a fear that it would lessen efforts to cut GHG emissions. That fear was well founded, but the consequences of climate change are too severe and what we know about this technology is promising enough that it is worth studying and discussing.

I'm not advocating we begin sulphur injection tomorrow – we don't know enough – but we do have sufficient knowledge to start debating its use and officials from governments, including those from the UK, the US, India and China are engaging with the subject.

A fundamental misconception about sulphur injection is that if you start you must do it forever and that it will increase the acidity of the oceans. This perspective assumes that we are going to use this technology as a substitute for cutting emissions, but this is completely implausible. No credible expert believes we can keep emitting CO_2 forever and use geoengineering technologies as a way to offset the impact.

With regards to the effect on the oceans, putting sulphuric acid into the stratosphere essentially does nothing directly to alter the acidity of seas. There is, however, a direct link between adding CO_2 to the atmosphere and acidification. The connection between sulphur injection and acidification is made only if we adopt a policy for using the technology while continuing to put more carbon into the atmosphere.

Another crucial misconception is to do with certainty; that while we can assess specific risks in subscale tests, we cannot test the technology at full scale. It's true that we can never know precisely how pumping sulphuric acid into the atmosphere will work, but neither can we predict the exact climate response of human-caused CO_2 emissions. Carbon is one of many things in our atmosphere that are changing the climate, so it is impossible to tell exactly what change was caused by CO_2 in the recent decades, and the same would be true if we undertook geoengineering.

The most difficult issue, however, is not the science or technology, which is available and relatively cheap, but about how we govern it. How do we build international consensus on how to study, develop and, potentially, manage sulphur injection technologies? If there is no global coordination, and different countries take different approaches, the consequences could be horrific. There's no magic answer, but that remains true of many other new technologies. We urgently need to be thinking of how to build institutions that are capable of making rational decisions about it.

David Keith is Gordon McKay professor of applied physics at the Harvard School of Engineering and Applied Sciences.

manmade change

Image: REX/Solent News

help to counter the effects of global warming, but **David Keith** and **Mike Hulme** debate

Solar climate engineering, through sulphate technologies, is not an effective way of reducing future climate-related loss and damage for two main reasons. First, is that the welfare "bads" we're trying to minimise – crop failures due to drought and damages caused by sea surges, for example – relate predominantly to regional and local weather, and these are poorly correlated to global temperatures.

Using solar climate engineering to create a global thermostat may allow us to reduce average temperatures worldwide and compensate, in part, for local heat accumulation caused by GHGs, but these globally averaged quantities are not what cause climate-related loss and damage. It is regional and local weather that does this – from droughts in the US to floods in Pakistan.

Any call to implement climate engineering to reduce the risks of GHG-fuelled global warming must establish what I call the "core claim". Advocates must be able to convince all interested parties that the weather damages of a natural + GHGs + solar-engineered climate will be substantially less than those caused by a natural + GHGs climate. This presents a significant challenge and one that distinguishes solar climate engineering from other forms of manipulative technology, such as pharmaceuticals. In the case of solar climate engineering there is no option that parallels double-blind clinical trials to test a new drug – such claims can only be tested through simulation models. So what do these models that we become dependent on show? Well, that at regional scales, solar climate engineering leads to variable and contrasting changes in local weather, especially rainfall.

Then there is still the question of the veracity of numerical simulation models; are they credible? I've spent nearly half my occupational life assessing climate models' ability to simulate regional and local effects, comparing empirical observations with simulations, and I don't have great faith in their ability to predict rainfall at regional weather scales. In September 2013, an IPCC report concluded: "At regional scales precipitation is not simulated well."

Solar engineering at the weather scales that matter most for people is not a win-win technology. At regional scales the danger is that deploying this technology is like a game of Russian roulette. Climate models will not be able to offer us the accuracy necessary to establish what the consequences of the technology are to human life or to defend against claims of legal liability in relation to local weather events once sulphur is introduced into the stratosphere.

This brings me to my second argument, which is about whose hand will be on the thermostat. Deciding when to implement the thermostat, agreeing what the setting should be and how it should be securely governed, would demand an unprecedented and simply unobtainable degree of trust and cooperation between nations. All of the affected agents need representation in any decisions made and over any regulatory bodies established. After more than 20 years of the UN framework convention on climate change, which can't be described as a roaring success, it's extremely optimistic to expect a novel system of global governance can be invented and sustained over the time necessary for solar climate engineering to be effective. Even more so when we recognise the extra geopolitical antagonism that solar climate engineering would bring about. There will be nations that will claim any damaging weather extreme that has affected their country was caused by sulphur. The potential for liability and counter-liability claims is endless.

The world has banned and heavily regulated some areas of science and technology and I believe there is a similar argument to be made for a ban on solar climate engineering, certainly of field trials. Solar climate engineering opens up a nightmare prospect of politically motivated weather designs and, potentially, legal, economic or even military conflict to the world.

Mike Hulme is professor of climate and culture in the School of Social Science and Public Policy at King's College London.

* The views in this article were presented at a debate on geoengineering hosted by the Institute for Science and Ethics at Oxford Martin School.

Grow your own

Vicky West explains how the woodland carbon code enables companies to offset their emissions

The emerging market in carbon offsets from domestic forests offers companies a way to compensate for their unavoidable greenhouse-gas (GHG) emissions in the UK, while providing other social and environment benefits. Woodlands cover around 12% of the UK's land and act as a natural form of carbon capture. As woodlands grow they sequester, or capture, carbon dioxide and store it as wood and in the soil, releasing oxygen back into the atmosphere.

Tree planting provides a low-cost option for businesses that want to compensate for emissions that also benefit the natural environment and society, as well as support other corporate and social objectives. Such initiatives, for example, provide new habitat for wildlife, sources of timber and opportunities for recreation. In the right place, woodlands can also reduce flooding and improve water quality. Furthermore, there may be opportunities for community engagement or for employees to volunteer and learn something about how forests are managed.

UK woodland carbon units, which are generated by projects verified as meeting the Forestry Commission's woodland carbon code, can be reported against gross emissions, to lower the net figure. Since January 2014, such units have been listed for sale, in advance, on the Markit Environmental Registry.

A quality standard

Backed by the government, the forest industry and carbon market experts, the woodland carbon code is unique in providing UK-based carbon credits. The standard, which launched in 2011, covers the measurement of CO_2 uptake, assurance of sustainable forest management practices, the management of risks and permanence through a "pooled buffer" of carbon credits. The code incorporates similar criteria to other leading international standards on carbon sequestration, covering assessing the baseline, leakage and permanence of the benefits delivered. The code is robust, consistent and transparent, while ensuring that the bureaucratic burden is minimised.

To provide buyers of carbon units with reassurance, projects must be certified by an independent body approved by the UK Accreditation Service. Two companies – Scottish Food Quality Certification and SGS – currently perform this role, initially validating projects to assess intentions at the outset, and subsequently verifying them at regular intervals to confirm the number of carbon credits, as well as wider benefits, that have been delivered.

In common with other international carbon standards, the woodland carbon code operates a shared "carbon buffer": each project contributes an amount of unsold carbon units, which can be drawn upon should one particular project suffer any losses. In effect, this provides a guarantee to a buyer that any verified unit they purchase is "permanent", as the buffer can be accessed to provide replacements should any individual project subsequently lose a significant number of trees – for example, due to disease or windthrow (trees uprooted or damaged by wind). The buffer is aimed at providing buyers with extra confidence when purchasing carbon units.

Buying units

The launch of the woodland carbon code on the Markit Environmental Registry – which enables organisations to track projects offering carbon, water and biodiversity offsets, as well as issue, trade and retire credits – provides greater transparency on when carbon credits are sold, transferred, reported and retired. Project developers and buyers have accounts on the registry containing details of the units they own.

There are two types of carbon unit available from projects certified by the woodland carbon code, and these reflect the long-term nature of woodland growth:

- **The woodland carbon unit (WCU)** is a tonne of CO_2 that has been sequestered in a woodland.

Ministry of Defence

In 2011, the Ministry of Defence (MoD) embarked on a pilot project with the Woodland Trust to develop new woodland at its Warcop training area in the Eden Valley in Cumbria. The project aims to provide the MoD with enhanced training facilities and to capture carbon. It was financed through the sale of pending issuance units to corporate organisations and a contribution from North Pennines Area of Oustanding Natural Beauty Partnership. The project has seen 160 hectares of grassland planted with a combination of ash, rowan, oak and other broadleaf trees, which will sequester more than 90,000 tonnes of CO_2 over 100 years.

The new woodland will also offer valuable sanctuary to species such as black grouse, and will increase the ability of the site to reduce the severity of local floods, as well as stabilise soils. The project provided an opportunity to engage the local community, with hundreds of hours of volunteer work donated. In the longer term, there may be opportunities for harvesting wood for fuel, which will help to further reduce CO_2 emissions from fossil fuels. David Olney, at the defence estates, said: "This excellent initiative allows us to improve training facilities, while securing significant conservation and environmental benefits at no extra cost."

It has been verified to guarantee that the carbon has been sequestered and can be used to report against an organisation's emissions as soon as it is purchased. Purchasing a WCU could, however, be more expensive than buying credits in advance.

- **The pending issuance unit (PIU)** is a "promise to deliver" a WCU during a given period. It is not "guaranteed" and cannot be used to report against your emissions until verified. A PIU does, however, give the buyer the chance to purchase advance credits in a world where carbon reduction is set to become even more important than it is now.

Every 10 years, projects are verified to ensure that the predicted carbon has in fact, been locked up, and at that point the PIUs delivered are converted to WCUs. PIUs are available from a growing number of projects, and some have already been sold. The first verified WCUs will be available in 2016.

There is a £400 one-off setup cost for corporate buyers – £200 for charities or businesses with fewer than 10 employees – to create an account on the Markit Environmental Registry, but once an account is created it can hold units from any number of projects.

Reporting sequestration

Defra's environmental reporting guidelines (lexisurl.com/iema17477) set out three ways in which a company can compensate for its gross GHG emissions: buying international carbon credits; buying domestic WCUs; or by generating renewable energy that is exported to the grid or to a third party. The UK's largest listed companies are now required to report gross GHG emissions in their annual reports, but whether a company reports on a mandatory or voluntary basis, using WCUs to help account for unavoidable gross emissions is an increasingly attractive option.

Whatever method is used to compensate for gross emissions, the reporting of carbon credits must be "ex post" – that is, after the emissions have been saved. In the case of woodland carbon, this matches the time profile of tree growth, so only verified WCUs, not PIUs, can be reported. PAS 2060, the specification on carbon neutrality from the British Standards Institute, is currently under review. The revised version is likely to clarify the use of WCUs in claims of carbon neutrality.

In practice

By 31 December 2013, 192 woodland projects had registered under the woodland carbon code. These projects cover more than 15,000 hectares of new woodland in the UK. Although planting has so far focused on native species, the new woods are diverse in structure, scale and location, and are predicted to sequester more than 5.6 million tonnes of carbon over the next 50–100 years. Around one-third of current projects have already been validated and will sequester more than 1.1 million tonnes of CO_2.

Twenty-eight organisations, including Marks & Spencer and the Green Investment Bank, have already purchased PIUs to use at a later date.

Like other commodities, the price of a carbon unit varies with supply and demand. The average global price of woodland carbon credits is currently about £6 per tonne of CO_2. However, there is a significant variation in price, with the cost depending on the nature of the project and the extra social and environmental benefits provided. In advance, the woodland carbon code's PIUs are being sold at up to £15 per tonne of CO_2.

Firms usually buy woodland carbon code credits to compensate for CO_2 emissions, although some credits are being banked in anticipation of higher prices in future. In general, companies have been attracted to the code by its strong environmental and social governance processes, which provide confidence that projects will not only deliver carbon sequestration, but also a range of benefits for nature and local communities.

Dr Vicky West is a climate change analyst at the Forestry Commission. Further information at forestry.gov.uk/carboncode.

Where to buy

Through a specialist carbon company – a list is available at foresty.gov.uk/carboncompanies.

Through the Markit Environmental Registry's request for information platform – contact environmental@markit.com.

Through the UK carbon reporting framework at ukcarbonreporting.org.

By finding a project locally. The Forestry Commission can help locate potential projects.

Case studies

Thorlux Lighting

Manufacturing company Thorlux Lighting wanted to compensate for some of the unavoidable emissions of greenhouse-gases from its production processes, so in 2008 purchased a farm, Cwm Fagor in Monmouthshire. The Worcestershire-based company has since created nearly 30 hectares of native woodland at the site, planting a mix of species, from oak and alder to douglas fir and red cedar. Thorlux Lighting received a woodland grant, but funded the remainder of the planting and management costs itself, meaning that the firm now owns a resource that will sequester more than 15,000 tonnes of CO_2 over the next 100 years.

As well as soaking up carbon, the Cwm Fagor wood will provide new habitat for wildlife and walking links between three isolated ancient semi-natural woodlands, as well as produce timber. Thorlux Lighting also plans to use the site for educational purposes.

Green Insurance Company

The Green Insurance Company joined forces with Forest Carbon Limited in a project to plant 34 hectares of new woodland at Kidburngill Farm near Workington in Cumbria. The insurance firm became involved to satisfy its commitment to lock up the CO_2 equivalent to the annual emissions from the vehicles it insures. The firm provided 35% of the project funding. Planting started in 2010 and the scheme became the first in England to achieve validation under the woodland carbon code. It has planted a mix of oak, alder and ash trees on what was previously heavily grazed pastureland and is predicted to capture nearly 19,000 tonnes of CO_2 over the next century.

Landowner James Osborn, commented: "Our native broadleaf woodland will provide links to adjacent woodlands and a much needed habitat for birds. The choice of tree species reflects this."

The ‘S’ word

Infrastructure business McNicholas is generating staff buy-in by axing the jargon and busting the myths that often surround sustainability

Family-owned infrastructure business McNicholas revamped its sustainability strategy in 2012 so its approach is more robust, yet simpler to make the issue part of day-to-day operations. McNicholas works with the utilities, communications, renewable energy and rail sectors to develop and maintain infrastructure in the UK and Ireland, and gaining buy-in from its 1,600 employees is pivotal to the firm’s sustainability vision. “Changing behaviour at both a corporate and personal level is critical to our success,” explains Emma Ward, sustainability manager at McNicholas.

“First and foremost the strategy has to appeal to the whole workforce, or we will not be able to embed sustainability across the business,” she says. “It is not enough to just have the commitment and leadership of the senior management team – which we have 100%. The strategy has to resonate with the people who bring our contracts to life on the ground, or we will limit our success.”

There are strong push factors influencing McNicholas’s drive to entrench sustainability more deeply in the business. Over its six decades, the company has built a reputation as a trusted and experienced partner in delivering infrastructure services, and its “McNicholas way” represents a quality brand with strong ethical values. Sustainability dovetails seamlessly with this ethos and it has become an established driver in how the company does business.

There is also increasing pressure from the company’s many blue-chip clients to deliver on the sustainability agenda. As Ward comments: “Our clients demand high sustainability standards, with performance in this area accounting for up to 10% of the award evaluation within tenders, so it makes good business sense to get it right.”

A simpler, less formal approach

By publicly referring to its sustainability strategy as “the S word”, McNicholas is setting the tone for how it engages with employees, trying to dispel some of the jargon and myths around the concept. The revision

of the sustainability plan in 2012 was a concerted effort to adopt a simpler and less formal style, with the aim of encouraging buy-in from employees. "We wanted to engage more effectively and transparently with our staff – the lighter, shorter strategy is more accessible, encouraging a wider audience to read it and understand our corporate responsibility ambitions. What sits beneath, however, represents an ever-more rigorous approach to sustainability," says Ward.

McNicholas aims to make "the S word" a normal part of the company's everyday life and conversations. Ward says that for this reason the approach had to be simple, even if some of the regulatory requirements and company processes underlying it are complex.

"Expecting employees to visualise our sustainability goals at the same time as facing demanding operational schedules and meeting customer care requirements would be difficult if sustainability was standalone, so we had to strip the concept back to its simplest meaning to help people see how the jigsaw fits together," she explains.

There are many examples that demonstrate the deepening commitment that McNicholas has to delivering its sustainability agenda, in terms of its achievements and targets. For example, it aims to eliminate all recyclable and reusable waste from landfill by 2016, no mean feat for a company of its size.

McNicholas was one of the first UK companies to achieve certification under CEMARS (the certified emissions management and reduction scheme) and aims to reduce emissions by 20% by 2020 against its 2008/9 baseline year. It also achieved an "excellent" CEEQUAL award for its best practice approach to environment management for its work on the Olympic Park, and was shortlisted for "sustainable company of the year" in the 2013 *Construction News* awards.

'Sustain-a-what?'

Education and communication lie at the heart of the McNicholas strategy, both with its workforce and increasingly with its supply chain and other stakeholders. The safety and sustainability team numbers 16 and frequently links up with managers and operatives in the field, encouraging a two-way dialogue and monitoring the implementation of safety and sustainability objectives. The company also uses formal training sessions, poster campaigns and "toolbox" talks to raise awareness and develop people's knowledge of sustainability issues.

The newly revamped "safety and sustainability moments" training sessions build on traditional toolbox talks and address a range of practical safety and sustainability areas with direct relevance to the work of those taking part. These are interactive and based on real-life scenarios that operatives could encounter when working on the company's construction projects. For example, one session could pose a broad question such as: "What are the environmental protection measures we should take when working near water?" Another could ask for feedback on the action to take in a specific situation, such as: "What would you do if someone spilt diesel in water?"

One important way in which the company rolls out its sustainability strategy to all employees, and gains their commitment to it, is through roadshows under the banner of "sustain-a-what?!" – making it clear again that the company wants to break sustainability jargon down into meaningful ideas and actions. "The last thing we want to do is turn sustainability into a big corporate tick-box exercise," says Ward. "The roadshows are a great way of making our sustainability strategy interactive and relevant to everyone."

With most managers and operatives at McNicholas working on projects in disparate teams, it is difficult to stage face-to-face forums for the whole workforce. But, in 2013, the team delivered 35 roadshows to more than 800 employees in locations as far afield as Belfast and Southampton. Ward says that the roadshows generated some "fantastic conversations" on sustainability, with many employees demonstrating a knowledge and interest in environment issues that have made it easy to facilitate lively debate.

Training and suppliers

McNicholas has recently reviewed its sustainability training for operational managers and site supervisors and is rolling out the site environmental awareness training scheme (SEATS) developed by the Construction Industry Training Board (CITB) and major construction companies. SEATS is the first nationally accredited environment training programme for those working on construction sites and is endorsed by the UK Contractors Group and the Environment Agency. The CITB says that SEATS provides those working on a site with the knowledge required to drive best practice in environment management and that it is a transferrable training programme that can be used by any organisation in the UK construction industry. McNicholas adopted the training programme because it was developed

by the industry for the industry, and as such has credibility throughout the sector. The one-day course aims to develop participants' knowledge in several broad areas, including:

- contaminated land;
- environment management;
- waste management;
- ecology;
- pollution prevention;
- energy and resources; and
- being a responsible and considerate contractor.

Although the course represents a common training programme for the sector, helping to promote consistency across companies and their supply chains, SEATS is designed to cover only 85% of the required environment knowledge with the other 15% specific to a company's own processes and procedures. Incorporating these bespoke elements enables SEATS to be made fit for purpose, says Ward. For McNicholas this has meant the inclusion, for example, of site specific emergency arrangements, the requirements of its environment management plan and details on submitting waste data. The learning gained is reinforced in a course handbook that every delegate receives as part of the training. Ward describes the handbook as a "brilliant resource", which acts as an aide memoire for participants to refer back to when certain environmental issues arise.

McNicholas views education and training in sustainability as a continuous process and not something that can be achieved through one training session, however. "I don't expect course participants to go back to their site quoting legislation – it is more about creating a culture where supervisors are more aware of the potential risks for the environment and what action they can take to mitigate or avoid those risks," says Ward.

McNicholas is an approved training centre for SEATS and aims to deliver the scheme to all 200 of its site supervisors and managers over the coming months. It is early days, with only a few courses having been delivered so far, but the feedback on the training's practical focus and interactive elements is promising.

Another way that McNicholas has started to gain momentum for its sustainability vision is by seeking to embed improvements across its supply chain.

"By working with like-minded suppliers, we will be able to further embed our principles throughout the company," says Ward. The company's preferred suppliers list consists of 78 companies. To obtain preferred status, a supplier has to undergo a rigorous assessment that reviews environmental performance, along with other key criteria. McNicholas's ethical and sustainable procurement policy makes clear that the company seeks to purchase goods and services that are produced and delivered under conditions that do not abuse the environment. All timber, for example, must be from FSC-certified sources.

Each member of the McNicholas procurement team has attended a training course on sustainability and many of the tools and techniques learned have been incorporated into the company's procurement processes and procedures. The company has recently developed a sustainability procurement matrix to encourage suppliers to embed sustainability objectives in their operations and is trialling it with some contracts. The matrix is detailed and enables an in-depth assessment of suppliers across a range of sustainability criteria, awarding a "high", "medium" or "low" rating based on their performance in each area, which include: ethical sourcing of materials, waste and packaging, percentage of recycled content, and carbon and water footprints.

Taking the message home

Ward says that McNicholas wants to take sustainability far beyond "just compliance" and make it a core part of the culture and the "way people do things around here". Her hope is that employees' commitment to sustainability does not stop at the end of the working day – the aim is for people to take the message home. "Embracing sustainability initiatives at work is only the start," says Ward. "Part of 'the S word' is to identify actions that staff can easily adopt at home."

This process has already started, one example being the company's annual charity calendar. The initiative uses drawings – based on corporate responsibility themes, such as the natural environment and helping others – from employees' children to illustrate each month of the calendar. For the 2014 edition, 45 young artists submitted their paintings and calendar sales are expected to surpass £500 – the amount donated by the company to The Lighthouse Club for the 2013 calendar. "The Lighthouse Club is a charity close to our hearts as it provides financial assistance to construction workers during times of need," says Ward.

"Sustainability is a powerful tool. Not only does it makes sound commercial sense, but it also helps to improve morale. Knowing that we are taking our environmental and social responsibilities seriously gives people a lift. Sustainability is helping to make McNicholas a great place to work, especially as more of our people start to take their own initiative and make our vision a reality."

Demolition derby

Terry Quarmby argues that new building products need to be designed with deconstruction in mind

The UK government – often following rules from the European commission – has attempted to address the problems associated with waste by applying a number of protocols and policies backed up by legislation. Certainly in sectors involving construction, packaging, automotive, electronic and electrical equipment, chemicals and hazardous substances the relevant regulations are prescriptive and, in general, regularly reviewed to account for changes in socioeconomic circumstances. However, there remain questions as to whether these reviews focus on the long-term implications of waste management, in particular the disposal routes for waste in the future, and whether they are as detailed and forward-looking as they should be.

The cost of doing business

The landfill tax was introduced in October 1996 to help the UK meet its obligations under the EU Landfill Directive (99/31/EC). An accelerator has applied to the tax since 1999, making it increasingly expensive to send waste to landfill and encourage producers to opt for cheaper disposal options. Sending waste to landfill in the UK is set to rise to £80 a tonne in April and remain at least at that level until 2020.

There has been steady decline in the use of landfill, with many sites closing and few new ones opening. What will eventually replace landfill is not clear, however. One thing is certain: waste production is not on the decline now nor is it likely to be soon. While we deride the use of landfill as a wholesale answer to waste disposal and bemoan energy-from-waste plants and incineration as costly to the environment and the pocket, there remains no other viable alternative to dealing with waste.

If we look at the construction industry, about 100 million tonnes of construction, demolition and excavation waste (CDEW) are produced each year in the UK, with only 40% recycled. The remaining 60% is either landfilled or used as engineering backfill in landfill sites. These figures may be improving slightly because the demolition industry tends to use waste transfer stations (WTSs) as a means to reduce landfill costs and avoid the tax. But with many WTSs charging around £100 a tonne plus haulage they are not necessarily a cheap alternative.

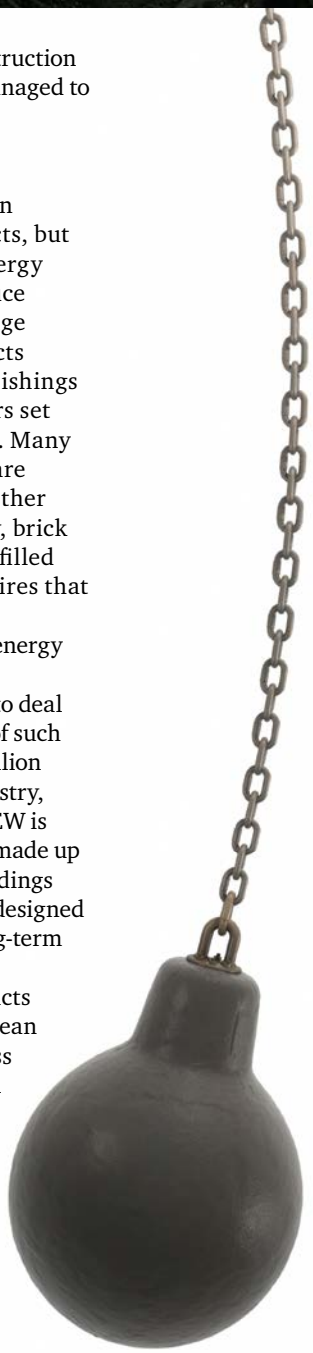
Some construction companies are doing more to separate waste onsite, so increasing amounts are being directed away from landfill, but plenty of improvements can still be made. One of these would be to eliminate, or at least reduce, the waste generated by construction products, but this is a subject that has so far managed to avoid proper debate.

Material selection

The demolition industry has a good record on salvaging and recycling construction products, but that success is at risk as improvements to energy and carbon reduction in new products produce poor-quality recyclate and nonexistent salvage values. For example, some end-of-life products would have started out as soft and hard furnishings containing foams and even polystyrene fillers set into chipboard, MDF or laminated ply board. Many structural timber components, meanwhile, are laminated or glued to inseparable layers of other materials. Even traditional-looking masonry, brick or concrete elements are often imitations or filled with expanded foams or high-tensile steel wires that are impossible to separate.

It would seem that, in the drive to improve energy efficiency and reduce carbon emissions in new construction projects, there has been a failure to deal with the consequences. Although the amount of such waste may be small compared with the 100 million tonnes produced annually by the building industry, it is important to remember that the "C" in CDEW is "construction waste", which is predominantly made up of manufactured products that are used in buildings and construction projects. These products are designed with a lifecycle of 25–30 years, so will be a long-term problem unless action is taken soon.

The real sting in the tail is that these products are also a problem now. Often there is more clean timber for disposal than is needed and biomass power stations have become swamped. Global demand for chipped timber to make boards, meanwhile, fluctuates at such alarming rates that project planning and time frames often suffer. Although WTSs can handle the CDEW currently directed away from landfill, they would be overrun if they had to deal with a further 60 million tonnes. And, WTSs still use landfill sites to dispose of hard-to-recycle materials.



Salvage of reusable materials is fast becoming a thing of the past because the products of today are designed to be cost-, energy- and carbon-efficient during their lifecycle rather than at the end of it. There is an obvious conundrum here: we desire to preserve natural

materials by substituting them for manmade ones, but this often leads to the creation of products whose materials cannot be reclaimed or reused, casing more waste. Designers of construction products, structures and infrastructure need to reduce waste at source to cut costs and promote the use of sustainable materials that can be reclaimed or recycled.

Building a solution

For a number of years there has been a debate over "design for deconstruction", whereby the materials used in the built environment can be reclaimed for use again. Unsurprisingly, it hasn't received the attention it warrants, which may be attributed to a number of issues, not least aesthetics, cost and lack of government support. But this is not an isolated problem concerned only with the products of construction, it is one that affects all industries and their waste now and in the future.

Outside incineration, there appears to be no viable alternative to landfill that is capable of accepting and dealing with the volumes of waste generated today and the foreseeable future. With the bulk of waste expected to be directed away from landfill within the next six years, this is an unacceptable position for the UK's industrial and commercial sectors and it is time that government initiated and instigated the solutions.

So what are the solutions? There are no quick fixes, which makes it more important to start the process of repair or restoration as soon as is practicable. The demolition industry wants design for deconstruction to play a major part in this process because it offers a simple and uncomplicated route to identify: reclamation and recycling opportunities; safe systems of deconstruction; and preformed environmental impact assessments for product placement and disposal. Coupled with the drive for "building information modelling" (BIM), design for deconstruction could be integrated into building and construction schemes where the products and elements of the new build can be evaluated for energy and carbon efficiency throughout their life and at the end of that cycle. In that way, the environmental impact of a product can be efficiently assessed before use and its disposal costs, and/or value, determined long before it reaches the end of its useful life in a building.

Both BIM and design for deconstruction can be drivers that assist and influence product and building designers to develop better quality and longer lasting materials. While neither of these concepts may be the definitive answer to the problem of waste management, either would go a long way towards creating a solution.

Dr Terry Quarmby, MIEMA and CEnv, is director at the Dorton Group.

IEMA to drive the future of global sustainability body

"Sustainability" and "global" were two words that featured recurrently in last year's Vision 2020 member consultation. Members from around the world told IEMA's chief executive, Tim Balcon, of their desire to see the Institute become the "go-to organisation" for anyone working with environment or sustainability responsibilities at all stages of their career.

That wish will start to become a reality with the imminent acquisition by IEMA of the Global Association of Corporate Sustainability Officers (GACSO).

I see massive potential for the future of GACSO as a membership and as a brand, and I guarantee that it will benefit from being powered by IEMA

The GACSO board is unanimous in its view that IEMA can, and will, offer the best mix of preserving the identity and 'one-world' ethos of the organisation

GACSO is a community of corporate professionals who "live and breathe sustainable development". It represents established and aspiring sustainability professionals, offering them a framework of support, guidance and knowledge, sharing opportunities that have career-long relevance. The GACSO team has recognised that the organisation's future lies with IEMA due to the Institute's strength of professional community, dedication to environment and sustainability skills and global ambitions.

So, from April 2014, IEMA will take over the operation and development of GACSO. IEMA will incorporate the association's membership, which includes leading individuals working in sustainability for some of the world's best-known brands, into its own membership of 15,100.

This move strengthens IEMA's community of members, providing a natural home for those at the strategic end of sustainability and enhancing IEMA's network of senior professionals. Collaboration with GACSO members, which includes several people who have run the organisation on a voluntary basis for the past few years, will ensure that IEMA can deliver an increasing number of quality events that serve all of its members who are working in sustainability and at the leadership level of the IEMA skills map.

The introduction of GACSO membership also extends IEMA's appeal, enabling it to recruit new members and build a community across professions, where sustainability is changing the nature of roles across the economy. This shift will provide a catalyst for IEMA's worldwide growth, recognition and influence.

"This is a really important and exciting move, both for IEMA and GACSO members, who will soon be a united force. I'll be delighted to welcome the GACSO members to IEMA and I'm very much looking forward to meeting every single one of them as soon as possible," said Balcon, commenting on GACSO joining with IEMA.

Dr Alan Knight said that the GACSO board was particularly impressed by the "passion and enthusiasm" IEMA demonstrated towards capitalising on the work of the sustainability organisation. "Our board is unanimous in its view that IEMA can, and will, offer the best mix of preserving the identity and 'one-world' ethos of GACSO – the strong knowledge-sharing heritage we have developed – while allowing for the most rapid evolution to a professional membership model for corporate sustainability practitioners," he said.

In response to Knight's acknowledgement of IEMA's dedication, Balcon said: "I'd like to thank the team at GACSO who have dedicated their time and energy into establishing this genuinely pioneering community, and for their enthusiasm about the organisation's future under IEMA's leadership.

"I see massive potential for the future of GACSO as a membership and as a brand, and I guarantee that it will benefit from being powered by IEMA at a time when organisations around the globe are finally switching on to the intrinsic value of environment and sustainability professionals."

To find out more about GACSO go to gacso.org. Further details about the new relationship between IEMA and GACSO will feature in the April issue of *the environmentalist* and on iema.net.

Baxter live on Radio 5Live

iema
Institute of Environmental Management & Assessment

Following the publication of a joint letter from 17 professional bodies, including IEMA, urging David Cameron to utilise their collective experience and expertise to help prevent future flooding crises in the UK, Martin Baxter – executive director of policy at IEMA and the Institute's signatory to the letter – was invited to provide comment on BBC Radio 5Live (pictured).

The letter, which was published in the *Daily Telegraph* on 21 February (see also p.11), begins: "As landscape architects, architects, engineers, hydrologists, ecologists and other specialists with the experience necessary to tackle flooding, we would like the government to be aware that the expertise of our professions is available and, we believe, urgently required."

Several media channels covered the call from the professions to the government, with Baxter providing clarity and comment on the content of the letter and the need for a "coordinated response" to mitigate climate challenges, including flooding – which continues to have significant impacts in parts of the UK, the US and Europe.

Baxter was interviewed on Shelagh Fogerty's afternoon show on Radio 5Live. "[Environment and sustainability professionals] are the ones who understand the issues and have the technical knowledge to apply the right measures," he told Fogerty.

Closing the discussion, Baxter, who was joined on the show by George Adams, president of Chartered Institution of Building Services Engineers and another signatory to the letter, advised that closer, more inclusive working will aid prevention and protection against future threats: "Government agencies and parties really must work much closer together, along with ourselves and other organisations, because we need a consensus for action and we need to provide communities with the necessary protection," he said.

BBC 5Live also included Baxter's comment in a subsequent news bulletin, demonstrating how IEMA's comment and leadership on environment and sustainability issues is increasingly sought by the media.

To view the letter to David Cameron in full, visit: lexisurl.com/iema17566.

Full membership standard about to change

From the beginning of April, anyone applying to become a Full member of IEMA will be assessed under the revised Full membership standard.

Due to the continuing growth in the popularity of Full membership during the first quarter of 2014, IEMA hit capacity for accepting applications under the outgoing system at the end of February. IEMA will begin accepting applications under the revised standard from 31 March. Details of eligibility criteria, competencies and an outline of the application documents are already available online. The revised standard, provides greater clarity around eligibility and introduces a revised assessment procedure, which will enable the Institute to process more applications.

The revised eligibility criteria states that, to apply Full membership of IEMA (and Chartered environmentalist status), applicants must:

- Be a member of IEMA.
- Have a relevant master's degree, pertinent higher qualification or be able to demonstrate an equivalent level of knowledge.
- Possess sufficient knowledge and practical experience to be able to clearly demonstrate they meet the required competencies.

In addition, the assessment process is changing in the following ways:

- Peer assessment will be carried out via an online video conference interview. There will still be the option to request a face-to-face interview at the next available assessment day, subject to an additional administration fee.
- All applications will be assessed against both IEMA's Full membership criteria and the CEnv criteria. IEMA Full membership is broader than the level required for CEnv status, so if you satisfy the Full membership criteria you will also fulfil the CEnv criteria.
- The interview will last 45–75 minutes. This new length is to allow candidates sufficient time to demonstrate they meet the required competencies.

The cost to existing IEMA members of applying for Full membership is £410. If an individual is successful, he/she will also be awarded CEnv status.

Further details and a full breakdown of what is new to the application and the assessment process are available from lexisurl.com/iema17567.

IEMA launches 'sharing your details' scheme

On 1 March, the Institute introduced a process enabling members to more easily connect with each other, with the aim of supporting the vitality and development of the IEMA community.

Members were notified of the introduction of the "sharing your details" scheme earlier in 2014. Now it is live, any current IEMA member has the opportunity to request the basic contact details of members who have opted to be included in the scheme. The purpose of the scheme is to enable members to connect, discuss and work together on IEMA-related activity. The new facility aims to enhance members' ability to participate, network and collaborate as part of the IEMA community.

Introduction of the scheme was approved at the 2013 AGM after IEMA had taken advice from the Information Commissioner's Office on the best way to share members' contact details and remain compliant with the Data Protection Act. All of the Institute's members had the opportunity to opt out of the data sharing scheme in the 30 days before its launch, and can still do so by emailing unsubscribe@iema.net with your name and membership number.

If you wish to request the basic contact details (name and email address) of another member, you can now get in touch via info@iema.net to request them. Please note we will only be able to pass their details on if that individual has opted-in to the scheme and you intend to contact them for IEMA-related activity. Don't forget that the IEMA LinkedIn groups and our Twitter feed (twitter.com/iemanet) are also great ways of contacting and connecting with other members.

Full details about sharing your details, including terms of use, are available from lexisurl.com/iema17571.

Renewal fees for 2014/15

Members are advised that from 1 June 2014 all membership renewal fees will be subject to a £2 increase.

The rise covers the increased costs that IEMA continues to encounter in delivering existing and new membership services, such as webinars and workshops. Over the past year, the Institute has also significantly amplified its voice on policy issues and its media presence. This is enabling members' views on national and international issues to be represented across more channels more often.

Renewals for 2014 that are due before 1 June will be charged at the current rate. All members whose renewals fall after 1 June will be advised of the exact fee for their 2014/15 renewal in advance, and full details will be available at iema.net in the coming weeks.

Policy update

Change to guide on 'green' tariffs

Defra is running a four-week consultation on new corporate greenhouse-gas (GHG) reporting guidance for renewable or "green" electricity tariffs. IEMA is concerned that the revised guidance could lead to confusion in how organisations report GHGs and, in some cases, lead to an under-representation of corporate emissions.

The environment department's 2009 GHG guidance advises organisations to report electricity consumption using the grid average emission factor and only allows a reduction in net emissions if a purchased tariff demonstrates clear additional carbon savings. Many experts feel this approach is best suited to the UK, where public funding has been a lead driver in securing electricity generation from renewable sources. Some organisations, however, would like to account and report using zero-carbon generation characteristics for any renewable electricity they purchase.

In its consultation, Defra is proposing to enable such reporting and outlines two options. In option 1, gross GHG emissions are calculated using the grid-average factor and zero-carbon characteristics of purchased green renewable electricity can be accounted in net emissions. Option 2 factors in zero-carbon characteristics to the reporting of gross and net emissions. In the second option, organisations will report at least two figures for emissions; if they use net and gross lines four values will be reported.

Both options are a significant change to the 2009 guidance, which is widely used. IEMA believes that option 1 will be a more proportionate change and is concerned that option 2 could be confusing. There are also concerns that option 2 could disincentive firms from installing energy-efficiency measures. Members involved in GHG reporting are encouraged to respond to the Defra consultation (lexisurl.com/iema17570). The consultation closes on 24 March.

Nick Blyth is policy and practice lead at IEMA.

More successful IEMA members

IEMA would like to congratulate the following individuals on recently upgrading their membership as part of their ongoing commitment to learning and professional development.

Associate

Badawy Aimen, BP Global
Roy Anderson, DNV Certification
Cally Bristow, Siniat
Jacqueline Brown
Paul Buckley, Magnox
Lauzan Burns, Amec
David Burton
William Connally, Environment Agency (NEAS)
Martin Corbett, Kaefer C&D
Emma Douglas
Helen Drury
Christopher Dunnett, Magnox Electric
Emma Eastwood, Appris Management
Nichola Ebbern, Spectrum Housing
Holly Edwards, Nuclear Graduates
Mark Fenton, HS2
Nichola Foote, Premises Management Services (North West)
Lee Giffard, National Grid
Kathy Gray
Yan Horton, Poeton Industries
Paul Humphreys, Noble Foods
Gam Jhutti, National Farmers Union
Stephanie Jones, AWE
Stephen Jones, Compass Group UK and Ireland
Daniel Kenyon, Wallwork Heat Treatment
David Lee-Wright, Proctor & Gamble
Susan Lyall, 0-1 Manufacturing
Sean Luchmun, Enterprise
Greg Mahon
Lisa Maloney, J Murphy and Sons
Marian Markham, Halcrow Group (CH2M Hill)
Will Marsden, Wates Construction
Richard McGarry, PMB Management
Simon Milford, Biffa Waste Services
Christopher Murray, Communisis
Olubukola Olose
James Quinn, Babcock International Group
Rajan Parmar, 0-1 Manufacturing
Kate Paxton, Method Consulting
Robert Peters, Midland Survey and Engineering
Lisa Phillips, Unilever UK
Luke Ramsay, Julie's Bicycle
Simon Render, Knowledge Pool Group
Stephen Ryan, SPP Pumps
Dawn Sales, CEVA Logistics
Stuart Semple
John Spellman, Aquatic Engineering Construction
Thomas Styles, Johns Associates
Paul Thomas, WYG
Caroline Tobin, DS Smith Tri-Wall
Brian Watkins, SPP Pumps
Chris Whiston, LRQA
Colin Whiteley, Amec
Philip Wolstencroft, Jaguar Land Rover

Full

Mark Bull
Edward Dixon, Simons Group
Mark Francis, Overbury
David Walton, Suffolk County Council
Chris Young, Environment Agency

Full and CEnv

Amy Dickinson, South West Trains
Duncan Morris, BAM Nuttall
Rebecca Garner, Serco
Sophie Thomas
Diana Salvio, Cummins

IEMA events

Date	Region/Time	Topic
19 Mar	North West	Business resilience health check tool
19 Mar	Republic of Ireland	Climate change and energy position statement workshop
19 Mar	Yorkshire and Humber	Creating healthy buildings workshop
19 Mar	South West	Social (Exeter)
21 Mar	South East	Business resilience health check tool
24 Mar	Yorkshire and Humber	Business resilience health check tool
24 Mar	Yorkshire and Humber	Climate change and energy position statement workshop
25 Mar	South East	Spring EIA update workshop – EIA Directive revision and noise assessment guidance
25 Mar	Midlands	Climate change and energy position statement workshop
26 Mar	South West	Business resilience health check tool (Dorset)
31 Mar	Midlands	Business resilience health check tool
3 Apr	South East	Social (London)
10 Apr	South East	Green drinks (Southampton)
16 Apr	South West	Social (Exeter)
1 May	South East	Social (London)
Webinars		
19 Mar	12.30–1.30pm	IEMA practitioners' survey – 2014 results
26 Mar	3.00–4.15pm	IEMA legislative update (England and Wales)
27 Mar	12.30–1.30pm	Good practices in the EIA of urban regeneration projects

Douglas McMillan

Managing director, BioLogic

Career file

Qualifications:
MIEMA, BSc in biological science, PhD in environmental sciences

Career history:
2011 to now Managing director, BioLogic
2004–2010 Senior environment, health and safety consultant and trainer, Antaris Consulting
2001–2003 Environmental scientist, Lisheen Mine
1997–2000 Language teacher and volunteer, various environmental non-governmental organisations
1994–1996 Editor of two books
1992–1993 Secretary of the International Tyndall School

Why did you become an environment professional?
My grandfather was very charismatic and inspired my love of nature, so environmentalism came naturally to me. Prior to starting my environment career, I worked in diverse range of roles and found that what gave me most satisfaction was delivering a training course well and helping to develop projects in different organisations. I quickly realised that the role of environment consultant and trainer was the one for me.

How did you get your first environment role? In 1993, as secretary of the International Tyndall School, I organised three international environment conferences in Ireland to commemorate the centenary of the death of John Tyndall. Tyndall first demonstrated the greenhouse effect in 1859 and carried out the world's first environmental air and water monitoring, hence the events' environment themes.

How did you progress your environment career? By doing voluntary work outside my normal job. For example, I assisted local communities by commenting on environmental impact assessments (EIAs) and producing ecological studies. On one such project, I helped to save a raised bog in Abbeyleix that had been drained in preparation for peat moss harvesting. I was able to counter an EIA survey that had found the bog to be of "no ecological value" after my own study identified more than 600 species present. I combined this work with additional environment monitoring as the basis for my PhD, which was a turning point in my career. I have also always sought out further professional training courses in the environment and related areas, such as energy.

What does your current role involve? I set up my own consultancy company in January 2011, so I am ultimately responsible for everything. Alongside developing new courses and services, I also have project management responsibilities, work to secure new clients, ensure the quality of our services and maintain our management systems.

What's the best part of your work? I have a strong independent streak, so being my own boss is great and I get to develop areas of work that interest me. Also, I am proud to have developed a company that actually "walks its talk" – we are the only carbon-balanced company of our type in the country and we offset the impacts of our courses.

What's the hardest part of your job? Trying to find the time to get everything done!

What was the last training course you attended? I recently became a certified energy manager.

What did you bring back to your job? My first encounter with energy was developing and delivering a course for building energy assessors. My recent training gave me increased confidence and knowledge working in the field. One of my roles now is as a programmes manager for the Sustainability Energy Authority of Ireland.

What are the most important skills for your job? Being able to understand different personalities to best attune messages; communication skills to put across those messages; and analytical skills to grasp the wide range of technical information I have to deal with.

Where do you see the profession going? Becoming integrated into core business practices as central to quality control and a must-have rather than an add-on. For forward-thinking organisations, sustainability issues are simply the other side of the "management system" coin and this will become increasingly evident.

Where would you like to be in five years' time? In the same role, but employing more people, achieving more improvements and pushing the sustainability agenda. I would also like to be manufacturing sustainable products myself.

What advice do you have for someone entering the profession?
Working in the environment can be very rewarding and stimulating, particularly if you are committed to making things better. Widen your expertise through training in new areas – see the IEMA environmental skills map – and overlapping disciplines, such as energy, resource management and health and safety, as there is a natural synthesis that will become more pronounced in the future. Lastly, ecology is to environment management what physics is to engineering. You must know your ecological principles or you could end up pushing first-generation biodiesels or greenwash!

How do you use IEMA's environmental skills map? I refer to it periodically for new business ideas.

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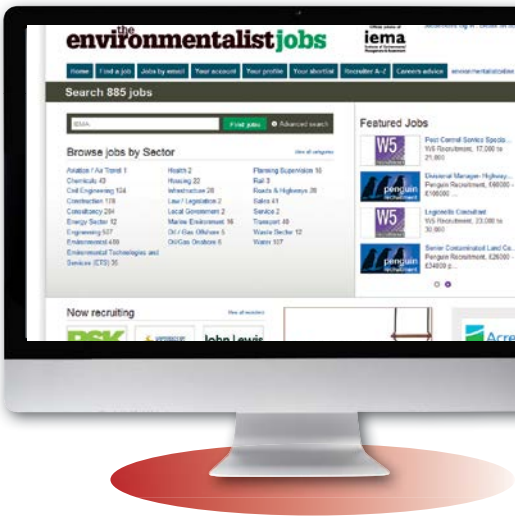

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14001	London	2nd June
14001	Birmingham	3rd June
14001	Glasgow	17th June
14001	Manchester	18th June
14001	London	23rd June
9001	Birmingham	14th July
Back to Back ISO 9001 and 14001 Update Workshops		
9001	Aberdeen	24th June
14001	Aberdeen	25th June
9001	Cardiff	26th June
14001	Cardiff	27th June
9001	Newcastle	7th July
14001	Newcastle	8th July
9001	London	9th July
14001	London	10th July

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