

THIS WEEK

CIAC

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A breath of fresh air

The decision to use the Montreal Protocol to reduce the impact of refrigerants on global warming is a step forward ahead of the Paris climate summit.

The world took a step in the right direction in the early hours of 6 November. Meeting in Dubai, 195 governments decided to pull the management of hydrofluorocarbons (HFCs) under the umbrella of the Montreal Protocol, an international agreement that governments signed in 1987 to protect the stratospheric ozone layer from damage by chlorofluorocarbons (CFCs). HFCs are ozone-friendly replacements for CFCs and are often used as refrigerants. Unfortunately, many are also powerful greenhouse gases, and their use is expected to skyrocket over the coming decades. Although a few governments were successful in delaying negotiation of the arrangement's details, the agreement to move forward is nonetheless welcome — and long overdue.

The United Nations Environment Programme estimates that HFC emissions are rising roughly 7% annually thanks in part to demand for air conditioners in emerging economies such as Brazil, India and Indonesia. By 2050, global HFC emissions could hit the equivalent of 8.8 billion tonnes of carbon dioxide, roughly equal to the current carbon emissions of the United States and European Union combined. The decision to regulate HFCs under the Montreal Protocol bodes well for the UN climate summit in Paris, which begins on 30 November. The Montreal Protocol is a well-oiled machine that has already proved its effectiveness and value among both industry and government leaders. In theory, dragging HFCs under its umbrella gives climate negotiators in Paris one less thing to worry about. All told, aggressively regulating HFCs could

reduce global warming by an estimated 0.5 °C.

Unfortunately, some governments still seem to be hedging their bets. In particular, India, Saudi Arabia and Kuwait pushed to delay consideration of detailed amendments to the Montreal Protocol until next year. Other global leaders, including US President Barack Obama, who has negotiated agreements on HFCs with leaders in India, China and Pakistan, will need to maintain pressure.

A day after his administration helped to negotiate the agreement on the Montreal Protocol, Obama denied permission for construction of the Keystone XL pipeline from Canada to the southern United States (see page 141). His decision was based on a simple criterion: whether the project would be in his country's 'national interest'. Obama said the answer is no, and he may be right. The world is awash with oil at the moment, and there is no need to rush any of it to market, let alone carbon-rich crude from Alberta's tar sands.

The world must, however, be clear about what this decision does — and does not — accomplish. It sends a signal to industry about the environmental values of the current administration, and it may make things a little harder for Canadian companies seeking to develop and export dirty crude oil. But a symbolic one-off gesture from one government will not change the fundamental dynamic driving greenhouse-gas emissions. To do that, all countries must implement meaningful policies that will rush low-carbon technologies to market. The clean-energy pipeline runs through Paris and next year's Montreal Protocol meetings on HFCs. ■

Universities' value

Proposals for UK higher education contain some positive points amid the financial gloom.

The UK government's austerity policies are soon expected to deliver swingeing cuts in some departments. In the teeth of those prospects, British researchers, and an influential parliamentary science and technology committee, have lobbied hard to make the case that even a flat research budget, after five continuous years of the same, would be a betrayal of the country's needs.

How successful they have been, and how worthy of exception the government considers them to be, will become clear only when UK spending plans are announced on 25 November. On page 144, we explore the worrisome prospects.

As if that wasn't enough, last week the government began a consultation over its proposed restructuring of the way it administers higher-education funding (see go.nature.com/c97sww). It

announced that it wants to abolish the Higher Education Funding Council for England (HEFCE), the body that distributes £1.6 billion (US\$2.4 billion) of 'quality related' research money to universities. Those core funds would still be administered separately from the more-responsive funding by the UK research councils, probably by a research-funding organization that would be responsible for both areas.

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The case for those particular changes has not been adequately made, but other aspects of the proposals have virtues. The government is tackling two scandals in the UK higher-education system: its relative neglect of quality standards in teaching, and its inadequacies in contributing to social mobility.

Another positive feature is that the government supports the continuation of the Research Excellence Framework (REF) for assessing research quality and impact, despite the proposed abolition of HEFCE, which successfully implemented that process. It is worth taking stock of the REF — not least because its results strengthened the case for

research investment by government.

True, many academics hated the REF, which required them to submit large quantities of information to justify their funding. But an inspection of the REF's outcomes, and of the retrospective reviews of the process by international members of the REF assessment panels (see go.nature.com/q919oe), suggests that it has many strengths.

Take the database of nearly 7,000 case studies of the societal impacts of academic research (see <http://impact.ref.ac.uk/casestudies>). The diversity of the impacts in terms of (for example) health, sustainability, education and economic growth — in the United Kingdom and beyond — is remarkable and inspiring.

And there is no reason to suppose that identifying these outcomes is the equivalent of the impacts tail wagging the research dog. In the REF, the assessment panels gave the societal case studies a mere 20% weighting, whereas academic performance had a 65% weighting. No one could sensibly maintain that the outcomes are necessarily predictable and should be required as a basis for funding in future. What does make sense is that the research community can help to ensure a maximal return on taxpayers' money by becoming aware of impacts pathways, and by broadening its outlook on its roles. As the case studies show, this can happen even in areas of research that

are unapologetically fundamental.

A study by the independent consultants RAND Europe estimates that the REF impacts-submissions process cost universities about £55 million (see go.nature.com/dzwbjn). That may seem to justify the concerns of academics and politicians about the burden. But set against the £1.6-billion budget that it relates to, one might even describe this 3.4% overhead as a bargain — especially given that the assessment system may become more efficient, and given the virtues of encouraging such impacts.

Mindful of the burdens, the government is evidently tempted to try to find a cheaper method of assessment of both academic and societal impacts using metrics. As is made clear by the REF panels, by a RAND analysis of the impacts evaluation (go.nature.com/yysa6m) and by an independent assessment of metrics in research (go.nature.com/rfrql), this temptation should be avoided. Insightful review of both types of outputs is the only way to do justice to them.

The impacts case studies provide welcome ammunition to the case for supporting research in all disciplines, and some government departments have been deploying them in that spirit. Readers who care about UK higher education should give their own responses to the proposals before 15 January 2016, at go.nature.com/l3rrtx. ■

Radio interference

Conflict at the Arecibo Observatory highlights the need for funders to become more flexible.

In more than 50 years of operation, the Arecibo Observatory has enabled some momentous discoveries. Researchers at the observatory in Puerto Rico found in 1965 that the length of a day on Mercury is more like two Earth months than three. The first binary pulsar, detected at Arecibo in 1974, earned its discoverers the 1993 Nobel Prize in Physics. The observatory's telescope made the first confirmed discovery of extrasolar planets in the early 1990s. And two years ago, astronomers reported using Arecibo to find Leo P, a dwarf galaxy that had gone undetected just 2 megaparsecs from the Milky Way.

Unfortunately, that five-decade streak of discoveries could be near its end. Arecibo is long in the tooth and certainly shows its age, but the problem is not that the observatory has exhausted its scientific potential. Its telescope remains the largest single-dish radio instrument in the world, and is in demand from those who study topics such as pulsars, asteroids and Earth's upper atmosphere.

The problem is money, as it so often is. Operating Arecibo costs about US\$12 million per year, a price that its owner — the US National Science Foundation (NSF) — feels increasingly unable to pay.

Arecibo's bell began to toll almost a decade ago, when a panel charged with balancing the NSF's astronomy budget put the observatory on its list of potential cuts. The agency's astronomy division has long been under intense pressure to support the development of new instruments such as the Large Synoptic Survey Telescope, currently under construction in Chile, without any increase in budget.

But few in the astronomy community or the NSF seem to relish the idea of closing a facility as scientifically productive as Arecibo. So the agency has endeavoured to find parties willing to contribute to the observatory's operation or, better yet, to take over the enterprise entirely.

In July, a glimmer of hope appeared in the form of the Breakthrough Listen project, a \$100-million effort sponsored by Internet billionaire Yuri Milner to scan the nearest 1 million stars for signals suggesting the presence of intelligent life. The project has already arranged to purchase about 20% of the observing time at another NSF radio facility, the Green Bank Telescope in West Virginia.

But no similar agreement has been reached at Arecibo. One

stumbling block may have been conflicts with the observatory's director, Robert Kerr, who has said that the NSF told him that it would cut its contribution to Arecibo by an amount equal to any contribution from Breakthrough Listen. Such an arrangement, he feared, would give the agency an opportunity to absolve itself entirely of the need to fund the telescope (see page 142).

NSF officials vigorously deny any such intent, and insist that they never even suggested a one-for-one reduction of funding as a condition of a Breakthrough Listen deal. Nevertheless, Kerr's objections led to his resignation as operations director. On 26 October, the science agency distributed an open letter soliciting "strategies and goals for continued operations that involve a substantially reduced funding commitment from NSF".

It might seem difficult to understand why the NSF has so much trouble accepting help from a private source. But the agency deserves some sympathy. It has a mandate to support a research agenda dictated by the scientific community through peer review, not by the interests of deep-pocketed philanthropists.

That is not to say that Breakthrough Listen's goals lack legitimacy — the argument that intelligent life must exist somewhere else in the universe is strong, the confirmation of a signal from an alien civilization would

arguably be the greatest scientific discovery ever made and the Arecibo telescope is one of the world's best instruments for making such a discovery. But accepting Breakthrough Listen's offer without minimizing its impact on the general community's access to the telescope would be irresponsible. The NSF is right to proceed slowly.

Such episodes are likely to be repeated as long as public science funding remains tight and the technology sector continues minting billionaires with the curiosity and intellect to put their money to work expanding the frontiers of human knowledge. In the case of Arecibo, and in future disagreements over how to best combine private and public resources, it is important to remember that although they may differ on how exactly to proceed, all sides share an interest

in the advancement of science. Elected officials are unlikely to increase funding for research any time soon, so it would be wise for managers at funding agencies and at publicly funded institutions to embrace the spirit of compromise. ■

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