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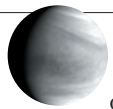

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A seismic shift

After 25 years of divisive debate, the governments of the world unite in Paris to fight global warming. But the hard work must start now.

On 12 December, French foreign minister Laurent Fabius passed into existence a landmark agreement on global warming, and without a single word of discussion. The small green gavel produced only a soft crack at the United Nations climate summit in Paris, a sound quickly overwhelmed by a standing ovation. But that sound should echo. It ushered in a seismic shift in international environmental and economic policy. If everything goes according to plan, the reverberations will be felt around the world for decades — and perhaps centuries — to come.

The Paris agreement strengthens the previous goal of limiting warming to 2 °C above pre-industrial levels, ultimately suggesting that governments should "pursue efforts to limit the temperature increase to 1.5 °C". Pushed by a coalition of island nations and some of the most vulnerable countries on Earth, this change offers a nod to scientific research, which suggests that even the 1 °C of warming experienced thus far is already having effects. Current commitments to reduce emissions might put the world on a path to keep the rise in temperature below 3 °C, and even that assumes substantial action in the decades to come. But all countries must revisit — and hopefully strengthen — their pledges every five years, beginning in 2020.

Despite the contradiction between commitments and goals, the Paris accord is a vast improvement over the last binding agreement to curb emissions. The 1997 Kyoto Protocol explicitly divided the world into two factions, rich and poor, and it required only rich nations to reduce their emissions. In so doing, it tried to address legitimate questions about equity and fairness. Poor nations argued — justifiably — that wealthy countries have profited immensely from fossil fuels, and that they were responsible for the bulk of historical greenhouse-gas emissions. They asserted their right to focus on lifting people out of poverty, while wealthy countries concentrated on bringing emissions down and developing technologies to enable everybody else to follow. It was a reasonable proposition — but it was destined to fail.

Emissions have continued to rise. Although most of the past emissions have come from wealthy nations, the bulk of those in the future will come from developing countries. Scientists have made it abundantly clear that every country must do everything that it can, and as fast as it can, if the world is to prevent the worst consequences of global warming.

The Paris agreement seeks to bridge the divide with carrots rather than sticks. Although countries agreed to engage in this new process, any action that they take to reduce emissions is on a purely voluntary basis. Indeed, the final change to the agreement in Paris, which took place quietly just minutes before the text was adopted, was to replace a 'shall' with a 'should' in a line stating how developed countries will commit to reducing emissions. This shift towards a voluntary framework based on national commitments was a necessary first step to bring everybody on board — and it worked.

Things may yet unravel. When negotiations pick up next year, the first task will be to spell out exactly what information countries need to submit regarding their emissions and commitments, and how the review process will work. Given that there are no penalties for failing to achieve a commitment, the foundation of this agreement is transparency.

Governments, scientists and advocacy groups need solid information to verify that everybody is living up to their commitments and to transfer knowledge about what works and what doesn't. The last — and often overlooked — piece of this puzzle is that developing countries will need help to establish the academic and technical expertise needed to meet these new international standards.

"The Paris agreement represents a bet on technological innovation and human ingenuity."

The Paris agreement represents a bet on technological innovation and human ingenuity. If governments follow through, companies and investors will shift resources towards clean energy to secure a place in an economy that will look very different several decades on.

In many ways, the debate about the long-term temperature-rise goal is symbolic. In the end, as noted in the agreement itself, the world needs to reduce net greenhouse-gas emissions to zero — and to do that, all countries must seek to halt the rise and bring down their emissions as soon as possible. Everybody has a role in making that happen. But today, the world can celebrate a win for global diplomacy. ■

Crop conundrum

The EU should decide definitively whether gene-edited plants are covered by GM laws.

When philosopher George Santayana said more than a century ago that those who do not learn from history are doomed to repeat it, he could have been predicting the European Union and its approach to genetically modified (GM) organisms.

As we report in a News story on page 319, the EU is dragging its feet over a legal ruling that could affect research and innovation for years to come. At stake is the use of gene-editing tools such as CRISPR–Cas9, which are revolutionizing biology. These techniques should theoretically trigger few safety alarms, yet they may be snared by the onerous legislation that has already added layers of bureaucracy to research involving conventional genetic engineering, and has slowed the cultivation of GM crops almost to a standstill in many nations.

The new tools can be applied to create mutations that could have occurred naturally, and leave no trace of foreign genes in the product.

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Accordingly, the US Department of Agriculture has ruled in several cases that the products do not have to be regulated as GM organisms.

The European Commission is yet to send the same signal. In fact, it could decide that such products are governed by the existing cumbersome rules — its 2001 directive on the deliberate release of GM organisms into the environment. That would be a disaster for research.

The commission represents the interests of 28 member states, which are deeply divided on issues of genetic modification. But it needs to make clear — soon and with no room for misinterpretation — that work with these new techniques is important and does not necessarily need to be regulated in the same way as the previous generation of GM crops.

The precise and efficient gene-editing tools insert a gene that can create tiny, targeted mutations in an organism's own genome. These mutations can permanently change the function of a host gene, change its sensitivity to environmental cues or switch it off entirely; the foreign gene can then be bred out.

The core legal issue is whether the 2001 directive applies to all products of genetic engineering, or only to organisms that have been altered in a way that could not occur naturally. Clauses in the directive mention both.

Non-governmental organizations that are hostile to genetic engineering say that the directive is about the process by which products are created. But legal analyses conducted in the past year by several member states — including Germany, which has been opposed to conventional GM crops — concluded that it is fundamentally about the products themselves.

The commission's own legal analysis, being handled behind firmly closed doors, is the one that will count. But the result has been repeatedly delayed, spreading immense uncertainty in the scientific community.

It is now promised before the end of March. Why is it taking so long?

The commission has strongly hinted that the matter will ultimately be settled in court. Its decision, when it comes, is bound to annoy parties on one side, which may then sue. The possibility that a decision that releases many gene-edited products from GM regulation could be overturned by a court will add to the community's uncertainty.

There is some history here, and it should not be repeated. The commission tried, and failed, to resolve the lengthy disagreement over conventional GM crops by getting the European Court of Justice to rule on whether member states should be required to allow cultivation of such crops deemed safe by EU regulatory authorities. The court ruled that they should, but some countries banned it anyway. In a messy compromise, the EU now allows individual states to opt out.

"Letting a court decide a political issue is a poor option."

The commission may be calculating that the reaction to a court ruling could be different this time, as a result of member states signalling their willingness to consider gene-edited products to be non-GM.

But letting a court decide a political issue is a poor option. It could take years. Even a positive verdict could rebound by reinforcing the narrative in some countries that the technology is being forced upon them. And it does not convey a positive message about legislation, which is supposed to reflect the will of the people.

The commission should indicate that the spirit of the 2001 directive does not cover the impact of the new gene-editing tools, and should give them an appropriate green light — with encouraging enthusiasm. If the exact wording of the 2001 directive gives room for doubt, then it should be updated to reflect a world in which new science has long overtaken the old.

Whatever the decision, the uncertainty must be lifted to allow research to proceed, and quickly. ■

Science for peace

The German research community can benefit from the influx of migrants.

This year's refugee crisis — a result of the civil war in Syria and enduring instability in the Middle East and Africa — has become an acid test for the European Union.

Although some countries would rather pull up the drawbridge where refugees are concerned, Germany has generously welcomed nearly one million migrants this year, without regard for the costs or logistical burden involved. "We can do it!" Chancellor Angela Merkel never failed to remind German citizens.

However, as police, immigration authorities, communities and volunteers creak under the strain, Merkel's optimism is increasingly being denounced in some quarters. To integrate hundreds of thousands of traumatized, mostly Muslim, war refugees into Western society is a massive social challenge. But, contrary to what some critics seem to assume, early signs show that the young refugees — and under-25s make up around half of the influx — will not be inclined to accept social welfare and sit back idly for long. Robbed of their hopes and dreams at home, many will grasp the opportunities offered.

And many will be eager to learn. If admitted into Germany's well-oiled education and science system (and into its booming labour market at large), they can be a boon rather than a burden to the country's knowledge-based economy.

German universities and science organizations are aware of the responsibility to these displaced people and the opportunity they represent. The messages they send in favour of openness and plurality — defining features of any honest science — are laudable at a time when xenophobia is on the rise elsewhere.

Thanks to several programmes and initiatives launched by the German science community in recent months, refugee students can access university education and doctoral-research opportunities, and qualified refugee scientists and scholars can participate in advanced science at research institutes across Germany (see page 320). These initiatives are much-needed and deserve every respect.

Refugees are expected to continue to arrive in Europe in large numbers, often lacking documentation of their professional or academic qualifications. Opportunities must continue to be available to them, and more must be helped to connect with potential employers, in and outside of academia.

Online tools such as the European Commission's Science4Refugees portal, on which employers can post job opportunities and refugees seeking science jobs can put their CVs, are well meant but not (yet) frequently used. Learned academies, universities and science organizations throughout Europe should more clearly and proactively promote the message that students, scholars and scientists who have been forced to flee their home can rebuild their careers as well as their lives.

Social researchers who study education, mobility and integration — for whom the current wave of migration is a research opportunity — must strive to empirically challenge presumptions about refugees' allegedly low level of qualification and susceptibility to political or religious extremism. To be sure, these things need to be — and will be — thoroughly investigated. But the idea touted by some that Muslim values are a fundamental obstacle to successful integration into a modern secular society is wrong and hopelessly short-sighted.

Whatever critics might say, Germany's rebirth as a haven for the prosecuted is a powerful gesture of peace. Embracing refugees, while assuring anxious citizens that openness need not threaten their own quality of life, is perhaps the most pressing social challenge faced by science in these times. ■

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