CLIMATE CHANGE TREATY

Panels Lead the Way on the Road to Kyoto Conference

Representatives from more than 160 countries will gather in Kyoto, Japan, during the first 2 weeks of December to ratify a treaty regulating the emission of greenhouse gases. But already, the road to Kyoto is becoming crowded with scientific advisory groups offering their own projections of the effects of global warming and prescriptions for stemming rising levels of carbon dioxide.

Last week, the Intergovernmental Panel on Climate Change offered its first regional analysis of the impact on humanity of a doubling of CO_2 levels over the next century. A few days earlier, the President's Committee of Advisors on Science and Technology weighed in with a proposal that the U.S. government spend $1.1 billion more on energy research to foster more efficient, and renewable, technologies. Also last week, Britain's science adviser, Sir Robert May, said that the scientific evidence has convinced him of the need for limits on carbon-based emissions—a conclusion that was immediately endorsed by Britain's prime minister, Tony Blair.

But translating scientific advice into political action will be the hard part. A recent call by the European Commission for a 15% reduction in 1990 emissions levels by 2010—a proclamation meant to influence a still-evolving U.S. position—was rejected last week by a top U.S. environmental official as "unrealistic and unachievable." And the White House conference on global warming held earlier this week was mostly an educational exercise rather than a forum for specific proposals and timetables. Those details could emerge later this month in Bonn at the final preparatory meeting for the Kyoto conference.

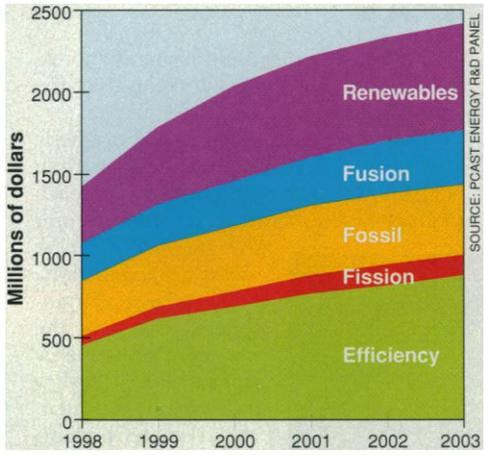
In the meantime, as the Kyoto traffic worsens, here are three views along the scientific road of climate change.

Panel Seeks Boost in Energy R&D Spending

Cheap and plentiful oil has put a damper on U.S. spending on energy R&D for nearly 2 decades. But the swirling debate over global warming is providing research advocates with the most potent political issue since the days of the oil embargoes. Last week a presidential panel waded into that debate with proposals for $1.1 billion in new government spending over 6 years on more efficient technologies and renewable sources of energy. Its goal is to win presidential support for such an increase and recognition of the importance of energy R&D in the U.S. negotiating position at Kyoto.

The new report, by a subpanel of the President's Committee of Advisors on Science and Technology (PCAST), was issued at a critical moment in the U.S. global warming debate, just 1 week before the White House assembled 200 researchers, business leaders, and government officials for a public conference on the topic. The panel's recommendations are winning high-level attention in the White House, with science adviser Jack Gibbons saying the proposed increases "are reasonable." But even if Clinton gives his blessing, any such increase would face an uphill battle in a skeptical Republican Congress.

The 20-member panel, chaired by John Holdren, Harvard professor of environmental policy, included an array of academicians, industry executives, and environmental representatives with varying views on the global warming threat. There was consensus, however, that the government has failed to invest adequately in new technologies that could benefit U.S. balance of payments and curb air pollution as well as slow the rise of carbon dioxide emissions. "The public," warns the report, "has been lulled into a sense of complacency by a combination of low energy prices and little sense of the connection between energy and the larger economic, environmental, and security issues that people do care very much about." It also calls for the Department of Energy (DOE) to revamp the way it organizes its myriad energy technology efforts.



An energetic response. The Holdren panel wants an across-the-board boost in applied R&D and technology programs at DOE.

DOE is spending nearly $1.3 billion on research on energy efficiency, fission, fusion, fossil fuel, and other programs such as solar and wind power, down from $2.1 billion just 5 years ago in constant dollars. The panel calls for a return to that level by 2003, with a steadily rising budget that would reach $2.4 billion in current dollars. The biggest boost would go for research on advanced efficiency technologies, followed by renewable-energy efforts that could prove particularly fruitful for developing nations. Fusion energy, which has suffered major decreases in the past 3 years, would go up by a third, to $320 million. The panel also calls for U.S. participation in a more modest International Thermonuclear Experimental Reactor project, now estimated at $11.4 billion.

Nuclear fission systems, which decreased dramatically in the 1980s and into the 1990s, would rise by about $40 million to $120 million annually. Coal liquefaction would be phased out to make room for greater efforts to burn coal more efficiently. In addition, the panel calls for DOE to coordinate more closely its basic energy sciences and applied energy technology work, in part by assigning someone to oversee the overall R&D portfolio.

DOE officials say they already are developing advanced technologies to reduce carbon emissions. A 25 September report by five department labs says that such technologies could halt the growth in U.S. energy consumption so that 2010 levels would match those of today and reduce carbon emissions to 1990 levels, although it offers no specific budget to do so.

Panel members expect their advice to get a sympathetic reception within the Administration. Holdren, who says he's "convinced the president has decided to take a leadership role," noted that "no critical words passed the lips" of senior White House officials during a briefing on 27 September, and Daniel Lashof, senior scientist at the Natural Resources Defense Council in New York City and a panel member, says "I would be surprised if [the findings] are not part of Clinton's overall message on global warming."

Indeed, Administration officials are praising the report's conclusions. DOE Secretary Federico Peña said it was an "extremely valuable" contribution in the effort to cope with climate change. Gibbons remarked that "$1 billion ain't that big a number" in the context of an overall energy policy. He added that the PCAST report would be a useful tool in shaping the Administration's 1999 budget request. But one White House official cautioned that tight budgets will make it hard to support an expensive new initiative, and Holdren admits that Congress "is a harder sell."

That's because Republicans have argued that many DOE applied technology efforts—such as nuclear reactor research—should be

undertaken by industry, and they have slashed funding for most energy R&D efforts, including fusion. And DOE, faced with rising costs for managing the nuclear stockpile, the push for an expensive new spallation source for neutron research, and a multibillion-dollar bill for environmental cleanup, can't do much without more funding. "DOE is in a quagmire," says one Republican staffer, who sees congressional purse strings opening only in the unlikely event that Republicans strongly embrace the global warming issue.

Still, Holdren remains hopeful. "We've been seduced by a long period of deficit reduction and budget cutting," he says. "And you can't expect private industry to do it all." And Lashof says the additional funding, while "significant," does not require "a return to [President] Carter-era levels."

–Andrew Lawler

Helping Those Most at Risk

As the world's policy-makers mull options for curbing emissions of carbon dioxide, an influential group of scientists has made a stab at projecting what a warmer planet might mean for everyday life. In its first report on the potential impacts of global warming on a regional scale, the Intergovernmental Panel on Climate Change (IPCC) last week described both possible benefits and harm to people and ecosystems. The goal, say the authors, is to give those countries at greatest risk enough time to take action.

An executive summary of the nearly 600-page "special" report was released last week at an IPCC meeting in the Maldives in the Indian Ocean, one of several island states threatened by rising sea levels. The authors drew upon the IPCC's last major report in 1995—which examined potential effects on ecosystems, human health, fisheries, and agriculture, but only at a global scale—and also incorporated the most recent peer-reviewed research.

The work, requested by the scientific committee of the United Nations Framework on Climate Change as background for the Kyoto meeting, is based mainly on a doubling of carbon dioxide levels, which by 2100 could bring a projected rise of 1 to 3.5 degrees Celsius in mean global temperature and a rise in sea level of 15 to 95 centimeters. It does not generally include the effects of aerosols, which could counteract warming. Because the climate models are very imprecise at a scale as fine as countries, however, the report is careful to describe its findings as "scenarios and projections" rather than "predictions," says climatologist Roger Street of Environment Canada, who co-authored the North America chapter.

The report tells a familiar tale of melting glaciers, shrinking islands, and more frequent extreme weather events like droughts and floods. It says that one-third of the world's forests "likely would undergo major changes in broad vegetation types" and that "entire forest types may disappear" as temperature bands move poleward by 150 to 550 kilometers. The North American tundra-taiga could shrink by two-thirds, becoming a source rather than a sink for CO_2. The number of water-stressed countries, now 19, would likely double by 2025, while the portion of the world's population affected by malaria could increase from 45% to 60% by 2050.

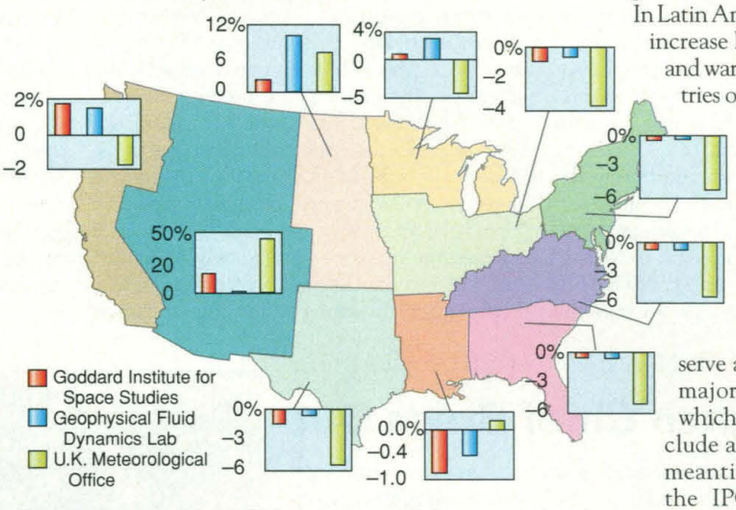
The impact will not be uniform, however. While ice-dependent wildlife at the poles may suffer, "the Arctic Ocean could become a major global trade route," and oil drilling might benefit from less ice. In China, rice yields might drop but wheat yields could rise; in Japan, a 1-meter sea-level rise could threaten half of the country's industrial areas. Up to 95% of European Alpine glaciers could melt, altering water flows and harming tourism, but winter crops may be able to expand northward. For North America, possible benefits include CO_2 fertilization of crops and Western forests and lower heating and snow removal costs. But greenhouse warming may increase heat-related deaths, damage agriculture in the East and South, and destroy 17% to 43% of coastal wetlands if sea levels rise 50 cm.

The report also attempts to estimate the "vulnerability" of each region by combining the climate projections with information on how easily a given region will be able to cope—for example, by switching to new crop varieties or building sea walls. Thus Africa, which is dependent on rain-fed agriculture, is most vulnerable, assuming it remains short of resources to adapt.

In Latin America, climate change may increase health problems, poverty, and war. On the other hand, countries of the former Soviet Union, already in the midst of a major transition, have the chance to alter crops and irrigation systems in ways that would be more compatible with the projected conditions.

The final report, to be issued in December, will serve as a prototype for the next major IPCC report in 2000, which will for the first time include a regional analysis. In the meantime, says Richard Moss of the IPCC's technical unit in Washington, D.C., the report's imprecision shouldn't be an excuse for inaction. "People at this moment in time are looking for the dramatic," says Moss. "But the science isn't there to do that. The real story is, 'This isn't going to be simple. We really need to manage our way through this.' "

–Jocelyn Kaiser



SOURCE: ADAMS *ET AL.*, 1995; IN IPCC SPECIAL REPORT, 1997

Economic uncertainty. Global change models suggest abundant harvests in some regions, offset by disruptions from changing weather and water resource patterns elsewhere.

Britain Stresses Need for Action

Britain's Prime Minister Tony Blair and his chief scientific adviser, population biologist Sir Robert May, fired off a double-barreled shot on global warming last week, aimed at influencing public opinion both at home and abroad. Their comments keep Britain in the forefront of countries seeking binding limits on reducing greenhouse gas emissions below 1990 levels.

Blair, in his first major policy speech to his party since he won office in May, surprised Labour delegates in Brighton by including a mention of the dangers posed by global warming. He took his cue from a report May issued on the same day, outlining his own views on the evidence that greenhouse gas emissions

AP/P. NICHOLLS

L. TINSLEY

Political clout. British Prime Minister Tony Blair *(left)* has endorsed May's report on the need for prompt action.

have the potential to change global climate. May backs the assessments by the Intergovernmental Panel on Climate Change (IPCC) that changes are an inevitable consequence of rising greenhouse gas emissions with potentially enormous environmental impact. "The key thing now is to convince people that it needs immediate action," May told *Science*. Blair endorsed the report by telling his audience: "You should all read it."

May's report also adds ammunition to the effort to persuade the world's skeptics that climate change is a real and serious problem. We need "to press for a solid result in Kyoto," his report says. But even getting politicians on board won't be enough, he says: "Most of the actions will be impossible unless the public in general is persuaded of the need for them."

Mitigation of climate change will require huge efforts in the energy, transport, and construction industries in terms of greater efficiency in production and use, says May. But in the short term, "these can be done with the development of appropriate current technologies," he stresses. The United Kingdom has already pledged to cut greenhouse gas emissions by 20% by 2010, if other countries will agree to similar cuts. As climate change may already be under way, the latest IPCC studies suggest, the need is to act quickly, says May: "As with turning a large ship, there are long lags between actions aimed at leveling off carbon dioxide levels and the levels actually stabilizing. This is a strong argument for early action."

Britain has a special obligation to take the lead in seeking an international consensus, May adds, because of its role in building the scientific basis for such action. "The quality of the U.K.'s contribution to research on climate change, in the broadest sense, is strong out of all proportion to our relative size on research spending," says May. He believes Britain should use its "moral authority" derived from its research and its promise to cut greenhouse gas emissions to help persuade other countries to cut their own emissions. "The U.K. takes these issues very seriously," he says.

–Nigel Williams

NATIONAL INSTITUTES OF HEALTH

AIDS Research Chief Bows Out

William Paul, a preeminent immunologist who oversees one of the largest budgets at the National Institutes of Health (NIH) as head of its Office of AIDS Research (OAR), announced last week that he is stepping aside. "There's never a perfect time to leave, but this is a pretty good one," Paul told *Science*. Paul says he feels he has accomplished much since being appointed to head the OAR in February 1994, and now wants to return to the lab. "Scientifically, I want to come back to a more vigorous approach to my own work," says Paul, who is eager to apply the latest immunological insights to AIDS vaccine research.

When Paul took over the OAR, Congress had just revamped the office (*Science*, 11 March 1994, p. 1364). Heeding the urgings of AIDS activists and researchers—and dismissing the objections of Varmus and other influential critics who were wary of appropriating money by disease rather than by NIH institute—Congress in 1993 gave the OAR broad new authority to oversee NIH's entire AIDS budget, which now stands at $1.5 billion.

RICK KOZAK

Back to the bench. William Paul is resuming AIDS vaccine research.

As part of this congressional mandate, Paul launched an ambitious review of the mammoth program by more than 100 extramural researchers led by Princeton University's Arnold Levine. The gargantuan "Levine Report," which was released in July 1996, "provides a blueprint for restructuring the NIH AIDS science program," Paul notes in a 2 October resignation letter he sent to colleagues. He also takes pride in bringing more attention and money to AIDS vaccine research. One of his ideas, an intramural vaccine research center at NIH, won so much support that President Bill Clinton announced its formation in a speech last May.

Paul's tenure, which he says will end "Novemberish," is winning plaudits even from those initially critical of giving OAR so much power. "Bill has done a great job and his departure is a real loss, but I am grateful to him for serving as long as he has," remarked NIH director Harold Varmus. National Institute of Allergy and Infectious Diseases director Anthony Fauci, who headed the OAR until Paul took over, praises his old friend's record, too. "He's done what he set out to do," says Fauci. AIDS activist Mark Harrington of New York City's Treatment Action Group adds: "Bill gave credibility to the office itself and to the idea that someone could coordinate research across the institutes."

Varmus says NIH is putting together a "high-profile" search committee and "will advertise widely, hoping to find someone with talents approaching Bill's to continue his good work." Varmus adds that he hopes to find a new director within 6 months, so that the person will be ready to testify at next year's congressional appropriations hearings. As for lingering doubts about whether a coordinated approach to AIDS is still needed, Paul says, "AIDS is special. And I hope the day will come when AIDS isn't special. That will mean we've done our job."

–Jon Cohen

Fabulous Sum for a Fearsome Fossil

SOTHEBY'S

Scientists hope to learn more about the lifestyle of history's most notorious predator after the most complete *Tyrannosaurus rex* ever found was auctioned off on Saturday in New York City for a record $7.6 million. The dinosaur tooth marks in her skull and a broken tooth embedded in a rib already tell them the 65-million-year-old *T. rex* was no stranger to combat.

Discovered in South Dakota in 1990, the fossil—dubbed Sue after its discoverer, Sue Hendrickson—was subsequently seized by federal agents. Since then it's been captive to litigation over ownership of the land, which is part of an Indian reservation (*Science*, 19 September, p. 1767). The courts finally ruled that it belonged to Maurice Williams, who will pocket the profit. Its new owner is the Field Museum of Chicago, which will use a donation from McDonald's Corp. to build a fossil-preparation lab where the public can watch scientists at work. Sue is expected to go on display in 2000.