Greenpeace and Science: Oil and Water?

Greenpeace U.K. has hired a director of science and begun an ambitious program of funding scientific research, raising questions about what role advocacy groups should play in science

London

NICHOLAS RIDLEY, Britain's then Minister of the Environment, must have thought he was onto a winner when he was informed that nuclear energy did not contribute to global warming. In December 1988, Ridley seized the moment. "To arrest the greenhouse effect," he announced, "we should concentrate on a massive increase in nuclear generating capacity." But Ridley had chosen the wrong moment to seize: the British branch of Greenpeace was about to appoint geologist Jeremy Leggett as its first director of science. Leggett joined forces with Mick Kelly, a senior researcher at the University of East Anglia—and one of the country's foremost climatologists—and roundly refuted Ridley's sunny view of nuclear power.

Kelly had already conducted research showing that more reliance on nuclear power would not have all that much effect on global warming. The coal-fired generating plants that nuclear plants would replace contribute only a fraction of greenhouse gases, perhaps even less than 10%, according to Kelly's research. Although he acknowledged that that fraction could be eliminated, he argued that greater energy efficiency would constitute a far greater saving of carbon dioxide emissions.

Armed with these data, Leggett sat down to draft copy for an advertisement disputing environment minister Ridley's remarks. On its own, Leggett concedes, the ad probably would have drawn a ho-hum response: "Greenpeace would say that, wouldn't they?" So he hawked it round Britain's leading scientists, doctors, and engineers, 100 of whom—including 16 Fellows of the Royal Society and a clutch of Nobel laureates—signed their names. The result was an ad that made national news. It persuaded many people not only that the Minister was wrong about nuclear power and the greenhouse effect, but also that Greenpeace, previously known more for fearless action than for facts, had come of age.

Behind the appointment of Leggett as the first scientific director of a Greenpeace national organization (there are today 22 Greenpeace affiliates worldwide) was a recognition on the part of the activists within Greenpeace U.K. that some of the environmental issues had become increasingly intricate and dependent on scientific data. "When you're dealing with the greenhouse effect," Leggett says, "it's much more subtle, much more complex, much more multifaceted . . . [than] 'stop the bloody whaling'."

And that recognition has in turn prompted Greenpeace U.K. to take a greater role in funding scientific research. But the specter of an advocacy group like Greenpeace funding science raises stubborn questions. Can an activist organization sponsor unbiased research? Will scientists who take Greenpeace money feel pressure to produce specific results? How will their scientific work be used by the organization?

The answers to some of these questions may well depend on Jeremy Leggett. With his doctorate in geology, Leggett spent 11 years teaching and doing research at Imperial College in London. Early on he discovered that his expertise in stratigraphy and seismology had political ramifications. "I was interested in the arcane business of the construction of caverns for letting off the bomb, which is the only conceivable way you could cheat on the test ban," he says. Based on such broader concerns, Leggett began to try to persuade other academics "to turn their blue-skies expertise into rather serious, militarily relevant expertise." His first success came in convincing scientists already involved with satellites to investigate the outlook for using remote sensing to monitor the test ban treaty. Indeed, Leggett created and became director of the Verification Technology Information Centre, funded by the Rowntree Trust.

So when Greenpeace went looking for a director of science who combined academic expertise with the ability to absorb and communicate abstruse information, Leggett was ready. As he puts it: "I didn't fall out of love with the subject I was teaching, nor with my job, but at the risk of being corny, it was very much time to stand up and be counted."

Part of standing up and being counted is providing ammunition—in the form of scientific data—for Greenpeace campaigns. Those data come partly from a new fund—the Greenpeace Educational Trust—set up, among other things, to fund research. The trust is a charity separate from the advocacy organization; as a result it enjoys certain tax advantages, but it cannot conduct campaigns. The trust hopes to raise money from the public beyond what Greenpeace U.K. already gets—£7 million ($12 million) last year—and spend it on research and education.

Science chief. *Jeremy Leggett, who was appointed first scientific director of Greenpeace U.K.*

The first beneficiary of this new scientific largesse—to the tune of £40,000 ($68,000) a year—is Jenny Nelson of Imperial College. Nelson is a research assistant to Keith Barnham, senior lecturer in physics at Imperial College, who leads a group working on solar cells. Nelson is the theoretician of the group, which is focusing on layered semiconductors. These materials, developed within the past 5 to 10 years, consist of alternating films of two different kinds of semiconductor. Like ordinary semiconductors, they are photovoltaic; that is, they convert light into electricity. The group's goal is a new kind of solar cell with a higher efficiency than is possible with ordinary solar cells.

And this goal represents Greenpeace's own political and scientific agenda. The energy es-

tablishment in Britain has generally dismissed the idea that solar cells could make a useful contribution to energy needs; as a result there has been little funding for solar energy and for renewable resources in general. Referring to Greenpeace, Barnham says of his work on solar cells: "There are no other sources of funding in the U.S. or the U.K." The figures seem to bear him out. Britain spends only 5.74% of its energy budget on renewable sources, third lowest of the developed countries. The United States spends 6.08%; when Barnham applied in the United States, he came away empty handed.

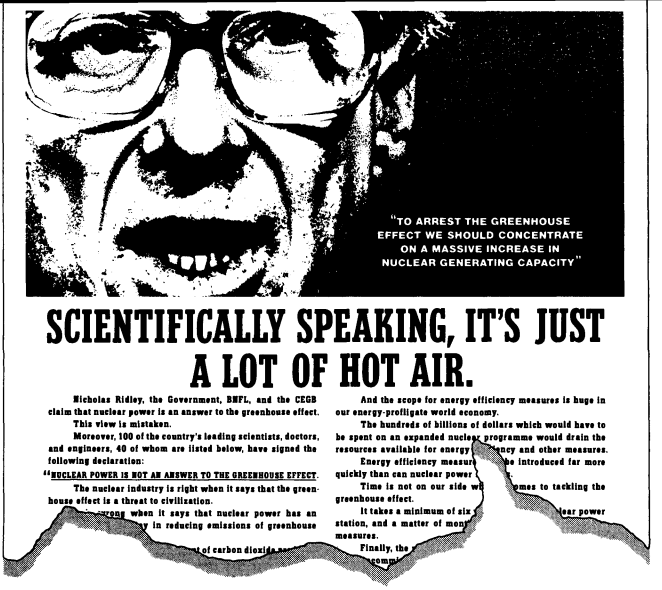
Yet Nelson and Barnham, with the aid of Greenpeace money, are out to prove that the establishment is wrong. The best available solar cells today convert 30% of the energy they capture. But Barnham has calculated that if he can come up with a solar cell that reaches 50% efficiency, the average British household could obtain all its energy needs apart from space heating from a solar panel of 2 square meters.

Nelson's grant is only the forerunner of a much more ambitious research program that will soon be realized by the Greenpeace Educational Trust. Plans are well advanced to fund at least four more projects, each at a different university. And although the final determination has not yet been made, the other projects Greenpeace funds will likely have the same antiestablishment edge as the grant given to Nelson. What is more, political criteria may also be applied in denying the funding. For example, Greenpeace will not fund research on cleaning up toxic or nuclear wastes because they feel that kind of work forestalls thinking about how to get rid of the industrial processes that produce the waste.

This kind of avowedly political research program poses a challenge to Leggett: Can he conduct the program in such a way that even his opponents admit the accuracy of the research Greenpeace supports? Or will the research be perceived as biased because of where the money comes from? And even beyond the question of the quality of the science, will the results be misused or overstated in the service of advocacy?

There does seem to be general agreement, both among scientists who take money from Greenpeace and in the wider scientific community, that there will be little pressure to produce results that support a particular point of view. The only people who seem to doubt the scientific quality of the work Greenpeace is beginning to do are its targets—some of whom admit that they aren't precisely neutral. Doug McRoberts, a spokesman for the U.K. Atomic Energy Authority, said of Greenpeace's reporting of research results: "Sometimes it seems to go way over the top." But, he added, "I suppose our views would be colored." And Lord Marshall, formerly chief scientist at the Department of Energy, later chairman of the Central Electricity Generating Board, and a staunch advocate of nuclear power, said in his view research by Greenpeace was "not very deep, usually rather shallow."

"If Greenpeace wants to win my respect," Marshall said, "they should do research and publish it in professional journals that can be refereed and reviewed."



In the public prints. *Ad written by Leggett blasting Nicholas Ridley, then U.K. Minister of the Environment.*

Ironically, Leggett agrees. He had himself concluded that refereeing is part of the key to enhancing the credibility of Greenpeace science. And since those who accept Greenpeace funding are well aware that they may be perceived by the outside world as mere advocates—and that, as Mick Kelly says, science supported by Greenpeace may be dismissed as sloppy or biased—Leggett has mandated that every publication, in-house or from external consultants, goes through a refereeing mill he claims is more thorough than that at most journals.

Part of this is simply self-protection. Factual errors in their scientific data would no doubt make Greenpeace activists look silly. "The price for making mistakes on serious issues these days is very high," says Leggett. And Kelly expresses pleasure in the fact that Greenpeace does a thorough job of peer review, a process that he calls "doubly important" in controversial matters.

Beyond organizational self-protection, though, the policy of outside review also protects those who undertake work for Greenpeace. "When working for any organization my position as a scientist is protected by honest publication," Kelly says. And many scientists who have no particular ties to Greenpeace seem convinced of that. "There is no danger of [researchers] finding results to please Greenpeace," according to Nicholas Kurti. A professor of physics at Oxford, Kurti signed the anti-Ridley ad Leggett dreamed up, but he hasn't received any money from the group.

But if there is general agreement that both Greenpeace as a group and the scientists who take money from them have too much at stake to fudge their results, there is concern about the uses to which those results may be put. Jim Bridges, professor of toxicology at the University of Surrey and director of the Robens Institute, a unit specializing in health and safety, says that sometimes the Greenpeace reports contain "political statements that I would find it a little hard to justify." Kurti adds that "occasionally their zeal gets away with them."

In spite of his slightly raised eyebrow, Bridges sees nothing wrong with accepting funding from advocacy groups. Although he personally has not worked with Greenpeace, he has carried out studies for Friends of the Earth, and among his staff of 120 there are almost certainly some who have worked for Greenpeace, he says—along with just about every other group that is giving out funds. Bridges says of his unit: "We establish our independence by working for all sides."

Bridges also raises a question that several other scientists brought up in discussions with *Science* about Greenpeace: the fact that there are few totally "neutral" sources of funding. "Isn't government a political advocacy group?" Bridges asks. By government, he means agencies like the Department of Energy which are part of the administration, and only to a lesser extent the research councils, which get their money from government but are less constrained in how they spend it.

Bridges acknowledges that sometimes when advocacy groups provide funding "it's very obvious what they want, and if they don't get it they suppress or edit the report." But Tim O'Riordan, senior researcher at the School of Environmental Sciences at the University of East Anglia, thinks suppression is a threat no matter who commissions the report. He cites a case in which the Department of Energy commissioned a report that demonstrated that energy conservation is extremely cost-effective—but never published it because that conclusion ran

counter to orthodoxy in the department.

O'Riordan, who hasn't received money from Greenpeace, but has from Friends of the Earth, thinks that these organizations are simply adding a useful counterweight in an arena that is already full of interest groups supporting scientific research. "It's done by the Central Electricity Generating Board, by the forestry agencies, the tobacco industry," he says. "Greenpeace and bodies like it have a considerable role to play in what you might call counter-intuitive science, which it is not in the established bodies' interest to fund," O'Riordan says.

And even a crusty old Greenpeace opponent like Lord Marshall sees a role for them. "In principle, nagging organizations like Greenpeace or Friends of the Earth could do a very good job. They could act as a conscience." They could also, Marshall adds, act as a stimulus, because "government and big organizations have a lot of inertia."

So a picture begins to emerge of Greenpeace science not as biased and therefore worthless, but as simply one among many brands of science that are being put at the service of advocacy of various kinds.

But that leaves one final question: Is this science in the name of advocacy doing any good? Leggett says yes. He points to a new respect for Greenpeace in the press and among working scientists. He also believes that stunts such as his ad opposing Ridley have led to a softening of comments on the part of the Atomic Energy Authority. "I think we caused a retreat," he said.

A spokesman for the authority, however, demurred: "I don't think I'd go along with that," he said. And so, as is appropriate for a forum in which science and politics are combined, the debate goes on.

■ JEREMY CHERFAS

Academy of Engineering Elects New Members

The National Academy of Engineering has elected 80 new members (one posthumously) and 7 foreign associates. This brings the U.S. membership total to 1535 and the foreign associates total to 126.

Thomas R. Anthony, General Electric Corporate Research and Development Center; **Minoru S. Araki,** Lockheed Missiles and Space Systems Group; **William J. Bailey** (elected posthumously), University of Maryland, College Park; **Earl E. Bakken,** Medtronic Inc., Minneapolis; **Robert R. Beebe,** Homestake Mining Co., San Francisco; **Richard E. Blahut,** IBM Corp.; **Gary L. Borman,** University of Wisconsin, Madison; **Donald A. Brand,** ENCON, Pacific Gas & Electric Co.; **Robert D. Burnham,** Amoco Research Corp.; **James D. Callen,** University of Wisconsin, Madison; **Richard M. Carlson,** NASA Ames Research Center; **Kenneth E. Case,** Oklahoma State University, Stillwater; **Nai Y. Chen,** Mobil Research and Development Corp.; **William A. Clevenger,** Woodward-Clyde Consultants, Sequim, WA; **Gerald W. Clough,** Virginia Polytechnic Institute and State University, Blacksburg; **James M. Coleman,** Louisiana State University, Baton Rouge; **Robert E. Collin,** Case Western Reserve University; **Harry M. Conger,** Homestake Mining Co.; **Harry E. Cook,** Chrysler Motors Corp.; **Michael L. Dertouzos,** Massachusetts Institute of Technology.

Frederick H. Dill, IBM Corp.; **Irwin Dorros,** Bell Communications Research, Inc.; **Alan B. Fowler,** IBM Thomas J. Watson Research Center; **Judson C. French,** National Institute of Standards and Technology; **Norman A. Gjostein,** Ford Motor Co.; **George J. Gleghorn,** TRW Space & Technology Group; **Lawrence R. Glosten,** The Glosten Associates, Inc., Seattle, WA; **William B. Gogarty,** consultant, Littleton, CO; **William C. Goins, Jr.,** O'Brien-Goins-Simpson & Associates, Inc., Houston, TX; **Marvin E. Goldstein,** NASA Lewis Research Center; **Gene H. Golub,** Stanford University; **Earl E. Gossard,** University of Colorado, Boulder; **William W. Graessley,** Princeton University; **Paul R. Gray,** University of California, Berkeley; **Arthur H. Heuer,** Case Western Reserve University; **Harry J. Hillaker,** General Dynamics Corp.; **John C. Houbolt,** Eagle Engineering Inc., Hampton, VA; **Stephen C. Jacobsen,** University of Utah, Salt Lake City; **Charles C. Johnson, Jr.,** C. C. Johnson & Associates, Inc., Silver Spring, MD; **Daniel D. Joseph,** University of Minnesota, Minneapolis.

Charles K. Kao, Chinese University of Hong Kong, Shatin; **Ken Kennedy,** Rice University; **Robert H. Kingston,** Massachusetts Institute of Technology; **Edwin E. Kintner,** GPU Corp., Parsippany, NJ; **James Lago,** Merck & Co., Inc., Rahway, NJ; **Norman N. Li,** Allied-Signal Laboratory for Separation Science & Technology, Des Plaines, IL; **Tung-Hua Lin,** University of California, Los Angeles; **Alan S. Manne,** Stanford University; **Albert R. Marschall,** Parsons Brinckerhoff Inc., New York City; **James F. Mathis,** New Jersey Commission on Science and Technology, Trenton; **Adolf D. May,** University of California, Berkeley; **David G. Messerschmitt,** University of California, Berkeley; **Keith K. Millheim,** Amoco Production Co.; **Stuart O. Nelson,** U.S. Department of Agriculture, Athens, GA; **Franklin F. Offner,** Northwestern University; **Bradford W. Parkinson,** Stanford University; **Arno A. Penzias,** AT&T Bell Laboratories; **Dennis J. Picard,** Raytheon Co., Bedford, MA; **Frank E. Pickering,** General Electric Aircraft Engine Group; **William R. Prindle,** Corning Glass Works.

Edwin P. Przybylowicz, Eastman Kodak Co.; **Ronald L. Rivest,** Massachusetts Institute of Technology; **Larry A. Roesner,** Camp Dresser and McKee Inc., Maitland, FL; **Robert K. Roney,** Hughes Aircraft Co.; **Murray W. Rosenthal,** Oak Ridge National Laboratory; **Herbert B. Rothman,** Weidlinger Associates, Inc., New York City; **Eli Ruckenstein,** State University of New York, Buffalo; **T. W. Fraser Russell,** University of Delaware, Newark; **Gavriel Salvendy,** Purdue University; **Norman R. Scott,** Cornell University; **Thor L. Smith,** IBM Almaden Research Center; **Robert C. Stempel,** General Motors Corp.; **John H. Sununu,** The White House, Washington, DC; **Herbert L. Toor,** Carnegie Mellon University; **Charles E. Treanor,** Calspan-UB Research Center, Buffalo, NY; **Walter K. Victor,** Jet Propulsion Laboratory; **William L. Wearly,** Ingersoll-Rand Co., Greenwich, CT; **Eugene P. Wilkinson,** independent consultant, Delmar, CA; **David A. Woolhiser,** U.S. Department of Agriculture Research Service, Tucson, AZ; **Loring A. Wyllie, Jr.,** H. J. Degenkolb Associates, Engineers, San Francisco, CA.

The new foreign associates are:

Zhores I. Alferov, director, A. F. Ioffe Physico-Technical Institute, Leningrad, U.S.S.R.; **Michael F. Ashby,** Royal Society Research Professor, Cambridge University, Cambridge, England; **John W. Fairclough,** chief science adviser to the Prime Minister's Office, London, England; **Roger Lacroix,** consulting engineer, Paris, France; **Ryoichi Nakagawa,** senior technical adviser, Nissan Motor Co., Ltd., Tokyo, Japan; **Adrian W. Roth,** vice president and founding member, Swiss Academy of Engineering Sciences, Zurich; **Dianzuo Wang,** president, Central-South University of Technology, Hunan, People's Republic of China.