

CO₂: How Will We Spell Relief?

By JANET RALOFF

Concern over greenhouse warming generates innovative 'releaf' strategies

On Oct. 11, a small electric utility set an environmental precedent. In announcing it would help finance the planting of 50 million trees in faraway Guatemala, Applied Energy Services of Arlington, Va., became the first company to take direct responsibility for offsetting the global consequences of the carbon dioxide (CO₂) that will be emitted by a fossil-fueled power plant it's building. The move also highlights what may be a cost-effective first step in helping to counter the greenhouse effect.

The greenhouse effect results when certain gases, particularly carbon dioxide, increasingly trap heat that would otherwise radiate into space (SN: 4/30/88, p.282). Interest in such a global climatic warming has soared of late. It stimulated recent congressional hearings and at least one new law, and it served as the primary focus of last June's World Conference on the Changing Atmosphere, a scientific meeting in Toronto, and the International Geosphere-Biosphere Programme's scientific advisory council meeting in Stockholm last October. The U.S. Department of Energy plans to release four studies on greenhouse issues and carbon dioxide within the next year, and the Environmental Protection Agency is finishing a major new assessment on the potential U.S. effects of global climatic change.

Weather is driving much of the current interest in greenhouse warming. As temperature records rise, so does public interest in slowing the buildup of carbon dioxide and other greenhouse gases. The 1980s have accounted for the five warmest years in the history of global measurements, and 1988 may extend this to six. Though final figures aren't in yet, as of Nov. 1 this has been the hottest year in recorded history, says James Hansen at NASA's Goddard Institute for Space Studies in New York City. Although this year's heat may simply represent random climate variability, he says, the fact remains that "the Earth has been getting warmer for some time." And, he contends, "the greenhouse effect is already responsible for changing the probability of extreme events — such as hot summers."

Continued greenhouse warming will eventually create significant climate changes and harm agriculture, industry and water resources while inundating low-lying coastal areas, Hansen and other atmospheric scientists warn. Higher global temperatures raise sea levels by melting polar ice caps and by causing thermal expansion of water in the

upper ocean.

Before the Industrial Revolution, atmospheric CO₂ levels remained fairly constant at about 280 parts per million (ppm). But combustion-driven industrialization and, more recently, global deforestation have helped increase those concentrations to about 345 ppm. And the level is rising roughly 0.4 percent annually. Fossil-fuel burning accounts for about 75 percent of current emissions, deforestation for most of the rest.

The United States leads the world in fossil-fuel emissions, now spewing out some 1.2 billion metric tons of carbon (CO₂ emissions are conventionally measured in terms of their carbon). That's almost one-quarter of the 5.5 billion tons emitted globally. The Soviet Union and China together contribute 33 percent of global CO₂ emissions; Western Europe and Japan combined emit 23 percent.

Hoping it's not too late to head off some of the greenhouse effect's most dire consequences, scientists worldwide are investigating policies and technologies aimed at curbing carbon dioxide's atmospheric buildup. As they respire, green plants take in CO₂, release oxygen and store carbon. Several research teams are exploring what it would take to increase natural CO₂ removal by forests — the planet's largest CO₂ filtering system.

Releaf efforts

Applied Energy Services has three small, coal-fired power plants in operation. As the company worked on constructing two additional plants and planning three more, "this greenhouse thing just kept coming up," recalls Roger Sant, the utility's chief executive officer and a former Energy Department official. Sant decided the company "ought to try and do something" about its emissions and contacted the World Resources Institute for help.

Trees planted anywhere would provide the same CO₂ benefit, because the aim is to take up the gas in the lower atmosphere, before it rises to do harm. But the Institute's screening panel looked specifically for projects in developing countries where deforestation is rampant. It selected a project proposed by CARE Inc., an international relief and development agency. Over 10 years, CARE plans to plant enough trees to remove 15 million metric tons of carbon — the amount Applied Energy Services' new 180-megawatt coal-fired plant in Un-

casville, Conn., will emit as carbon dioxide over its 40-year operating life.

As valuable as the program may prove, it's not cheap. Besides the utility's \$2 million endowment, CARE and the U.S. Agency for International Development each will offer \$2 million as cash or "in-kind" financing. The Guatemalan government will contribute \$1.2 million. And the services and training of the 35 Peace Corps volunteers who will work on the project are valued at \$7.5 million.

Daniel Dudek of the Environmental Defense Fund in New York City lauds the company's pioneering effort, but adds: "I think it will be hard to expect the American public or utilities to make many investments in Brazil or Guatemala when they could be made at home." So he's investigating domestic tree planting.

An economic analysis Dudek presented to Congress in September reports that U.S. utilities could offset 10 years'

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Short Rotation Woody Crops Program, Oak Ridge National Lab

The roots of silver maples in this Kansas plot are 9 years old, the regrown above-ground stems just 4 years old. Scientists are studying how often to harvest a fast-growing tree's above-ground growth to maximize its CO₂ fixation.

worth of carbon dioxide emissions from their new coal-fired power plants — or 3 percent of total U.S. CO₂ emissions — by planting 10 million acres of trees. This is an area twice the size of New Jersey but would take up less than a quarter of the highly erodible cropland to be set aside by 1990 under the U.S. Agriculture Department's Conservation Reserve Program. If utilities were to lease areas set aside under the program, Dudek calculates, it could cost them as little as 70 cents per ton of CO₂ emissions "removed." Using other rural lands not benefiting from this subsidy might double the costs.

But even that seems inexpensive when compared with the alternatives, his study suggests. Planting urban shade trees to reduce home energy needs and take in carbon dioxide (SN: 5/7/88, p.296) would cost \$1.49 to \$7.43 per ton of carbon dioxide removed, he says, and introducing a whole range of other measures to reduce energy use — and therefore carbon dioxide emissions — could cost the equivalent of \$12.30 to \$18.45 per ton of coal emissions eliminated. And while it's possible to "scrub" carbon dioxide from power plant smokestacks, Dudek says these more expensive technologies would triple or sextuple electric-generating costs. Meyer Steinberg at Brookhaven National Laboratory in Upton, N.Y., who has also examined the costs of CO₂ scrubbing, puts the price lower — perhaps just a doubling in the cost of electricity.

However, Steinberg adds, this estimate assumes the ability to pipeline liquid carbon dioxide and dump it 100 miles out to sea. Although the technology exists, "you don't know what it's going to do to the ecology," he says. The 1986 Lake Nyos incident in Cameroon (SN: 6/20/87, p.388) killed more than 1,700 people when unusual natural events caused the waters to belch up a toxic carbon dioxide cloud. Steinberg says no one knows whether volcanic activity on the ocean floor might not "all at once burp up the carbon dioxide [being stored there], asphyxiating much of the world."

Forests or just trees?

While tree planting can be a first step in attacking the carbon dioxide problem, most people don't realize that "what we're talking about will not look like conventional forests," says Gregg Marland. For the past 10 years, this Oak Ridge (Tenn.) National Laboratory scientist has studied the potential of CO₂-relief strategies. To get high carbon dioxide uptake, he finds, "we end up talking about something that looks more like an agricultural crop than a grove of stately Douglas firs." Trees dynamically affect the carbon balance when they are actively growing. Though California's giant redwoods are a major carbon repository, they are almost

useless in sopping up newly generated CO₂, because their collective growth rate "is about zero," Marland notes.

How much of the problem can trees handle? A family of four wishing to offset its share of carbon dioxide emissions would have to plant about 6 acres of fast-growing trees, Marland's data indicate; utilities would need a 30-mile-diameter stand of trees to offset the emissions from each 1,000-megawatt coal-fired power plant. And offsetting current global CO₂ emissions with trees alone would require doubling the growth rate of all the world's forests, or planting fast-growing forests over an area equivalent to that deforested globally to date.

Economic relief

Because of its massive tree-clearing efforts, Brazil currently ranks third in carbon dioxide emissions, according to David A. Wirth of the New York City-based Natural Resources Defense Council. Other developing nations also destroy substantial portions of their tree canopy each year. And industrial nations contribute to the destruction in developing countries, Wirth says, through trade policies that create incentives for unsustainable tree cutting.

One such policy is the importation of beef from Brazilian ranches, largely for fast-food franchises. Studies show these ranches are economically unsound (SN: 6/4/88, p.366) and a leading cause of forest clearing. Wirth argues that by changing some trade policies, the United States and other importers of Third World products could help preserve forest canopies far from home.

Wirth also argues that industrial nations, as major shareholders in the World Bank, could require that the Bank's loans do more to conserve existing forests and create new ones. The World Bank is a major financing source for Third World projects.

Because many Third World countries lack the means to repay their loans, much of their debt can never be paid off, contends Henry R. Breck, an independent investment banker in New York City and a trustee of the Natural Resources Defense Council. Moreover, he argued during a Senate subcommittee hearing in September, it may not be in the environmental interests of the lending nations to have these debts paid off if the funds can only come from energy and land-use practices that increase CO₂ emissions.

He recommends the World Bank reduce or forgive some loans in exchange for new CO₂-reducing practices. However, he notes, some areas — like sub-Saharan Africa — "may have nothing to trade." With much of their debt already rescheduled or canceled and their poverty endemic, he says, "the only way we can ensure that sound, effective environmental practices are followed . . . is to make new money, probably on an annual basis,

a condition of following [CO₂-limiting] practices."

In Latin America, where commercial banks hold much of the debt, other economic tools might be needed — such as tax breaks for banks that swap loans for CO₂ conservation, Breck adds.

Beyond relief

Most environmentalists agree that trees alone won't save Earth from a climate change. Emissions from fossil fuels are greater than anyone can reasonably expect tree planting to offset. That's why many analysts, including Sandra Postel and Lori Heise of the Washington, D.C.-based Worldwatch Institute, argue that boosting energy efficiency and adopting fossil-fuel alternatives "will buy the greatest degree of climate insurance for the dollar."

Several bills have been drafted recently to encourage that shift from fossil fuels. One of the most ambitious, authored by Sen. Timothy Wirth (D-Colo.), would seek to reduce U.S. carbon dioxide emissions 20 percent by the year 2000 and fund research into new CO₂-mitigating technologies — from wind power and hydrogen fuel cells to advanced nuclear reactors.

A report issued in November by Renew America, a project of the Washington, D.C.-based Fund for Renewable Energy and the Environment, gives a state-by-state breakdown of carbon dioxide emissions from use of coal, oil, natural gas and motor vehicles; carbon emissions from residential/industrial/commercial sources; forest cover; and the availability of programs to encourage energy efficiency, discourage acid rain emissions or restrict emissions of chlorofluorocarbons and methane, two other classes of greenhouse pollutants.

"With 5 percent of the world's population, the United States is responsible for roughly 20 percent of [carbon dioxide's] global greenhouse effect," says Tina Hobson, Renew America's executive director. While federal action to deal with the problem can serve as a model for other nations, she says, there is "an important role for the states" — largely through implementing federal environmental protection laws, pioneering creative ways to encourage energy conservation, and helping individuals make environmentally sound choices.

The worst course, most greenhouse experts say, is to do nothing. And that's why Oak Ridge's Gregg Marland is so impressed by Applied Energy Services' Guatemalan project. "To a certain extent, it's symbolic," Marland says, "but it's also courageous." The World Resource Institute's Gus Speth agrees. Deciding to do something about the carbon dioxide problem — before any law requires it — "is one of the most farsighted and socially responsible decisions a private company has ever made," he says. □