

THE CLIMATE REPORT



Video News About Global Warming

"The balance of evidence suggests a discernible human influence on global climate."

Intergovernmental Panel on Climate Change

Two thousand five hundred of the world's leading atmospheric scientists participating in the United Nations Intergovernmental Panel on Climate Change have concluded that "the balance of evidence suggests a discernable human influence on global climate." Scientists predict global warming may lead to:

- *more intense heat wave
- *spreading infectious diseases
- *more intense tropical storms
- *changing weather patterns
- *sea level rise

What is the Climate Report?

The Climate Report is a video news series relying on authoritative science from the Intergovernmental Panel on Climate Change (IPCC) Report on global warming and how it will affect our health and the environment. This Report provides an opportunity to educate viewers about the interrelationship between weather, environment, and pollution.

The Climate Report features stunning new graphics, narration by Ira Flatow of National Public Radio, and interviews with leading IPCC scientists and other experts, including:

Dr. Dan Albritton, NOAA Aeronomy Laboratory
Dr. Tom Karl, Senior Scientist, National Climate Data Center
Dr. Jerry Mahlman, NOAA Geophysical Fluid Dynamics Laboratory

Dr. Rita Colwell, University of Maryland Biotechnology Institute and President of the American Academy for the Advancement of Sciences,
Dr. Paul Epstein, Harvard University Medical School
Dr. Larry Kalkstein, Director, Center for Climatic Research, University of Delaware
Dr. Stephen Leatherman, Director, Laboratory for Coastal Research, University of Maryland

The broadcast-ready Climate Report consists of six two to three minute segments and is available FREE to broadcast meteorologists and weathercasters nationwide. The Report, including selected quotes and stills, is summarized in this brochure.

SEGMENT 1: IS GLOBAL WARMING REAL?

Dr. Dan Albritton
Dr. Tom Karl
Dr. Jerry Mahlman

"... scientists are saying, after careful study ... that the first signs of human influence on climate may just now be emerging."

Dr. Dan Albritton,
NOAA Aeronomy
Laboratory



The burning of fossil fuels -- oil, coal, and gas -- in cars, trucks, and power plants is causing carbon dioxide (CO₂) and other greenhouse gases to build up in the atmosphere. These gases act like a blanket, trapping heat and warming the planet.

Over the last century, we have added enough greenhouse gases to the atmosphere to warm the planet.

"... the most convincing argument is just taking a look at the temperature record and showing that temperatures increased by about a degree Fahrenheit on a global basis."

Dr. Tom Karl, Senior Scientist, National
Climate Data Center

Now, the IPCC predicts that over the next century the global average temperature will rise between 2 and 6 degrees Fahrenheit. This may not seem like a big change, but consider that the temperature has risen only 5 to 9 degrees Fahrenheit since the end of the last ice age 10,000 years ago.

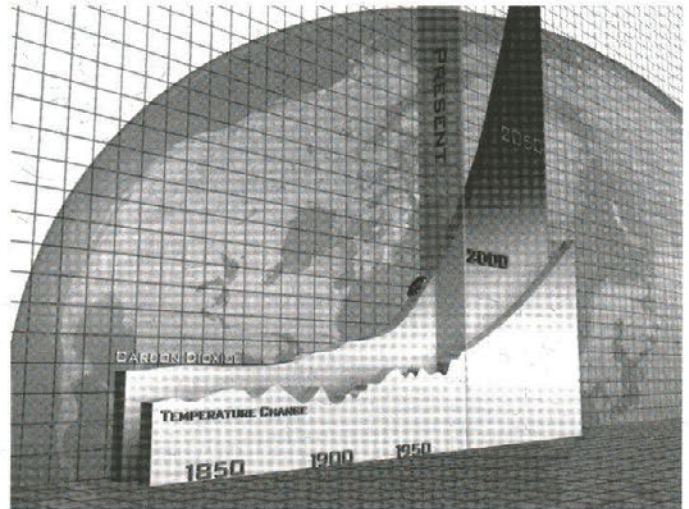
SEGMENT 2: WHAT CAUSES GLOBAL WARMING AND HOW WILL IT AFFECT WEATHER?

Dr. Tom Karl
Dr. Dan Albritton
Dr. Jerry Mahlman

Pollution is causing CO₂, the prime greenhouse gas, to build up in the atmosphere at alarming rates. Scientists monitor carbon dioxide levels in the atmosphere. They also have reliable temperature records dating back to the 1850s. These records show that as CO₂ levels have risen so has the average temperature.

The level of CO₂ in the atmosphere is already 30% higher than it was 100 years ago. Scientists predict that we are well on the way to a dangerous doubling of CO₂ levels in the atmosphere.

Global warming threatens the climate and will change the weather. It will affect mid-continental areas such as the



Midwest of the United States, causing summers to be warmer and dryer than they are now.

Rainfall patterns are already beginning to change in the U.S.

"... we're finding that the proportion of total annual precipitation from extreme precipitation events has increased significantly."

Dr. Tom Karl, Senior Scientist,
National Climate Data Center



While the combination of warmer, dryer weather could mean more severe droughts. More intense rainfall can lead to more flooding.

In the Climate Report, scientists predict that climate change will mean more intense storms. Those living along our coasts could see storm damage increase as more intense storms combine with higher sea levels.

SEGMENT 3: WILL GLOBAL WARMING FLOOD OUR COASTS?

Dr. Jerry Mahlman
Dr. Stephen Leatherman
Frank Nutter, Reinsurance Association of America

Global warming will cause sea level to rise threatening our coasts. The IPCC projects sea level will rise 2 feet over the next century, four times faster than it has over the past century. A 6 inch rise in sea level could cause 100 feet of erosion to beaches and coasts, flooding wetlands, homes, and threatening fresh drinking water supplies.

Global warming will warm the oceans. The Climate Report illustrates how warmer water will take up more space and expand over beaches and other coastal areas. More intense storms expected with global warming will combine with higher seas, exacerbating damage to shorelines and buildings.

"The barrier islands along the Atlantic and Gulf Coasts of the U.S. are going to be the most impacted by global warming and sea level rise both through increased erosion and storm flooding."

Dr. Stephen Leatherman, University of Maryland

Climate change will not only erode beaches and damage coasts. It will affect property insurance rates. In this Report, Frank Nutter of the Reinsurance Association of America says that climate change has already raised property insurance rates in areas at risk of sea level rise.



SEGMENT 4: WILL GLOBAL WARMING MEAN MORE KILLER HEAT WAVES?

Dr. Larry Kalkstein
Dr. Tom Karl

"Climate change is likely to have wide-ranging and mostly adverse impacts on human health, with significant loss of life."

Intergovernmental Panel on Climate Change

The 1995 summer heat wave in the Midwest serves as a warning of what a warmer future may bring. The prolonged stretch of very hot days in Chicago was made worse by nighttime temperatures that stayed in the 80s (degrees F) for two consecutive days. It was this deadly combination that killed over 650 people.

The IPCC predicts that we will see increased mortality and illness as heat waves become more intense and last longer.

SEGMENT 5: WILL GLOBAL WARMING BRING EPIDEMICS?

According to the IPCC, global warming will expand the ranges of many infectious diseases such as malaria, dengue fever, and cholera. As the world warms, the rodents and



mosquitos that carry diseases will move into new areas, exposing new populations to these life-threatening illnesses.

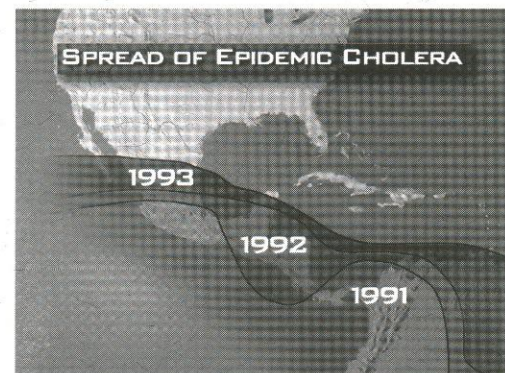
"We are seeing changes in mosquito borne diseases, rodent borne diseases that are consistent with that gradual warming and the increase in extreme events."

Dr. Paul Epstein, Harvard Medical School



The summer of 1995 saw dengue fever break out in Texas. Mosquitos carrying dengue fever could spread further north with warmer temperatures.

The Climate Report illustrates how cholera, another deadly disease that spreads with warmer temperatures, migrated northward between 1991 and 1993 through Central America and Mexico toward Texas.



SEGMENT 6: WHAT CAN WE DO ABOUT GLOBAL WARMING

Dan Lashof, Natural Resources Defense Council
Dan Becker, Sierra Club

The bad news is that global warming threatens our health and our environment.

The good news is we can curb global warming. Two-thirds of the CO₂ emitted in the U.S. comes from power plants, cars, and light trucks. We can take steps now that will slash greenhouse gas emissions and save money at the same time.

The Climate Report illustrates how we can cut our energy use and save money.

- °use compact fluorescent bulbs
- °purchase more efficient home appliances
- °insulate our homes

Power plants must pollute less.

- °use cleaner fuels to provide electricity to our homes and offices and switch to renewable wind and solar energy

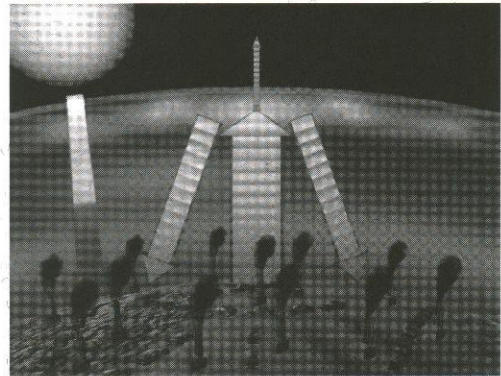
We can also cut pollution from our cars and light trucks. The average car or minivan gets 20 mpg and will pump 50 tons of CO₂ into the atmosphere over its lifetime. We can start to cut these emissions by driving less.

- °combine trips
- °take a bus or train
- °carpool
- °bike or walk

But, the biggest single step we can take to curb global warming and save money is to make our cars, minivans and other light trucks go further on a gallon of gas.

°We can raise miles per gallon (CAFE) standards. This will require anti-pollution technology that is available today to be put on cars and light trucks. We can safely make these changes.

This Report concludes with the observation that humans have the ability to change the climate, but we also have the ability to alter our actions to protect it.



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Elements of an International Agreement on Global Warming, February, 1997

In 1995, scientists found that human activities are having a "discernible influence on global climate." Pollution, including "greenhouse gases" -- carbon dioxide (CO₂), methane, and others -- from burning coal and oil to produce electricity, drive cars, fly airplanes, and grow food, is piling up in the atmosphere, where it warms the Earth by trapping heat that would otherwise radiate into space. Greenhouse gases emitted today will affect Earth's climate for centuries. The Earth has already warmed about 0.5 degrees Centigrade (C.) in the past 100 years. Sea level is rising, glaciers are retreating, and over the past several decades, much of the United States has experienced above-normal temperatures and more intense rain and snow storms. Scientists link these changes at least in part to greenhouse gas pollution.

Unchecked, this pollution will subject societies to a vast and potentially dangerous experiment: a world warmer, and warming faster, than at any time in the past 10,000 years. Continued climate change could expand the range of tropical diseases, cause more severe storms and coastal flooding, reduce agricultural productivity in vulnerable regions, and threaten the survival of many plants and animals. In the western U.S., economically critical water supplies will be altered. In the eastern U.S., valuable coastal real estate and treasured forests will be damaged. If pollution curbs do not begin soon, it may not be possible to prevent a dangerous climate change.

Every country produces greenhouse gas pollution, imports or exports fossil fuels, and will be adversely affected by climate change. No one country can significantly slow global warming. In 1992, 160 nations adopted the United Nations Framework Convention on Climate Change. The Rio Treaty requires each country to track its greenhouse pollution, and asks industrialized countries - who have polluted the most - to take the first step in controlling the problem by voluntarily limiting their greenhouse gas emissions. But the Rio Treaty hasn't worked: most nations are polluting more now than before, and pollution is increasing rapidly in industrialized and developing countries. Nations will regroup in Kyoto, Japan, in December 1997 to try again.

What will the nations decide at Kyoto? EDF proposes that they adopt *legally binding pollution "budgets,"* starting soon enough and set low enough to keep the *rate and amount of warming* within environmental limits. Nations and businesses that cut pollution below budget should be able to bank the extra reductions, apply them to future budgets, or sell them. The budget agreement should spur pollution reduction, forest planting on degraded lands to absorb greenhouse gases, and protection of regions of high biodiversity that store CO₂. The agreement should encourage the maximum participation of industrialized and developing nations, provide competitive opportunities for innovative businesses to develop and market emissions-reducing technologies, and include effective compliance and enforcement mechanisms. These elements would give nations and businesses incentives to begin reducing emissions quickly, and the flexibility to do so cost-effectively. Flexible programs like this have been proven to meet environmental goals faster, at far less cost, than other environmental policies. An international agreement based on these elements can keep Earth's climate hospitable for generations to come.

Essential Elements Of An International Greenhouse Gas Emissions Budget Agreement

1. *Environmental Goals Based On Ecological Limits:* Emissions reduction obligations should be set so that warming will not exceed 1°C. per century and the ultimate atmospheric concentration of greenhouse pollutants will equal an atmospheric concentration of no more than 450 parts per million by volume (ppmv) of CO₂.
2. *Legally Binding Emissions Caps:* Budgets should be legally binding, in order to spur national and private sector action. Initial caps should be set for industrialized nations, with the first budget beginning not later than 2005 and ending not later than 2014. Ten-year emissions budgets should be used to provide accountability and economic investment, planning and response flexibility. Budgets should be set substantially below 1990 levels, cover all greenhouse gas emissions and uptake, and be stated in terms of 100-year Global Warming Potentials (GWPs). A first budget of 20% reductions below 1990 levels is one approach that would meet the ecological limits of 1°C./century and 450 ppmv atmospheric concentration.
3. *Transparent, Verifiable National Emissions Reporting:* To foster a competitive market in "quality" emissions reductions, all nations must report all greenhouse gases emissions by sources and uptake by sinks, and transacted reductions by country and vintage.
4. *Continuing Review And Evaluation:* Successive caps should be set based on science assessments and progress reviews produced during the first five years of each budget.
5. *International Pollution Reduction Trading and "Banking":* Allowing nations and firms to earn and sell emissions reductions to other countries, companies and individuals encourages early, cost-effective reductions. "Banking" for earned reductions encourages early action and rewards innovations critical to long-term progress in reducing greenhouse gas emissions.
6. *Joint Implementation For Credit:* Joint implementation (JI), undertaken voluntarily, can provide developing countries with improved technologies and enhanced protection of forest resources, while reducing emissions at lower cost. JI for credit means recognition, on a project-by-project basis, of earned, verified emissions reductions produced by investments in countries that have not yet adopted budgets. JI credits can be saved, bought or sold, and their value will give investors reason to invest in JI projects. Where JI credit results in a project that emits less than the project would have emitted had JI credit not been available, the resulting emissions reduction should be recognized for credit.
7. *Incentives For Non-Budget Nations:* Emissions budgets, linked with JI, provide incentives for non-budget nations to adopt budgets. Non-budget nations undertaking project-by-project JI will face relatively high transactions costs. They can reduce those costs, and thereby encourage more investment in their emissions reduction opportunities, if they voluntarily adopt budgets. In addition, non-budget developing nations could be offered a growth budget, i.e., an initial emissions budget above historic emissions levels that declines over time.
8. *Strong Compliance And Enforcement Mechanisms:* For nations that fail to meet their budgets, emissions over-budget should be deducted automatically from their next-decade budget, with "interest." For nations significantly out of compliance, reductions earned at home and sold to others should be discounted automatically. Nations that exceed their budgets even further before the end of a budget period should be prohibited from selling reductions, and their performance should be reviewed by the Parties.

Common Questions About An International Greenhouse Gas Emissions Budget Agreement

- *Why limit warming to 1°C./century?* Because faster warming may jeopardize entire forests and ecosystems and pose a difficult challenge to many societies. The fastest global warming known to have occurred over long periods and large areas in the last 10,000 years has been much less than 1°C./century, so projected warming would require faster adjustment by species than at any previous time over that period. As warming occurs, many trees, plants and animals will try to migrate to cooler areas to survive. But trees can't "run", and human development is breaking up habitat, making it tougher for trees, plants and animals to colonize new areas. Rapid climate change means more stress on trees, and more likelihood that disease, pests, and fires will kill whole forests, destroying watersheds on which many societies depend. Such rapid warming would pose many other, new challenges to societies worldwide because it would be the fastest global warming since the dawn of civilization. Climate change should be limited to the lowest rates feasible given greenhouse gas emissions that have already occurred. These correspond to global rates of warming of no more than 1°C./century.
- *Why limit atmospheric concentrations to 450 ppmv CO₂-equivalent?* Before the industrial era, the concentration of CO₂ in Earth's atmosphere was about 280 ppmv. In the late 1800s, with large-scale burning of fossil fuels, CO₂ concentrations began to increase. Each additional CO₂ molecule in the atmosphere warms the Earth; the greater the atmospheric concentration of greenhouse gases, the warmer the world will be. In the past 10,000 years, global temperatures have varied no more than about 1°C. Concentrations of 450 ppmv CO₂-equivalent would result, in about a century, in an Earth about 1°C. warmer than today. Greater concentrations would mean a world warmer than any since the dawn of civilizations. So 450 ppmv may be the limit for societies to adjust to without significant disruption.
- *Will pollution caps for industrialized countries but not for others hurt the U.S. economy and U.S. competitiveness?* Not necessarily - it depends on the structure of the international agreement. The emissions budget approach gives countries like the U.S. flexibility to reduce emissions cost-effectively while minimizing job loss. Joint implementation for credit opens opportunities for U.S. companies to export emissions-reducing technologies, creating jobs here at home, and provides incentives for other countries to adopt budgets.
- *Won't an international agreement sacrifice national sovereignty?* No. Each nation will be free to choose how to meet its emissions budget. One nation may establish efficiency goals, another, a national pollution cap-and-trade system; a third might impose taxes.
- *Isn't a global pollution tax better?* For years, nations have tried and failed to set such a tax. Even if they could, there is no guarantee that the tax would be high enough to cut emissions.
- *Isn't pollution trading immoral?* No. Well-designed trading programs are cutting pollution faster than other approaches, while saving money that can be used to address other problems.
- *Aren't emissions budgets too complicated?* The elements of emissions budgets are straightforward (see above). Integrity is key to any pollution program; that's why the budget approach uses verified annual emissions reporting and strong compliance and enforcement.
- *If countries adopt budgets, how can my company, community, or school get ahead on our greenhouse savings accounts?* You can "score" greenhouse gas emissions from your energy use on a U.S. Department of Energy "scorecard". Ask your electric power company how it's going to build its greenhouse savings account and pass the savings on to customers. Contact the Environmental Defense Fund at 212-505-2100, 202-387-3500, or at www.edf.org.



**EMISSIONS TRADING:
PRACTICAL LESSONS FROM EXPERIENCE***

Testimony of

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Before the

Joint Economic Committee

U.S. House of Representatives
U.S. Senate

July 9, 1997

* Mr. Dudek is a Senior Economist at the Environmental Defense Fund. The author gratefully acknowledges the assistance of Joseph Goffman, Senior Attorney with the Environmental Defense Fund, Washington, D.C.

INTRODUCTION

My name is Daniel J. Dudek and I am a senior economist with the Environmental Defense Fund, a national not-for-profit environmental organization with over 300,000 members. EDF's mission is to solve environmental problems by combining science, law, and economics. EDF, among all environmental organizations, has particularly focused on the development of market-based policies. I am here today to testify as an unabashed advocate of market-based environmental policies. EDF believes such policy tools:

- increase environmental effectiveness
- reduce compliance costs
- create financial rewards for environmental performance
- tap existing on-site expertise in the search for new solutions
- create incentives for new technologies, processes, and environmental management.

We believe that the nation has accumulated significant experience with several forms of market-based environmental policies, particularly that class of market tools known as emissions trading. Emissions trading was initially implemented in the late 70's to address concerns about rigid Clean Air Act compliance deadlines and the need to encourage local economic growth for employment. Since that time, emissions trading and banking has been applied to heavy duty engine nitrogen oxide and particulate emissions, the lead phase down in gasoline by refiners, the reduction of production of stratospheric ozone destroying chlorofluorocarbons, cutting acid rain, retiring high emitting vehicles, creating incentives for alternative vehicle fuels, and for the reduction of pollution discharges to rivers and lakes.

Conceptually, emissions trading is quite simple, no more complex than addition and subtraction. In fact, EDF has frequently analogized the acid rain program to the opening and management of a checkbook. Within a category of sources each of which has an emissions limitation requirement, any one source may reduce its emissions more than required and find its emissions below its emissions limitation. That source in effect can transfer or assign the extra increment of emissions reduction to a second source; the second source can emit above its required limitation up to the amount of the first source's extra reductions and both sources' combined emissions still equal the same quantity that would have been emitted had both been emitting at their initial required levels. The key is defining what constitutes an extra reduction and quantifying it. The key to the success of these programs has been empowering business to determine the most effective strategy to produce pollution reductions.

During the '80's emissions trading initiatives created a mixed record, at best. Since emissions trading was grafted onto existing command-and-control programs which suffered basic flaws, it often had the effect of amplifying those flaws. As a result, many environmentalists worried that including emissions trading in programs that did not

control total pollution well in the first place would only aggravate existing command-and-control programs' considerable barriers to achieving the intended levels of emissions reductions (Hinds, 1996). At the same time, the inherent difficulty of converting command-and-control requirements into tradable emissions reductions made transactions cumbersome and costly. However mixed, these experiences provided invaluable learning for the development of more market-oriented emissions trading programs.

With the enactment of the acid rain emissions trading program in the Clean Air Act Amendments of 1990, this decade has seen a steady expansion of emissions trading programs that have brought, or are poised to bring, exactly the benefits the original proponents of emissions trading promised. For the most part, these programs have succeeded by integrating the design of businesses' compliance requirements with the design of the emissions trading tool. In many cases, this design integration has forged a new paradigm for pollution control that offers superior environmental performance, lower cost and a ramping back of otherwise intrusive relationships between regulators and business.

If one of the often debilitating flaws of command-and-control programs was their failure to make any party accountable for achieving specific levels of reductions in actual emissions, and if, for this reason, such programs made emissions trading environmentally risky and economically cumbersome, then the distinctive genius of the acid rain program's design -- which has been instrumental in encouraging the widened use of emissions trading in the past several years -- was in taking these problems on directly.

In so doing, the acid rain program introduced the paradigm-shifting notion of making sources explicitly obligated for meeting a limitation on their actual emissions. This has the effect of guaranteeing that the intended emissions reductions in fact will be achieved and of capping total emissions at the aggregate reduction level. To the great benefit of emissions trading, this approach also means that any emissions reductions below a source's required emissions limitation level are, by definition, surplus and therefore tradable. As a result, sources can create, bank, sell and/or buy, the tradable emissions reduction currency without the need of regulatory intervention with respect to any transaction. Uncertainty and overall transactions costs which dominated emissions trading in the 1980's are radically reduced, if not eliminated.

All of this is made especially easy and understandable by the mechanics of the acid rain program. Every year, the EPA allocates a fixed total of marketable permits, called emissions allowances, to the group of sources with emissions limitations. These allocations were explicitly established by Congress as an integral part of the Clean Air Act Amendments of 1990. In fact, the distribution of these allowances to affected sources was key to reducing industry's opposition to the program and ameliorating impacts among states. Sources can buy, sell or bank these allowances however they wish provided that at the end of each year each source holds allowances equal in number to its actual emissions. As a result, even the regulator's role is fundamentally streamlined.

Aside from its many inherent virtues, the acid rain program has provided an instant textbook example of how emissions trading can work and how the problems associated with emissions trading in the past can be escaped or solved. Congress' work in designing the program restored both environmental and economic credibility to the concept of emissions trading and offered a variety of environmental policy-makers and interested parties teaching-by-example. It is in response to this teaching, that environmental regulators from Southern California to the Northeast have developed and deployed emissions trading to combat air pollution throughout this decade.

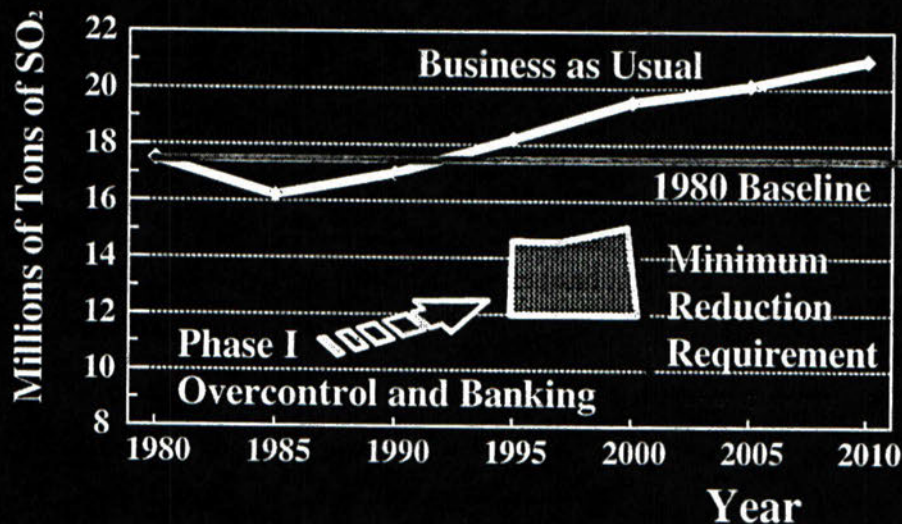
ENVIRONMENTAL BENEFITS OF EMISSIONS TRADING

EDF had long been convinced of the importance of integrating environmental programs into economic decision-making. Put simply, the vast bulk of the money spent on environmental problems comes from the private sector. Given our market economy's ability to grind down costs through competition and innovation, why shouldn't we harness entrepreneurial energy in solving pollution problems? If we did, we would have more investment choices, new products and markets, fewer resources spent, and, perhaps most important for the environment, more progress faster. However, for many years, EDF was largely alone in this belief. Emissions trading was and is controversial even in the Environmental Protection Agency. It took the spectacular results of the acid rain allowance trading program to demonstrate the power of market forces to produce environmental benefits.

Enhanced Environmental Performance from Early Reductions and Banking

As the figure below indicates, one of the most dramatic results from the Clean Air Act acid rain program has been the degree of overcontrol, i.e. the number of extra reductions that utility sources have made in response to the opportunity to produce and "bank" extra reductions for future use. In 1995, the first year of the program, utility emissions were 39% below allowable levels and in 1996, the program's second year, they were 35% below allowable emission levels (EPA, 1997). This is 3.44 and 2.86 million tons respectively. What other environmental program can show such dramatic performance in so short a time? This performance is especially salient when viewed from the perspective of the environmental problem we are attempting to solve.

PROGRAM PERFORMANCE



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In part, acid rain as it affects ecosystems is a cumulative emissions problem which acts over time to leach the buffering capacities from the soils sustaining forests and surrounding lakes. As this buffering capacity is depleted, the process of lake acidification and forest decline are accelerated. By reducing emissions sooner rather than later, the program provides relief to these acid-stressed ecosystems exactly when they need it most. In economist's terms, the marginal benefits, i.e. avoided damages, associated with these extra reductions are highest when we first begin to reduce emission levels. The typical command-and-control regulatory program, on the other hand, phases reductions in slowly and provides no motivation for companies to reduce any more than they are required by the regulation.

In effect, emissions trading turns traditional environmental incentives on their head. Companies are challenged and rewarded by a flexible compliance program and market opportunities to go beyond government minimums. Environmental management becomes part of the strategic business plan.

Recently, EDF was able to participate directly with a company in which this very dynamic was unfolding. On May 14, EDF and British Petroleum struck an agreement to design a greenhouse gas emissions trading program and to test design options with demonstration transactions (*Los Angeles Times*, 1997). BP's action reflects exactly this strategic understanding, an understanding engendered whenever markets for emissions reductions are created. Furthermore, it reflects another critical change induced by the

spread of the emissions trading paradigm – the switch from reactive to proactive policy involvement by business.

Reduced Program Costs and Higher levels of Environmental Protection

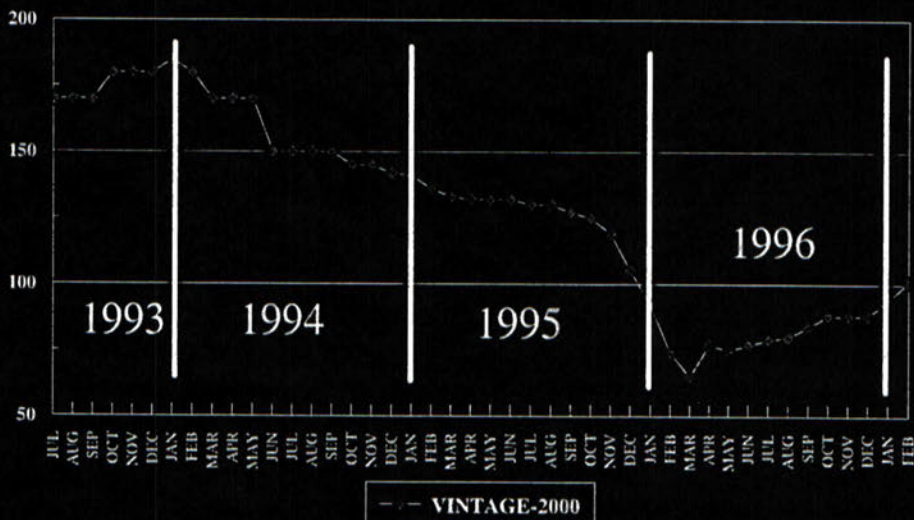
In addition to accelerating emissions reductions and realigning the incentives of private firms, emissions trading programs, especially those exemplified by the acid rain program, bring other environmental benefits. The simple notion that making sources explicitly accountable for their actual emissions can simultaneously serve as the cornerstone for an emissions trading system has helped air regulators confronting a variety of pollutants and environmental problems see that they can design programs that impose explicit caps on total emissions and thus ensure achievement of intended emissions reductions. This insight has helped win over many previously skeptical environmentalists and regulators.

However, the ability of well designed cap and trade programs to guarantee emissions reductions and the lowest achievable costs led to another more critical insight – that we could afford more environmental protection if policy makers could be guaranteed that costs would be as low as possible. It was this insight that led President Bush to adopt a 10 million ton reduction in sulfur dioxide emissions for the Administration's acid rain program proposal to Congress, a goal long advocated by environmentalists. Assured of the lowest costs to the economy by the flexible market orientation of the program's design, President Bush was able to eliminate the usual tension between environmental and economic performance.

How has the program performed in economic terms? The chart below shows the unexpected history of allowance prices. The economic models employed to assess the potential costs of compliance with the acid rain program predicted substantially higher costs and allowance values (Ellerman, et al., 1997). This performance is especially dramatic when considered in the context of the Direct Sale Subaccount established under Sec. 416 which sets aside 50,000 tons per year for direct sale at \$1500 per ton adjusted by the Consumer Price Index.

SO₂ ALLOWANCE VALUES

DOLLARS PER TON



Source: Emissions Exchange Corporation



Focuses Environmental Resources Efficiently and Stimulates Innovation

Some critics have argued that there is "not enough" trading in the acid rain program. They miss two points. First, the purpose of the acid rain program is not to promote trading.¹ Rather, it is to reduce acid deposition at the lowest cost. All evidence points to the fact that the program is succeeding triumphantly. The allowance values reflected in the figure above are far below the marginal cost of compliance projected for the program when it was enacted.

Second, the allowance-trading market may be effective in reducing costs because it fosters implicit or "latent" emissions trading as well as active trading. Put another way, emissions trading places all compliance options in direct competition with each other. Of course, any program that permits flexibility in compliance choices does this. Because of emissions trading, however, that competition is geometrically expanded in the acid rain program. Different compliance options do not compete with each other only at any one facility. Because emissions trading allows a facility operator to choose to apply a

¹ Nonetheless, trading activity increased in 1994 and has continued in 1996. Trading between distinct entities doubled between 1995 and 1996 from 1.9 million tons in 1995 to 4.4 million tons in 1996 (EPA, 1997). At the same time, it is important to recognize that transfers even between units with the same owner can produce very substantial cost savings when compared with more inflexible regulatory programs. These internal transfer economies are a critical consideration for transboundary pollution problems such as acid rain, ozone, and greenhouse gases.

compliance option at its own site or, in effect, at any other affected facility that can make surplus allowances available, the facility operator's range of choices are much broader, the competition among them much more intense, and the capacity of that competition to lower costs much, much greater.

BASIC MARKET REQUIREMENTS

To date, the dramatic spread of emissions trading in the 1990's has been carried by three programs that were more or less patterned on the acid rain "cap and allowance" or "cap and trade" model. The Northeast states' Ozone Transport Commission (OTC) adopted a nearly identical system for controlling oxides of nitrogen (NOx) in the 12-state region as an important measure for reaching the groundlevel ozone standard in cities throughout the region. In Los Angeles, the South Coast Air Quality Management District adopted a similar cap and trade program to reduce NOx and sulfur dioxide emissions in the L.A. basin. Finally, the Illinois Environmental Protection Agency (IEPA) developed a cap and trade program for reducing volatile organic compounds in Chicago.²

EDF participated in the "design team" effort convened by the IEPA. Initially, the design team assumed that the characteristics of VOC emissions, their atmospheric behavior in ozone formation and difficulties quantifying them militated against the use of a cap and trade approach. In trying to develop an emissions trading design that ensured environmental integrity and economic viability, however, the design team discovered the superior features of a cap and trade program actually made it easier to address these issues. In contrast, it was alternative designs that did not include caps or that did not proceed from the cornerstone of defining compliance in terms of actual emissions that proved to be the least likely to achieve success.

On the basis of this experience, as well as on its participation in the OTC's design efforts for its NOx program, EDF has concluded that cap and trade programs should be the template of first resort that policy-makers use when designing air pollution programs. To be sure, there are a variety of models and approaches to emissions trading that policy-makers can use in designing specific programs. None has the inherent environmental and economic advantages of the cap and trade model. As a result, in EDF's view, the variety of emissions trading models should be understood to occupy a hierarchy at whose top is the cap and trade approach. For this reason, in assessing alternatives, program designers should begin by determining whether the cap and trade model can be applied to managing the pollutant(s) for which they may be creating a program. Only if they conclude that such an approach is impracticable, should they examine alternative tools.

In fact, notwithstanding its strong preference for cap-based programs, EDF itself has advocated for the use of emissions trading approaches that do not follow the cap and trade template in a number of circumstances, particularly in its work on emissions and emissions trading in the mobile source sector (EDF and GM, 1992). Such approaches are

² Illinois uses the term "volatile organic materials" or VOM to describe its program.

demanding for sources that cannot be subject to a total emissions cap or are not being subject to mandatory regulation. Even sources with these characteristics, however, can play a beneficial role in an emissions trading program, just as emissions trading can dramatically improve the performance of programs for controlling emissions from these sources. In fact, the market forces unleashed by cap and trade programs can be focused on the search for untraditional, but cost-effective emissions reductions such as accelerated vehicle retirement.

In working with such programs, EDF has concluded that a second maxim, of equal importance to the ultimate preference for cap and trade models, should guide the work of policy designers: in fashioning emissions trading programs, regulators must develop program features that are highly specific to the pollutants being managed and the environmental problem being addressed. Attempts to promulgate generic emissions trading rules that purport to be applicable to a variety of sources or a range of programs almost inevitably will result in failure. One need only look at the U.S. EPA's ill-fated proposal in 1995 of an Open Market Trading Rule (OMTR) for a demonstration of the importance of this maxim.

EDF was deeply critical of the OMTR and vigorously opposed its final promulgation. To be sure, we offered the agency detailed criticism of a number of its features. In our view, however, its flaws stemmed from the fact that EPA had set itself an impossible task in attempting to propound a rule with generic application. For example, in its attempt to craft the OMTR for use across the full range of existing command-and-control programs, the EPA was unable to fashion a method for establishing that emissions reductions were surplus and tradable in a way that both guaranteed the environmental integrity of the underlying emissions control program while ensuring that open market trading was economically practical. More critically, the EPA failed to provide guidance for the integration of this proposed program with existing emission reduction credit trading programs or with emerging state-based cap and trade programs.

From EDF's perspective, there is no reason to reject open market trading out of hand. Instead, open market trading must be understood to sit far below cap and trade approaches on the emissions trading hierarchy and the application of open market trading should be attempted, as is the case of all trading approaches, only when it can be carefully integrated into the overall design of a specific emissions control program.

However great the superiority of cap and trade programs relative to other trading approaches, even cap and trade is not a magic bullet. The importance of fashioning emissions trading programs by integrating them into overall pollution management programs cannot be overstated.

In crafting pollution control programs, policy designers must pay attention to several fundamentals, however, if their efforts are to succeed:

1. Environmental integrity is paramount. A pollution control program is virtually certain to fail if sources are permitted to trade emissions reductions that are not truly surplus relative to the emissions limitation target of the overall program or, at least, of the category of sources being regulated. The cap and trade approach succeeds because it makes traded reductions surplus virtually by definition. The open market approach, in contrast, must struggle to assure that traded reductions are surplus.

It is imperative for the success of emissions trading programs that the clear and unequivocal message be sent that emissions trades are fully equivalent as compliance options to on-site controls.³ The performance of most emissions trading markets has been characterized by significant sources of supply, but effective demand has been much slower to develop. Frequently, this pattern has been due to regulatory uncertainty introduced by either environmental or economic regulators. In this regard, public education is a key component to success. Critics can easily misrepresent emissions trading as "selling licenses to pollute". Demonstration transactions, preferably with environmental partners, are an important tool in allaying suspicion about the environmental effectiveness of such programs.⁴

2. Market fundamentals apply to emissions trading markets. An insufficient number of participants will doom an emissions trading market. For example, the U.S. established an production quota trading system to implement the Montreal Protocol and eliminate chloroflourocarbons, which deplete stratospheric ozone. Because there were so few producers, the quota-trading market saw little, if any, activity. Similarly, an early water effluent trading program was established by the state of Wisconsin to reduce pollution in the Fox river. The program was designed, however, in a way that featured extensive regulatory oversight of transactions. As a result, anticipated uncertainty and high transactions costs inhibited participation.

3. High transactions costs may be good for brokers and other intermediaries, but not for buyers and sellers. The design of the acid rain program was highly conducive to minimizing transactions costs: regulatory approval was eliminated and transparency was maximized. Critics have repeated the mantra that there is "not enough trading".⁵ These have tended to be market intermediaries, who have missed the point – the program's

³ Of course, the pollution controlled whether through on-site controls or emissions trades must meet all applicable health-based limitations such as the National Ambient Air Quality Standards.

⁴ For example, in 1992, the Illinois Environmental Protection Agency sponsored a 200 vehicle test of the EDF-GM design for retiring high emitting vehicles. The rigorous nature of this demonstration helped to convince the US EPA that this program design was sound. Ultimately, the design has been incorporated into the set of Economic Incentive Programs offered to states for use in meeting the ambient air quality standards established under Title I. California has recently developed a 70,000 car per year program.

⁵ Transactions costs include the costs for search, negotiation, approval, monitoring, enforcement, and insurance. To the extent that the legal regime prevents these costs from being reduced, their existence will reduce the number of transactions and increase overall program costs. For a more complete discussion see Stavins (1993). Dudek and Wiener warn that "regulators wishing to reduce compliance costs using these tools need to design them (and their supporting institutional infrastructure) with a view to managing transaction costs or risk not achieving the primary benefits that they offer in the first place" (1996, p. 6).

purpose is to achieve the required reductions at the lowest cost, regardless of how much or little work or profit there is for brokers. Indeed, those firms, like Cantor Fitzgerald, whose low-cost intermediary services have been specifically designed to streamline transactions costs have done the best at surviving, while those that sought to emphasize their own role have left the market. A key institutional innovation was establishing the legal ability for any person to own or hold such allowances. This has allowed options, swaps, forward and futures contracts to be developed.⁶

In contrast, the OMTR seemed to be designed to maximize uncertainty and related transactions costs. While the proposed rule suggested that emissions trading brokers could provide the tools for hedging or absorbing those costs for buyers and sellers, it would appear that brokers would have to play a featured role – and charge the market accordingly.

4. Banking has important environmental and economic benefits, but must be carefully designed. If sources can keep excess emissions reductions in one year and use them in future years, then an emissions trading system gives them an incentive to make additional surplus reductions early. In virtually every case, early reductions yield additional environmental benefits, as exemplified by acid rain. At the same time, banking can be critical to market formation. In the early years of many markets, potential supply-side investors may have reason to doubt whether demand exists for extra emissions reductions they may create. If they know, however, that reductions made even in the early years of a program can be used in later years, when the market can be expected to mature, the value of that expectation will justify making early reductions. In many cases, investments in early reductions involve investments in aggressive and innovative control technologies, thus helping to stimulate the deployment of environmental innovation.

Of course, for many environmental problems, acute exposure to pollutants is more serious than cumulative exposure. In these cases, later emissions increases are not *environmentally* offset by earlier excess reductions. It falls to program designers then to find approaches to balance the benefits of banking with its potential problems. For example, the designers of the OTC's NOx cap and trade program permitted unlimited banking but included a "flow control" requirement limiting the use of banked emissions reductions in certain circumstances.⁷ The designers of the IEPA VOC program, in contrast, included a device to limit, ultimately, the number of emissions reductions that could be banked.

⁶ EDF participated in the development of an interpollutant emissions swap. In this case, 25,000 tons of SO₂ allowances from Arizona Public Service were exchanged for 1.75 million tons of CO₂ reductions from Niagara Mohawk Power Corporation.

⁷ This provision illustrates the importance of designing the emissions trading market in conformity with the underlying environmental problem. In particular, NOx trading programs are intended to control ozone precursors which tend to have greater environmental impact during hot weather. These same weather patterns induce increased demand for electricity which results in increased NOx emissions from the increased combustion. In the absence of some feedback on NOx emission reductions bank withdrawals, the potential would exist for trading to exacerbate the environmental problem.

5. Regulators cannot be market-makers, but they can give markets the tools to build the institutions to facilitate market activity. A key to markets, of course, is information. Program designers can ensure this by maintaining a transparent system for accounting for sources' emissions and tracking trades. In addition, auctioning a small portion of emissions credits or allowances can jump-start price discovery.⁸ Of course, private intermediaries are instrumental to facilitating market activity. For this reason, emissions trading markets should be designed to let any person, not just sources, hold and transact allowances or credits.

PRESENT POLICY NEEDS AND PRIORITIES

The practical experience with emissions trading is significant and growing. However, some real barriers to the realization of its full potential remain. First, not enough has been done to educate the public about the importance of these environmental reforms. They have reduced costs and provided more environmental protection sooner. This is the kind of good news that is all too rare in environmental policy making. This good news needs to be shared with our colleagues and trading partners throughout the world as well. As we review our experience with the Commission on Environmental Cooperation established under the North American free Trade Agreement, we should extend NAFTA's mandate to free trade in environmental commodities.⁹ NAFTA is an excellent laboratory for the extension of emissions trading outside the U.S. Our trading partners among the OECD nations need to understand more of the positive experience with emissions trading in the U.S. At the present time, negotiations aimed at the development of a market-based international protocol for the control of greenhouse gas emissions is threatened by misunderstanding of emissions trading (Dudek and Goffman, 1997).

Secondly, the remaining artifacts of the old command-and-control system continue to inhibit effective application of emissions trading. Nowhere is this more evident than in the difficulties of cooperatively managing interstate flows of ozone and its precursors. Last year, EDF was involved in the first interstate emissions trade of NOx emissions reduction credits. The trade was between facilities of two companies straddling the borders of New Jersey and Pennsylvania. Most aspects of the negotiations between the two companies involved were a relatively straightforward business transaction. However, the negotiations between the two states and the two regional EPA offices were protracted. Since such a transaction had never before been consummated, each state had to under the other's program in order to adjust for the transfer. In the end, the resolution of critical details concerning emissions inventories had to be punted to the

⁸ Ellerman, et al (1997) note the importance of the SO₂ allowance auction in price discovery and in the ultimate emergence of a smoothly functioning market. The auction provisions in the legislation could have been strengthened through provision of a sunset mechanism geared to the emergence of private alternatives for example. This approach was followed in the design of the Illinois VOM trading program.

⁹ EDF has established a program in the El Paso-Juarez region to build an institutional capacity and experience with cross-border emissions trading. Closer cooperation with Canada in the control of SO₂ emissions as well as ozone precursors offers positive economic opportunities.

US EPA since the strategies each state was pursuing differed so radically. These differences existed and persisted despite the fact that each state program was developed under the US EPA's Final Emissions Trading Guidance of 1986. We will continue to have high compliance costs and poor environmental protection if we don't address these key interstate comparability issues.

Lastly, we need to extend the development of emissions trading both in the emissions and sources covered. EDF's strategic vision is of a complete set of environmental commodity markets as companions to the normal markets for goods and services. This comprehensive approach would extend the environmental and economic effectiveness of these programs more widely throughout the economy. Emissions trading programs have been very effective in controlling costs for producers. They have also acted to reveal and identify and bring to market emissions reductions options not previously contemplated by regulators. The remaining challenge is how to tap consumer energy to amplify the economic rewards to producers' environmental decision making. Creating market incentives for companies to reveal the emissions consequences of their products in competition for consumer purchases, for example in the case of energy or vehicles, would be a significant step to creating markets for environmental commodities that engaged all Americans.

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International Greenhouse Gas Emissions Budgets and Joint Implementation

Under the United Nations Framework Convention on Climate Change, the United States has proposed that at the Third Conference of the Parties to the Convention, to be held in Kyoto in December 1997, Parties adopt a protocol with legally binding, cumulative caps on greenhouse gas emissions ("emissions budgets") to limit and reduce emissions of pollutants that, left unchecked, will likely cause significant and dangerous changes to Earth's climate system. The structure, history, and legal mandates under the Framework Convention envision that industrialized nations would adopt budgets initially, with developing nations adopting budgets at some future time. As nations that have adopted legally binding budgets consider whether to invest in emissions reduction opportunities domestically, or emissions reduction opportunities in nations that have not adopted budgets but would like to participate in emissions reduction activities on a voluntary basis ("joint implementation"), the following question arises:

Under what framework should emissions reductions resulting from "joint implementation" be recognized?

This paper identifies the components of a framework for recognizing emissions reductions resulting from joint implementation. In so doing, the paper strives to craft a framework that will foster voluntary JI while assuring environmentally credible results.

The Environmental, Economic and Development Importance of JI

At the macro level, there are strong environmental, economic, and development policy reasons to favor voluntary joint implementation (JI) between industrialized and developing nations and firms. It is essential, in both environmental and economic terms, that the Kyoto Protocol create a structure that will invite the immediate voluntary participation of developing countries and their eventual participation in a comprehensive system of emissions budgets. Greenhouse gas emissions from some developing countries are rapidly reaching or exceeding those generated by many industrialized and Eastern bloc nations. In an idealized international system with equitable global economic development, it might be preferable if all countries adopted emissions budgets at the same time. In practice, however, many developing countries may not have such emissions limits for at least a number of years. Those years present an important opportunity for encouraging environmentally friendlier infrastructure investments in developing nations, particularly in the burgeoning electric power and industry sectors. Voluntary JI can facilitate this investment.

To the extent that voluntary JI projects represent investment in basic infrastructure, their reduced emissions profiles continue out into the future. If financially successful, these projects can shift the technologic norm for nations to one that is more, rather less, favorable to the environment. And, such projects provide strong incentives for increased participation by developing nations in emissions reduction activities.

Voluntary JI creates important opportunities for firms in both industrialized and developing nations to innovate, and offer on a competitive basis, emissions reduction technologies and services in markets all over the world. This market-opening function of JI plays a critical role during the time period in which industrialized, but not developing, nations have legally binding emissions budgets. Because voluntary JI provides opportunities for firms from industrialized and developing countries to compete on an equal footing in markets for emissions reductions, JI provides the foundation for political support for legally binding emissions budgets in the industrialized, and eventually, the developing world.

Voluntary JI on a project-by-project basis also provides an incentive, over the longer term, for developing nations eventually to adopt legally binding emissions budgets. Because they will need to establish their environmental integrity on a project-specific basis, JI projects will incur higher transactions costs than will emissions reduction projects undertaken in nations that have adopted legally binding national budgets. Over time, developing nations that wish to undertake extensive voluntary JI will find that by adopting budgets, they can reduce transaction costs, and therefore capture more of the economic benefits as well as encourage further investment in cleaner technologies and forest protection.

The environmental, economic and development benefits of JI are also manifest on a project-specific level. Where, for example, reducing carbon dioxide emissions from an efficient electric power plant in an industrialized nation would cost substantially more than achieving the same emissions reductions by modernizing an inefficient power plant in a developing country, the investment in emissions reduction should flow to the developing country. Voluntary JI will allow this to happen. The developing nation benefits from the improved technology, and potentially also from ancillary environmental benefits (cleaner local air quality, reduced transboundary flows), while the industrialized nation achieves emissions reduction at lower cost. Similarly, joint implementation may provide financial inflows to developing nations to assist in areas of high biodiversity that also sequester carbon dioxide, or to re-forest degraded lands. Project partners are well advised to consult with local and indigenous people: projects with strong community roots and clear legal status will be more likely to deliver environmental benefits because their investments will be more sustainable.

A Rule-Based Framework that Facilitates Credible JI

What type of rule framework can facilitate voluntary JI while assuring environmental results? An overly lenient rule framework would not provide credible environmental benefits. An overly burdensome rule framework, however, also would not provide credible environmental benefits, because it would raise transactions costs so high as to prohibit effective GHG emissions reduction projects in non-budget nations, effectively “dis-inviting” their participation. And a “one-size-fits-all” rule framework would fail to

reflect the wide variety of circumstances and real environmental improvement opportunities in nations throughout the developing world.

How, then, to craft international and domestic legal rules that realize effective emissions reductions and spur non-budget nation participation and eventual graduation to compliance-credible budgetary regimes? Below is a summary of suggested essential elements of a JI framework.

International Emissions Budgets and Joint Implementation: Essential Rules

Under an international emissions budget approach, a group of nations would adopt ten-year legally binding greenhouse gas (GHG) emission budgets under the United Nations Framework Convention on Climate Change (UNFCCC). Each would commit to limit its net GHG emissions to a specified budget amount, expressed as a percentage reduction in GHG emissions from a base year, e.g., 1990. Participating nations and NGOs, including firms, could purchase or sell emissions reductions, with such transactions applied to the respective importing/exporting nation's overall budget. Joint implementation, i.e., emissions reduction activities undertaken on a voluntary basis in nations without budgets, would be available for credit.

By what rules should these joint emissions reductions be credited? A single criterion, namely that projects must provide a reduction in emissions that is additional to any that would otherwise occur, is recommended.¹ To implement this criterion, five practical questions must be answered.

¹ An additional criterion might be that projects be consonant with national environmental and developmental priorities. This criterion should be administered at national and bilateral levels, recognizing the importance of consultation with local communities in undertaking all projects, whether JI, other emissions reduction projects, or any other development project. The criterion probably should not, however, be subject to multilateral dispute settlement, in view of the sovereignty problems that would raise.

Other criteria, such as "but-for," have been suggested. That is, JI credit should not be earned unless the project proponent can show that but-for the existence of the credit, the project would not have gone forward. The "but-for" criterion, however, provides no environmental benefit beyond the additionality criterion, and does present formidable proof problems, thereby raising transactions costs and ultimately discouraging emissions reductions. Suppose, for example, that project partners are considering whether to build a cheaper, dirtier power plant, or a more expensive, cleaner plant, and the available financing is not sufficient to enable the cleaner plant to be built. The availability of JI credit for the cleaner option may help attract financing that otherwise would not be available, but this financing may not be sufficient to make the cleaner option a "go." The combination of JI and the potential financing, however, may induce the manufacturer of the cleaner technology to drop the price sufficiently to enable the project to go forward. Emissions reductions resulting from the cleaner power plant would satisfy the requirement that the reductions "would not otherwise have occurred." However, it is difficult to say that but-for the JI credit, the project would not have gone forward. The "but-for" criterion raises endless questions about the extent to which any factor pushed the cleaner technology into the realm of feasibility, yet the criterion

1. How should "reductions in emissions" be measured?
2. How should what is "additional to what would otherwise occur" be determined?
3. Who should make these measurements and determinations, and with what degree of transparency?
4. How should disagreements about the verifiability of the reductions be resolved?
5. What quantitative limitations, if any, should be placed on the participation of nations in joint emission reduction activities?

This paper examines these questions, each of which, to varying degrees, actually arises across all emissions reduction activities, whether JI, or activities conducted within a single sovereign nation, bilaterally, or multilaterally, and provides conclusions and recommendations.

1. How should "reductions in emissions" be measured? There are two principal ways by which emissions reductions could be measured: (a) ex ante projections, and (b) ex post real-time accounting of actual changes in emissions, as indicated by direct measurement of emissions, or extrapolated from direct, real-time measurements of relevant variables, e.g., fuel consumption, forest cover.

Actual changes in emissions as measured through real-time accounting are a more environmentally preferable and sure heuristic than projections, and are therefore to be preferred in every case. Crediting should be based on frequent, e.g., annual, actual measurements. Crediting based on real-time accounting also provides strong incentives to improve actual project performance. Ex ante projections will be useful for potential investors assessing alternatives. However, projections of credit are a completely inadequate basis for crediting, because of the environmental mismatch between uncertainty in projections and the certainty of actual emissions.

2. How should "what would have occurred" be determined? There are two general approaches that, in theory, could be taken: (a) the case-by-case approach; and (b) the standard formula approach. As explained below, environmental, economic, and development factors generally favor the case-by-case approach; however, because these are fairly paperwork-intensive, project proponents should have available to them the option to select formula-based approaches.

a. The case-by-case approach. The question of "what would have occurred" in the absence of any particular JI project is a highly project-specific one, and will vary from nation to nation, and even across regions within nations, according to levels of development, availability of capital, and other constraints. The determination of "what otherwise would have occurred" in the absence of a particular JI project is essentially the setting of a project baseline. In any particular geographic area, this will involve the certain types of calculations.

achieves no environmental benefit. Rather, the environmental benefit inheres in the emissions differential between the "baseline" alternative and the proposed project. Thus, "but-for" should not be included as a criterion.

For example, in the case of power plants, the project baseline would be the present engineering standard for new builds in the local area of the project. For forest protection or afforestation projects, setting the project baseline would require proof of land use. For example, in an afforestation project, the project proponents would need to demonstrate that the land had been unforested for a specified period of time, e.g., the previous 10-20 years. Forest protection/afforestation programs should also be required to procure insurance against the possibility that the tree planting would not be successful, or that the protected forest would be destroyed. Each type of project should also be required to have in place a monitoring and verification plan. Setting the baselines, and establishing the monitoring and verification plans, may involve expertise from a number of disciplines, including financial accounting, engineering, forestry, agriculture, or other disciplines, depending on the project involved.

b. The standard formula approach. These might include:

- *Standardized discounting/credit ratios.* A standard-discount formula would require that JI credits be applied at a ratio greater than one, to take account of leakage, i.e., the possibility that the project that achieves the reductions will simply displace emitting activity to other locations. For example, a standard-discount approach that values a particular type of JI activity at 25% of other non-JI emissions reduction activity would mean that project proponents would need to obtain four times as much carbon reduction/sequestration from that type of project as they would from a comparable project in a nation with a legally binding emissions cap in order to receive comparable credit.
- *Better-than-Best Available Technology (BAT).* Another type of formula would develop agreed international definitions of what constitutes the best available technology (BAT) for a particular type of JI project. Under this approach, JI credit would only be awarded for activities that reduce emissions further than the internationally defined BAT. For example, if high-efficiency combined-cycle natural gas-fired electric power plants were defined as BAT, then JI credit would only be available for power plant construction that resulted in fewer emissions than the internationally-defined BAT standard.

c. Discussion. The case-by-case approach would spur innovation and technology leadership that is relevant to the actual prevailing local conditions where the project is being undertaken. This approach thus allow capture of the maximum emissions reduction opportunities, avoiding the risk that some emissions reductions will be missed or dismissed by operation of the relative arbitrariness of any formula. In addition, by "ratcheting up" the baseline for "what would have occurred" on a project-specific basis, the case-by-case approach encourages market penetration of new technologies that deliver effective emissions reductions under local conditions.

For example, under the case-by-case approach, when a JI power plant project is first proposed in a local area, it may be that a combined cycle gas-fired plant that will achieve significant reductions over what would have occurred is not economically feasible, but would be if JI credit were available, while a renewables-based plant is simply not feasible under local conditions, even with the availability of JI credit. Over time, as more and more combined cycle JI plants are built in that area, economies of

scale may be such that the combined-cycle plant will become the feasible “what would have occurred” project baseline, and the nth new power plant project, in order to obtain JI credit, will have to demonstrate the additional emissions reduction capability that a renewables plant would provide, ratcheting up the baseline in response to ongoing changes in local conditions.

A standardized formula approach, by contrast, is likely not to deliver such precisely calibrated incentives for improved emissions performance. Standard discount or credit ratio formulas may under-encourage, or over-encourage, JI projects, depending on whether the formula is set stringently or leniently, because a single formula cannot account for the significant geographical, environmental, and economic variations across nations and regions that affect the assessment of “what would have occurred.” Further, since such formulas could only be adjusted with some difficulty, they are not able to adjust over time as in the case-by-case approach.

Similarly, a standard formula BAT approach will tend to under-incentivize, or over-incentivize, emissions reduction activity, depending on the level at which BAT is defined, because a single centrally defined BAT overlooks the differences among nations and among regions within nations. A level of technology that constitutes better-than-BAT in one nation or region may be entirely unfeasible in another nation; at the same time, there may be lesser technologies feasible in the second nation that would still achieve significant emissions reductions. A BAT rule that prohibits JI in the second nation would deprive that nation of the feasible technologies and deprive the environment of the emissions reductions that could otherwise be achieved.

In addition, in the international arena, efforts to develop centralized definitions of BAT run a high risk of deteriorating into difficult and divisive trade negotiations. Accordingly, it would be preferable to identify, and learn from, other effective models for developing and implementing credible, internationally agreed accounting standards for determining, on a case-by-case basis, “what would have occurred.”

It should be emphasized, however, that both the standard discount/credit ratio and BAT formula approaches can be useful if set correctly. The advantages and disadvantages of each should be considered carefully in relation to the case-by-case approach. For example, the case-by-case approach will require greater documentation and therefore greater cost, but potentially offer more precision in describing the reality of what is occurring. Credit ratio and BAT formulas would offer a less paperwork intensive alternative with fewer available credits for those who preferred that type of approach. So, if properly balanced, a multi-track system could be established, with the choice open to project proponents to select the methodology that best fits their circumstances.

3. Who should make the measurements and determinations, and with what degree of transparency?

In theory, there are three models for “who should make the measurements and determinations.” One model is “full internationalization,” in which all measurements of emissions reductions and determinations of additionality, whether in the context of national actions or international cooperative activities (including JI and other

transactions), would be made by international authorities operating under the Secretariat of the Framework Convention. This approach has the potential to provide significant assurance to the international community that internationally agreed requirements concerning quality of data, determination of additionality, etc., are being met. However, full internationalization would likely be opposed by many countries on sovereignty grounds, and furthermore would require the establishment and maintenance of an extensive and expensive set of international bureaucratic institutions.

Another model would be "full nationalization," in which all measurements and determinations would be made by national authorities. This model addresses sovereignty concerns, but does not provide as much international accountability. In addition, this approach could restrict emissions reduction activities in countries that are in the process of developing, but have not fully developed, the national infrastructure.

"Full privatization" would be a third model. Under that approach, nations and firms would enter into contractual agreements with private sector entities, which might include for-profit as well as not-for-profit organizations, in which the latter, operating in a competitive service-provider market, would undertake to provide measurement services and services related to determining additionality. The full privatization approach addresses the sovereignty concerns, and reduces transactions costs greatly. In addition, if the private entities are required to be fully transparent about their determinations - and their financial affiliations, the private sector model provides a significant degree of accountability. However, in the absence of some national/international regulatory nexus, accountability is less than in other models.

Recommendations pertaining to these models are provided in paragraph 5 below.

4. How should disagreements about the verifiability of the reductions be resolved?

Procedures will need to be developed under the FCCC by which Parties, and NGOs, may seek review of and challenge measurements and determinations of emissions reduced or avoided. One model would be the development of an Independent Panel that could review challenges brought by Parties and by others. The Independent Panel model is currently being used in the World Bank. The Independent Panel or other challenge procedure should be available for all disagreements about the verifiability of reductions, whether the reductions are undertaken in the context of JI or other mechanisms, including reductions and emissions transactions to meet national budgets. The challenge procedures should be required to consider information from Parties and from NGOs.

The existence of such challenge procedures should provide an incentive for JI investors and hosts, as well as investors in other types of emission reduction activities, to select highly credible, strongly independent auditors to review determinations and measurements.

5. What quantitative limitations, if any, should be placed on the participation of nations in joint emission reduction activities?

Because industrialized nations have contributed most to the total current loading of emissions in the global atmosphere, it is reasonable to expect that those nations should take the lead in implementing steps to begin reducing emissions. Following from this, some have called for the placement of limitations on the quantity of emissions reductions that industrialized nations could invest in or purchase from developing nations. Such limitations could be expressed in terms of limits on total quantities, or on percentages of total obligations, or other means.

Other factors are likely to operate so as to encourage industrialized nations to pursue emissions reduction opportunities domestically in preference to many emissions reduction opportunities in developing countries. Such factors include differences in cultures, business environments, and the relatively higher transactions costs associated with demonstrating, on a project-by-project basis, the reliability of emissions reductions achieved through joint implementation. By contrast, developing nations that seek to participate in voluntary JI projects are actively looking for ways to reduce those transactions costs so as to attract greater investment by industrialized nations.

Quantitative limitations on the amount of joint implementation that nations may be permitted to participate in, however, would seriously under-incentivize JI. This is because it would be difficult, in the face of a quantitative restriction on JI, for any group of JI project partners to determine whether their project risked running afoul of the quantitative limits on JI. The uncertainty about whether any particular project's recognition might be called into question because the project potentially risked exceeding a quantitative limitation, would operate as a serious deterrent against JI project investments.

6. Conclusions and Recommendations

Examination of the various models and considerations above suggests that a number of positive features should be drawn upon in developing the actual rule-based framework for JI. With that in mind, the following framework is proposed:

- JI crediting should be available on a project-by-project basis for emissions reductions from what otherwise would have occurred, without arbitrary limitation on the amount of JI that JI partners, voluntarily, can undertake.
- Countries that wish to participate in JI transactions as host countries should be encouraged to develop national legislation for certification of independent, third-party project auditors. The legislation could be structured similarly to legislation that already exists in many nations, at national, state or provincial levels, for certification of public accountants, engineers, lawyers, doctors, or other licensed professionals, and should provide for disclosure of financial affiliations.
- Certified auditors should be encouraged to develop, through their professional associations and/or through national legislation, generally accepted principles for emissions reduction accounting, including for determinations of "what otherwise would have occurred." These generally accepted principles could be developed at national levels, with appropriate harmonization/mutual recognition agreements. Highly generalized statements of the principles could also be provided by the Parties to the Framework Convention, either as guidance, or as minimum requirements for national or private professional associations to fulfill.
- The generally accepted accounting principles should offer project proponents the following choice of methodologies for determining "what otherwise would have occurred": (a) case-by-case, or (b) standard formula, including (i) credit ratio, and (ii) best-available-technology.
- Project-by-project actual measurements of emissions, determinations of additionality, and identification of the generally accepted methodology on which the measurements and determinations are based, would need to be presented to the host and investor countries for their consideration, and those countries would in turn need to pass the determinations to the Framework Convention as part of reporting on compliance.
- All measurements and determinations should be public, and the processes for undertaking them should be transparent, so that interested parties may review and comment on them.
- Procedures should also be developed under the FCCC by which measurements and determinations may be challenged, based on inputs from Parties, NGOs or others. Consideration should be given to the convocation of an Independent Panel that could review challenges brought by Parties and by others.

EMISSIONS BUDGETS



Building An Effective International Greenhouse Gas Control System



ENVIRONMENTAL
DEFENSE FUND

February 1997

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EXECUTIVE SUMMARY

For over a decade, the Environmental Defense Fund (EDF) has been engaged in the design, development, and implementation of markets for environmental protection. These activities have ranged from the creation of markets for water savings from conservation investments to reduce irrigation to the acid rain allowance trading system of the Clean Air Act Amendments of 1990. Since 1985, EDF has been concerned about the problem of global climate change and has been working to develop both a scientific understanding of the problem as well as practical solutions. This paper represents our current thinking concerning a framework for an international protocol that could deliver both the environmental and economic benefits desired.

The concept of emissions budgets were first introduced by EDF at the meeting of the Ad Hoc Group on the Berlin Mandate (AGBM) in February of 1996 in Geneva at the request of the Netherlands. The fundamental strategy of emissions budgets is to establish a dynamic framework of review and learning over time by harnessing in tandem a continual process of scientific and technical review to a process of emissions control within a legally binding framework which allows parties to trade extra emissions reductions. Of course, such a system must ultimately be gauged against the goals it aims to achieve. EDF believes that credible environmental goals would include:

- ◆ a first period of emissions reductions that begins by 2005 and ends not later than 2014
- ◆ an ultimate concentration objective of 450 ppmv (CO₂ equivalent), inclusive of all greenhouse gases (GHG)
- ◆ a transient constraint to limit the warming rate not to exceed 1° C per century.

The foundation of emissions budgets are legally binding obligations for OECD nations and economies in transition established on the basis of historic emissions baselines and set as a cumulative emissions budget for 10 years. For other nations, comprehensive GHG inventories and reporting would be required. Also critical to the foundation are the transparent and verifiable annual national reports covering all gases, sources and sinks by sector and including all transacted international GHG reductions by country and vintage. The plan for this construction is given by the continuing review and evaluation process to set new budget levels which on a 10 year cycle would:

- ◆ assess the science
- ◆ review the progress of the Parties
- ◆ review the development and adoption of technologies.

The bricks resting upon this foundation are the emissions reductions produced by Parties and their transaction through international greenhouse gas emissions reduction trading. Parties' performance in meeting their emissions obligations would be durable with savings for early reductions and automatic debt carryover for any shortfalls. Performance

would be evaluated for all GHG emissions by sources, uptake by sinks, and transactions in terms of 100-year global warming potentials (GWPs). Joint Implementation, for credit, is an essential element for addressing both graduation and economic competitiveness concerns. For nations that have not taken a budget, project-by-project crediting of reduction investments with the possibility of international review would be the primary trading path. For nations with a budget, full international trading of reductions is available. In addition, for those non-Annex I Parties that opt to take an emissions budget, an explicit growth allowance should be provided. Such growth allowances would be made available under a formula by which they would decline over time so as to reward early participation.

The mortar holding the system together is the incentives for sovereigns to meet their underlying emissions commitments. These include:

- ◆ All GHG reduction obligations remain until discharged
- ◆ For Parties with cumulative net emissions greater than the budget but less than 110%:
 - ❖ all emissions greater than budget automatically deducted from next budget
 - ❖ dispremium charged on emissions over budget (e.g., 1.2 to 1.0)
- ◆ For Parties with cumulative net emissions greater than 110% but less than 120%:
 - ❖ Above **Plus** automatic discounting of the non-complier's sold GHG reductions that have not yet been used by other countries for compliance beginning in the year of first occurrence (discounting to be in proportion to amount of non-compliance)
- ◆ For Parties with cumulative net emissions greater than 120%:
 - ❖ Above **Plus** mandatory COP review of Party's noncompliance
 - ❖ Prohibition on further sales of reductions as of the date of noncompliance

Under the emissions budget approach, each nation would be free to meet its budget and earn savings in any way, consistent with its own sovereign priorities, that it chooses. Each Party would determine whether it would participate in international emissions trading and who would be empowered to do so. The approach is designed to capitalize on our greatest asset in addressing the global threat of climate change -- human ingenuity. Emissions budgets reward early adopters, innovators, savers, and cost reducers. EDF believes that emissions budgets provide a straightforward, uncomplicated policy framework with clear environmental goals and easy to measure performance that is sufficiently flexible to consistently capture these assets over time.

INTRODUCTION -1-

Under the "Berlin Mandate" adopted at the first Conference of the Parties (COP), signatories to the United Nations Framework Convention on Climate Change (FCCC) have committed to develop a protocol to control greenhouse gas (GHG) emissions by their third Conference, to be held in Kyoto, Japan in late 1997. In the atmosphere, these pollutants, the byproducts of fundamental economic activities like energy production, transportation and agriculture, can lead to accelerated warming resulting in dangerous changes to the earth's climate system. Analyses produced by the Intergovernmental Panel on Climate Change (IPCC) indicate that failure to limit the emissions of these gases are expected to be damaging to natural ecosystems and costly to the many human societies that have developed during the 10,000-year period of relative climate stability leading up to the present.²

At the same time, because of the link between GHGs and activities fundamental to both industrialized and developing economies, many anticipate, or at least fear, that the costs of limiting their emissions will be high. For the same reason, others question the capacity of any international agreement to establish a truly durable and efficacious regime for limiting these emissions. This doubt is intensified by the fact that an international GHG regime could exist only as the artifact of a voluntary agreement between and among sovereigns, often in competition with each other, and representing the widest possible diversity of economic needs and resources and political and cultural aspirations. As a result, the tools that can be used to induce or enforce compliance by sovereigns with their GHG emissions obligations may be limited – and downright meager when contrasted with those that domestic authorities can bring to bear to ensure that private firms comply with domestic emissions limitation requirements.

In view of these circumstances, an international program must meet a set of exacting tests of equity, economic efficiency and responsiveness, durability in terms of legally binding commitments, flexibility and, above all, environmental efficacy – if it is to be credible. In addition, the international regime should function as a framework that can encompass the inevitable variety of domestic policies and measures – ranging from emissions taxes and technology standards to emissions cap-and-trade systems – that

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² See Intergovernmental Panel on Climate Change, Science of Climate Change: Impacts, Adaptation and Mitigation of Climate Change: Scientific-Technical Analyses, Cambridge University Press, 1996.

each nation will adopt in the exercise of its sovereign decision-making for the purpose of meeting its international obligations. Equally important, the protocol must be designed to create a reliable mechanism of accountability for nations' performance of their GHG emissions obligations.

Finally, the FCCC itself introduced and codified a distinction between nations characterized by advanced industrial economies (denominated as "Annex I Countries" in the parlance of the FCCC) and those at all other stages of economic development. It is all but certain that this distinction, or some form of it, will inform at least the initial structure of the commitments and obligations propounded in Kyoto, with few, if any, emissions limitations imposed on the developing countries. Nevertheless, because of rapid economic growth and other conditions, the latter category of countries are expected to contribute an ever increasing proportion of global anthropogenic emissions of GHGs. Consequently, the international regime must be sufficiently dynamic to induce those nations ultimately to participate in a worldwide effort to limit GHG emissions. This inducement is key both to an environmentally effective agreement and to limiting economic advantage from non-participation.

In response to these challenges, EDF first introduced the concept of emissions budgets at the February 1996, meeting of the Advisory Group on the Berlin Mandate (AGBM) in Geneva at the invitation of the Netherlands. Emissions budgets are the building blocks both of a verifiable and legally binding protocol and an effective international emissions trading regime. This paper builds on that earlier work to elaborate particularly on the critical reporting and compliance elements of this policy approach.⁻³⁻

In July, 1996, at a meeting of the second COP in Geneva, U.S. Undersecretary of State Tim Wirth announced U.S. support for negotiations that would lead to legally binding GHG emissions limitation and reduction obligations. Because it marked a watershed shift in U.S. position, Undersecretary Wirth's statement transformed the international debate on climate change by making the prospect of success for the Berlin Mandate plausible, perhaps for the first time. At the same time, Undersecretary Wirth's statement linked acceptance of such obligations to the availability of flexible, cost-reducing mechanisms of international emissions trading and joint implementation for credit.

During the December, 1996 meeting of the AGBM the U.S. government offered a document containing a preliminary description of a system of national emissions limits and international GHG emissions trading including the option of emission budgets. The U.S. followed its December submission with proposed draft protocol language on January 17, 1997 embodying the concepts included in the earlier document, but now focusing on emissions budgets. The proposed draft language provided further detail, but contains, as

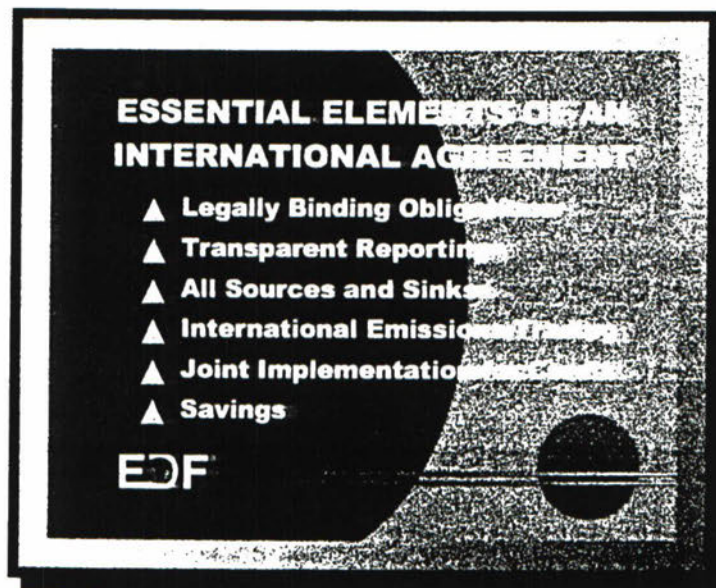
³ See Dudek, Daniel J., "Emission Budgets: Creating Rewards, Lowering Costs and Ensuring Results", Proceedings Climate Change Analysis Workshop, Springfield, Virginia, June 6-7, 1996, 18 pp.

the U.S. itself has indicated, a number of gaps that remain to be developed in order to fully develop the mechanics of a comprehensive global GHG budget and trading system.

For the COP to succeed in negotiating a viable GHG emissions protocol and for such protocol to succeed, in turn, in curbing GHG emissions such a vision is necessary. If designed in a way that included and integrated the necessary elements of accountability and flexibility, a GHG emissions budget and trading system would open the best – perhaps, the only – path to a global GHG regime that could meet the challenging array of tests confronting such a regime. However clear and well-aimed the U.S. documents have been in presenting a general outline, they also highlighted the crucial task of identifying the critical elements of such a system and of integrating those elements that must be accomplished by participants in the process leading up to and through the upcoming Kyoto Conference.

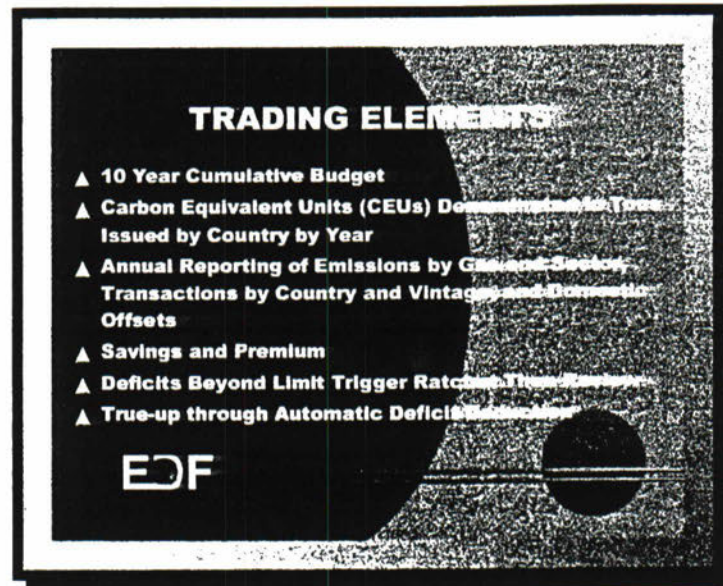
This report seeks to lay out EDF's current thinking on these critical elements and their integration. Specifically, it proposes an emissions budget and trading system for greenhouse gases that includes the following:

- ★ **national budgets**
- ★ **covering all sources and sinks**
- ★ **expressed as total GHG emissions over a decade-long period**
- ★ **and in terms of carbon equivalent units (CEUs).**



Nations could meet their decadal budget obligations by trading CEUs with each other and by "saving" CEUs whenever their decadal GHG emissions total was less than their total budget. Such CEUs could be used to offset GHG emissions in subsequent decadal periods and even earn "premiums" in the form of increases in their emissions

value.

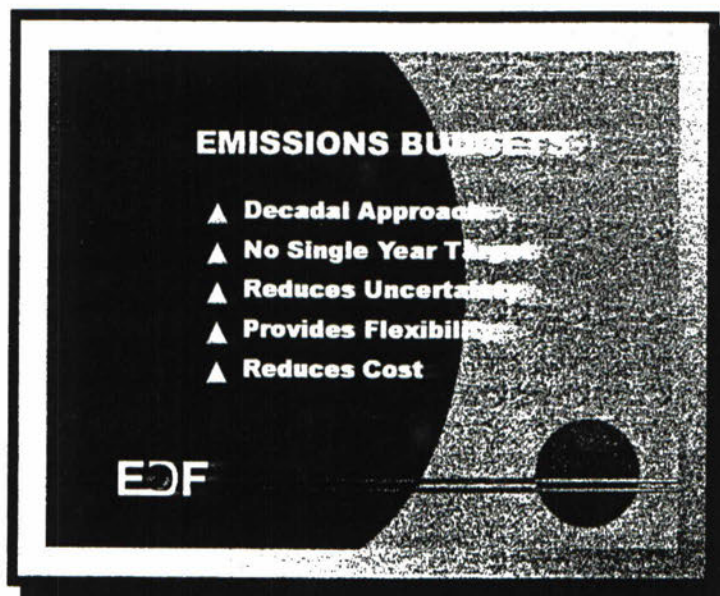


To ensure compliance, countries would be obligated to furnish detailed annual reports of their current and cumulative emissions and of the acquisition and/or sale of their CEUs. Countries exceeding their budgets would be subject to a two-pronged automatic sanction. The emissions value of any CEUs such countries had exported would be discounted upon their use by those holding such CEUs. In addition, cumulative GHG emissions in excess of a country's decadal budget -- adjusted to reflect CEUs acquired or exported by the country -- would be deducted --again, automatically -- from the country's budget for the decadal period immediately following.

Finally, each decade's emissions budget for affected nations would be established during the course of an ongoing review process undertaken by the Secretariat. Emissions budgets for upcoming decades would be announced at the 5-year point of the current decadal period after assessments of the atmospheric and climate science and of technology developments as well as of the performance to date of the overall regime.

A simple exposition of these elements by itself does not reveal the underlying logic that dictates their necessary integration. Consequently, in addition to reviewing the importance of using an emissions budget and trading approach as the bulwark of an international GHG regime, one of the aims of this report is to distill the inextricable linkage between accountability and flexibility that these specific elements embody and that is indispensable to the success of a global GHG control strategy.

REVIEW OF THE EMISSIONS BUDGET POLICY FRAMEWORK

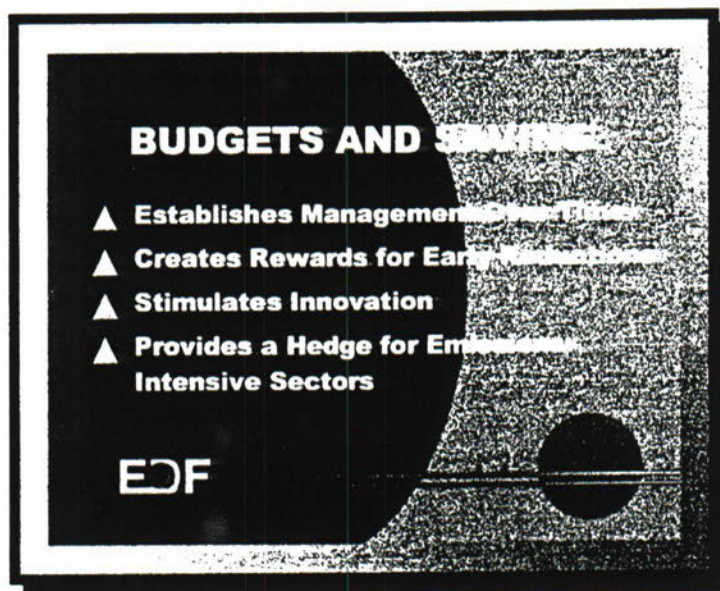


The fundamental definition of compliance -- i.e., in the form of an explicit quantity of emissions for which each nation is accountable -- parallels the experience of the U.S. under the Clean Air Act. Historically, Clean Air Act programs have imposed a variety of requirements on pollution sources, but only rarely have these made the sources directly or expressly accountable for their total emissions. As a result, these programs have tended to achieve fewer emissions reductions than intended or desired. In contrast, to combat acid rain, Congress amended the Clean Air Act to reduce emissions of sulfur dioxide from power plants. Here, each plant was held legally accountable for meeting a specific total emissions limit. This feature, together with the inclusion of emissions trading, has made this program one of the most successful of U.S. environmental policy initiatives.

Equally critical to the ultimate success of an international GHG regime is the integration of flexibility elements with express accountability on the part of each nation for meeting an explicit emissions limit. First, structuring each nation's budget as a 10-year cumulative obligation not only reflects the cumulative aspect of the effect of greenhouse gases on climate warming, but it also offers economic actors and nations' economies the temporal framework in which they can rationalize their response to the simultaneous demands of meeting their GHG emissions obligation and of inevitably dynamic economic conditions. As a result, sources and nations will be able to minimize the costs associated with budget compliance. At the same time, the 10-year budget period still creates a time horizon short enough to signal meaningful accountability so that nations and firms will feel compelled to manage their GHG emissions to meet the budget.



Second, the inherent opportunity for year-to-year “saving” of unused increments of each nation’s GHG emissions budget within each decadal budget period creates an explicit incentive for early reductions. Since it is the cumulative effect of GHGs in dangerously accelerating the *rate* of warming and of resulting climatic and ecological change that represents a critical aspect of the threat posed by global climate change, honing incentives for early reductions is essential. For this reason, an effective regime should permit “savings” of unused increments of a nation’s emissions budget to be carried forward for use in later periods.



To augment the value of such “savings” and thus intensify the incentives for early reductions, nations or firms that create and save unused budget increments or

CEUs should be able to earn a small premium that would increase the GHG emissions value of CEUs carried forward over time. Again, ecosystems -- and human society -- are critically sensitive not only to the extent of climate warming but also to the rate at which climatic change occurs. Offering an emissions-value-increasing premium for emissions savings parallels the environmental protection value that early reductions create by slowing the rate of climatic warming and avoiding ecological damage.

In addition to direct environmental considerations, among the effects created by both the opportunity for nations and sources to manage emissions over time and the resulting incentives for early reductions is the stimulation of innovation in reducing or avoiding GHG emissions. Successful innovation not only lowers cost but it is further rewarded through the economic value garnered by traded or "saved" CEUs. Increasing investment in environmental innovation opens an ongoing flow or supply of the technologies and innovations necessary to sustain, and ensure the economic affordability and environmental efficacy, of a long-term global commitment to curb GHG emissions.

Finally, the importance of temporal flexibility embodied in both cumulative budgets and the availability of "saving" is vividly illustrated by examining their significance for the emissions-intensive sectors and activities that dominate, at least in part, most industrialized and developing country economies. Since nations will accept to make the transition to low-emissions economies only if they can do so while maintaining robust economies, the predominance of these sectors dictates that nations have the flexibility needed to manage this transition over time. Similarly, the ineradicable economic self-interest of the firms that operate in these sectors demand that they, too, be afforded the tools needed to meet their emissions obligations while remaining viable. The ability to trade and save CEUs for future use provides precisely the mechanism for accommodating continued activity by these firms and sectors while allowing nations to meet the obligations of GHG emissions budgets.

INTERNATIONAL GREENHOUSE GAS TRADING: COST-SAVING AND SOVEREIGN COMPLIANCE

Intra- and inter-budget-period savings is but one of two iterations of emissions trading. In addition to the "trading" of emissions between years and budget periods that savings allows, the budget system also permits trading between and among sovereign nations and firms in different countries. The set of benefits provided by inter-temporal trading through saving also emerges from international emissions trading. Since such trading confers an affirmative economic value upon actions that produce surplus reductions, the emissions trading market rewards environmental innovators and any firm or sovereign that overcomplies with its emissions reduction responsibility. In addition, emissions trades, almost by definition, allow the trading firms or nations to achieve the same net emissions reduction at a cost lower than that which they would

have incurred in making their reductions in the absence of the trade. That firms – and sovereigns – can resort to trading in addition to whatever other emissions reduction strategies might be available guarantees that they will enjoy increased flexibility in integrating their economic needs and their GHG compliance requirements.

At the same time, it is the economic dynamics of the emissions trading market that can provide the key to unlock the riddle of sovereign compliance with an international GHG emissions reduction protocol. Regardless of whether a protocol imposed quantitative emissions limitations or required specified technologies or taxes, the challenge of ensuring *sovereign nations'* compliance with a GHG protocol is one of the central environmental challenges in designing such a protocol.

To illustrate why this challenge is so daunting, the enforcement tools afforded the U.S. Environmental Protection Agency under the federal Clean Air Act make a revealing contrast with the remedies practically available in an international context in which the accountable party is a sovereign. For example, Title IV of the Clean Air Act, which established the emissions trading program for sulfur dioxide (SO₂) reductions requires firms to pay an *automatic* penalty of \$2,000 for each ton of excess SO₂ emitted and to suffer an *automatic* deduction in their future allowable emissions. In addition, they are subject to a full panoply of civil and criminal sanctions. The availability of these remedies and the ability of enforcement officials to bring them to bear against firms reflects a widespread and highly durable consensus that permeates virtually every sector of U.S. society, a consensus, in turn, that, together with the threat of these sanctions, elicits compliance from the vast majority of regulated firms.

Similar tools are not nearly so readily available in an international context, nor is there likely to be a comparable consensus amongst sovereigns in the foreseeable future. Consequently, even with the third COP in Kyoto less than a year away, many governments and interested parties appear to be stumped by this question: if, at the end of each budget or compliance period, there are nations whose GHG emissions exceed their budgets, what happens? Environmentally, the atmosphere will continue to be subject to unacceptable levels of GHG emissions. By the same token, from the point of view of the integrity of a protocol purporting to embody “legally binding commitments”, the credibility of such an agreement would be destroyed if, instead of having an ongoing obligation, those nations simply are permitted to start with a “clean account” in the next budget cycle.

At the other extreme, remedies and sanctions that excluded such nations from the GHG emissions budget and trading system or imposed general trade sanctions would, if imposed without any intermediate compliance/enforcement measures, also render any agreement non-credible on environmental grounds. Simply banishing non-compliers from the trading system would be self-defeating as a first-order sanction, since those countries would continue to emit GHGs at excessive levels. In fact, one of the key functions that the protocol's compliance strategy must serve is ensuring that countries facing difficulties in complying are provided a mechanism or path that eases

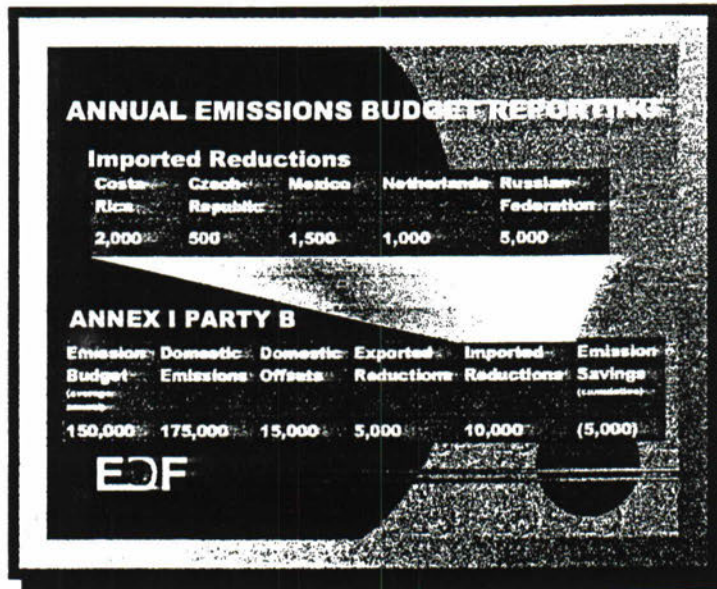
their achievement of compliance. A first-resort exclusion of these countries from the trading system would be environmentally counterproductive.

As for an approach that relied on general trade sanctions, the recent history of trade sanctions demonstrates that nations are extremely reluctant to administer such sanctions. Their imposition as a first-order measure requires a degree of political will that is unlikely to exist in the GHG context in the near term. Moreover, the environmental objectives of a protocol --not to mention the economic competitiveness concerns of nations with GHG emissions budget obligations -- strongly suggest that the protocol should seek to engender a dynamic that will encourage those nations in the developing world, which initially may not be subject to legally binding GHG reductions obligations, to assume such obligations eventually. General trade sanctions, however, may discourage, rather than encourage, other parties from taking on budget obligations. It is hard to imagine that nations considering accepting legally binding GHG obligations would choose to do so if the result were to expose them, as a first-order sanction, to the economic losses created by trade sanctions.

Ultimately, such sanctions will have to be included as sanctions in a protocol, but it is hard to see them serving any role other than that of last resort. On the contrary, the effectiveness of any GHG emissions limitation regime will depend on structured, automatic and readily usable first- and second-order measures. To accomplish this, the Kyoto protocol must build a "compliance tripod" of measures, fashioned as an extension of the emissions trading and banking system itself, which would both ensure inter-temporal environmental compensation for excess emissions and create an inherent disciplinary feedback against nations' noncompliance. The three legs of the tripod are: 1) annual reporting, 2) automatic GHG emissions debiting with interest for those countries exceeding their GHG emissions budgets and 3) automatic discounting of GHG emissions reductions exported by nations that are significant violators.

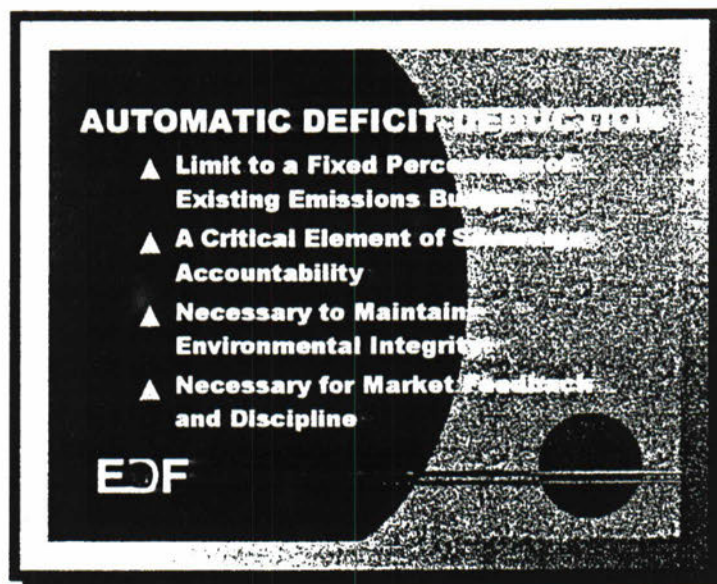
Reporting

The annual reporting of each nation's GHG emissions, internal offsets and international GHG emissions trading activity is an obvious, as well as indispensable, instrument of accounting for each nation's compliance performance. By the same token, the reporting system should also serve as the formal instrument for tracking, and therefore formally effecting, the exchange of emissions between sovereigns and each sovereign's "savings" and carrying forward of increments of its emissions budget through the achievement of early reductions. These mechanics will be discussed in more detail, in the section on "Mechanics", below.



Debt-Carryover and Discount

The concept of inter-temporal flexibility underlying banking -- which produces the benefit of early reductions -- must be applied to the likely event that some nations, including those not generally regarded as "bad actors", may simply miss their budgets. By imposing an automatic but limited debt-carryover with interest, the protocol would be able to harness that behavior by ensuring that it is environmentally compensated for -- rather than being either "forgiven" or subject to sanctions so draconian as to be unimplementable in the international context.



The debt-carryover would be implemented by automatically deducting from the ensuing period's budget the full amount of the nation's excess emissions at the conclusion of the current budget period. This automatic deduction would be augmented in size by an additional percentage of sufficient size to ensure that the mechanism itself -- which, in effect, is a form of "borrowing" an increment of a future budget and "repaying" the increment with "interest" -- would not be used as a routine compliance option. Rather, as a remedy for what would be treated as an initial instance of noncompliance, this debt-carryover would be a first-tier response, which could be followed by more stringent sanctions in the event the nation exceeded its net budget in the following period.

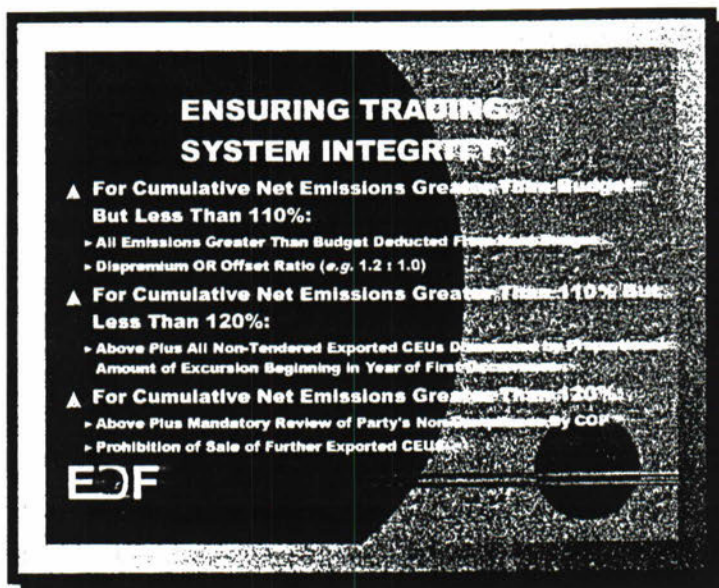
In addition to ensuring that each nation's accountability was truly continuous from budget period to budget period, the automatic debiting of nations' consecutive budgets for excess emissions would serve two other functions intrinsic to the integrity of the global GHG emissions budget and trading system. First, these debits would ensure that the environment was compensated both for the GHG emissions reductions initially lost and, through the additional "interest", for the delay in achieving those initially lost reductions. Second, in the absence of an automatic deduction for excess emissions, CEUs transferred by non-complying nations could be used to offset emissions generated by the firms or nations acquiring the CEUs notwithstanding the fact that such CEUs did not represent surplus emissions reductions. By offsetting the non-complying nation's excess emissions, however, the automatic debit would ensure that GHG emissions reductions transferred by the non-complying nation were surplus or ultimately became surplus. The automatic debt-carryover is an essential element of both the protocol's system of accountability and to its environmental integrity.

The Discount

Though indispensable, mandatory debt-carryover alone is not sufficient to reward compliers and sanction non-compliers in a credible, effective and reliable way. In fact, the debt-carryover offers a partial answer at best to the question of what it is that the protocol can use or create to compel or induce a sovereign to achieve compliance with its GHG emissions budget. Certainly the prospect of an automatic deduction, augmented by "interest", in the immediately following budget period signals nations that an "emit now, pay later" strategy for managing their GHG emissions over time would be inevitably expensive and potentially risky.

For nations whose commitment to, or capacity for, compliance is only marginal, however, the budget deduction can prove to be little more than a mere restatement of the nation's future obligation, an obligation that in itself has little credibility unless backed by something more than attenuated threats of eventual sanctions. Since, as discussed above, a compliance strategy that relies primarily on the imposition of sanctions is simply not credible in this context -- and could even be self-defeating, the protocol needs to incorporate a mechanism that will lead sovereigns to *prefer*

compliance over noncompliance even if they are not persuaded by the possibility of sanctions.



It is from the inherent economic dynamics of the GHG emissions trading market that such a preference must come. In fact, the protocol should seek to rely directly and explicitly on the emissions trading market as the mechanism for delivering that preference. To do so, the protocol should include an automatic and immediate imposition of discounts on GHG reductions exported by nations whose annual reports show that the combination of their emissions and their exported reductions is putting them over their GHG budgets. In those cases, the protocol should require that, beginning in the year -- within any budget period -- in which this first occurs, governments applying those reductions to their own budgets automatically discount, by the proportion of the exporting country's excess GHG emissions, the exported reductions' tonnage value for emissions offset purposes.

This automatic discount is necessary because without it, exported GHG reductions from non-complying nations would be available to offset in full other nations' actual emissions notwithstanding the fact that the exported reductions or CEUs did not represent actual surplus reductions. Although the automatic debt-carryover addresses this issue as well, the remediation it provides does not occur until the subsequent budget period.

Equally important, this automatic discounting would force the market to value various countries' exported reductions differently based on their compliance. Reductions from compliers would earn more than those from non-compliers at least in proportion to the tonnage-value discount imposed on the latter. At the same time, firms and nations buying exported reductions would exercise preference for reductions from

complying nations, and invest effort in ensuring that reductions they acquired were from countries in compliance or on a course for compliance. Thus, by sending a market signal back to nations that fail to manage their emissions reduction obligations, this discount provision fulfills the capacity of the "compliance triangle" to impose a discipline both on these sovereigns and their firms and on their emissions trading partners.

Because one critical attribute of the automatic discount is its shifting of some risk -- and, therefore, incentive -- to buyers, the discount enhances the integrity of the emissions trading system in another way. Buyers' preference will be for reliable trading partners who can deliver CEUs that will retain their full value in offsetting emissions in the context of buyers' own compliance obligations. As a result, a preponderance of the CEUs transacted in the global emissions trading market may be those that *in the first instance* are highly likely to represent truly surplus reductions.

At the same time, in contrast to a regime in which non-compliers were excluded from the emissions trading market de jure, the fact that it would be the market, in exercising its preferences, that produced the effective exclusion of non-compliers from emissions trading comports with an overall strategy of using the market to elicit compliance. In this instance, the loss of economic opportunity resulting from this exclusion could act as a spur to drive non-compliers to take the actions necessary to achieve compliance. In fact, firms and other entities seeking to generate surplus GHG emissions reductions and sell them in the global market would become constituents for compliance within their own countries. In the face of the limitations that characterize an international enforcement regime, the protocol must rely on using the incentives inherent in a global GHG emissions trading market to mobilize constituents in favor of compliance.

From a superficial perspective, an approach, such as an automatic discount, which exposes buyers to uncertainty as to the use-value -- in this case, the emissions-tonnage value -- of their acquisition would seem to be incompatible with an active exchange market. However, a simple comparison to currency markets, or, for that matter, to any transaction involving currencies that are "foreign" to one of the parties, and which regularly fluctuate in value in comparison to the party's "domestic" currency, demonstrates that this uncertainty is a routine part of international commerce. Moreover, it is easy to imagine that transaction partners and intermediaries would find a variety of hedging or insurance instruments readily available to manage such uncertainty. Only if it resulted in the full confiscation of a CEU's offset value would a discount system fatally inhibit the development of an international emissions trading market.

In this case, no such confiscation would be necessary. The concurrent presence of the debt-carryover mechanism would render surplus, at least eventually, exported reductions, even from initially non-complying countries. Consequently, the emissions-offset value of such reductions would not have to be discounted to zero. By the same token, the discounting would be applied only for those CEUs presented for

use in meeting the buyer's compliance obligations after the selling nation's budget exceedance emerged in annual reporting. CEUs that had been used prior to that time would not be discounted, thus avoiding the imposition of retroactive liability for purchasers of a sort that could inhibit emissions trading activity.

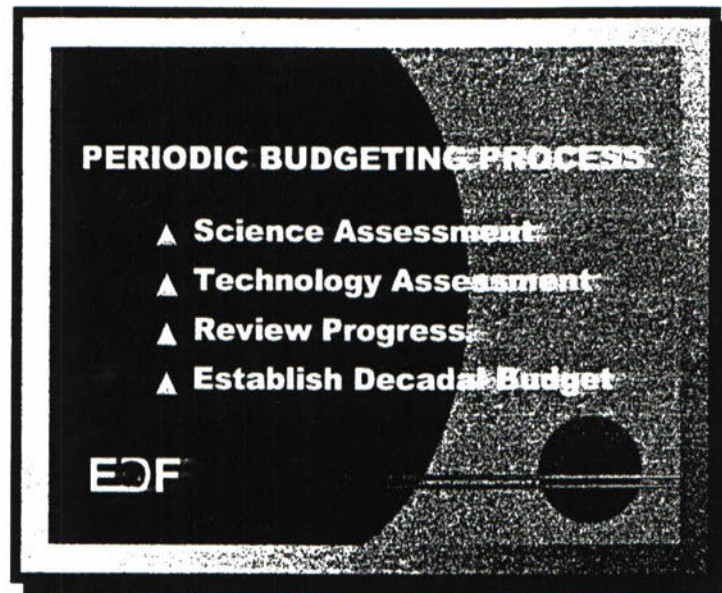
Without *both* an automatic debt-carryover to subsequent budget periods *and* an automatic discount applied within each budget period for CEUs exported by nations demonstrably exceeding their budgets, an international GHG protocol would lack adequate mechanisms for ensuring both nations' accountability for compliance and its own credibility. Without the ability to rely, in any but the most extreme circumstances, on the kinds of remedies, sanctions or other coercive measures typical of domestic pollution control laws such as the U.S. Clean Air Act or, in some instances, the general system of international commercial trade, a GHG protocol must develop a fully integrated set of incentives to motivate compliance.

That is why implementing nations' GHG emissions obligations through a system of emissions trading is so indispensable to the success of a GHG protocol. An emissions trading market is virtually the only mechanism that can provide such incentives. At the same time, the emissions trading and compliance regime must be carefully designed to hone these incentives. Just as the opportunity to create early reductions and "save" them for future use intensifies incentives for early action and for the development of environmental innovations, features like a discount applied to the GHG emissions reduction exports of non-compliers are essential to perfecting those incentives that can effect nations' -- and their firms' -- preference for compliance. Moreover, such a discount does more than provide a tangible instrument for delivering such incentives. Without a discount, the emissions budget and trading regime will lack important mechanisms that can be readily usable in the first instance to perform the function -- traditionally served by penalties and similar remedies in domestic legal programs -- of disciplining sovereigns that stray from the path of compliance.

THE IMMUTABLE IDENTITY BETWEEN TRADING AND COMPLIANCE

In a GHG emissions budget and trading system, the mechanics of accountability must be carefully designed. Fortunately, it is possible to create a unified system through which sovereigns can effectuate emissions trading and, at the same time, to design it so as to establish their accountability for meeting their GHG emissions budgets.

Setting the Budgets

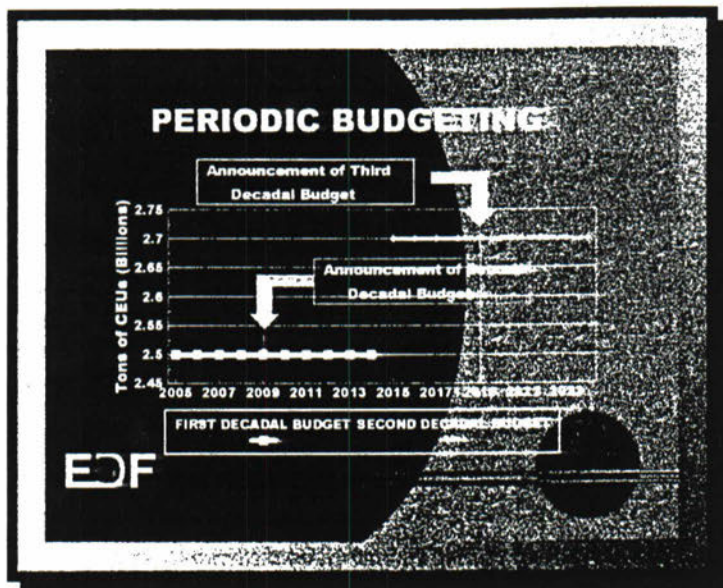


The key specification for each budget period is setting the numerical value of each nation's decadal budget. Presumably, since the initial commitments of the industrialized nations under the FCCC were expressed in terms of 1990 emissions levels, the protocol will establish each nation's initial budget as a function of its 1990 emissions. For purposes of setting the initial budget as well as each subsequent budget, the Parties should rely on the resources of international institutions such as the Intergovernmental Panel on Climate Change, under the direction of the Secretariat, to focus on three major components.

First, as the IPCC has done continuously since before the signing of the FCCC in 1992, the IPCC should provide an ongoing assessment of all scientific developments relevant to climate change. Inevitably, this will include a dual focus on tolerable concentrations of GHGs in the atmosphere and tolerable rates of climatic change. Second, technological advances and innovations are likely to progress at an accelerated pace in the wake of the establishment of a GHG protocol and in response to the incentives it engenders. These, as well as technological costs and limitations, should also be carefully assessed. Finally, nations' performance under the protocol as that performance develops needs to be assessed as well.

These assessments should inform the setting of the budget for the immediate subsequent period as well as projected reduction trajectories over a multi-budget-period horizon. An equally critical element of the budget-setting process is timing. Specifically, each budget should be established and announced no later than the end of the fifth year of the current budget period. By following this schedule, the protocol's budget-setting process will afford nations and firms the time necessary to

anticipate their upcoming compliance obligations and to integrate them with their overall economic responses.



This budget-setting schedule also contributes to the protocol's ability to establish a credible system of accountability. A five-year separation between the establishment of the ensuing period's budget and the application of remedies such as an automatic debt-carryover can help ensure that the budget-setting process will not be compromised by efforts to ease non-complying nations' obligations under the debt-carryover provision. As a result, the carryover will represent a true net deduction from a budget that is not inflated to defeat the effect of the carryover.

Mechanics of Reporting, Accounting and Trading

One of the innovations introduced by the SO₂ emissions trading program under the U.S. Clean Air Act was that the SO₂ emissions "allowance" served – all at the same time – as i) the currency of trading, ii) the instrument of compliance for affected sources and iii) the regulatory mechanism applied by the U.S. EPA for ensuring sources' accountability and for "tracking" emissions trades. Similarly, the protocol can establish a single, simple sovereign accounting system that performs the same multiplicity of functions for an international GHG emissions budget and trading regime. At the same time, this system would be able to succeed without relying on the allocation of emissions "allowances" or marketable permits.

This is critical, since in the context of a GHG protocol a compliance accountability infrastructure must be designed to meet several constraints as well as

the demand that it work. First, the protocol, and its compliance and trading accounting method, must be able to accommodate every possible policy approach -- e.g., pollution taxes, technology standards, research and development subsidies, marketable permits -- available to sovereigns in adopting their respective domestic strategies to meet their GHG emissions budget obligations. A system that presupposed the adoption of certain measures and the exclusion of others would be untenable to the extent that it would necessitate the forfeiting by sovereigns of at least a portion of their own policy-making prerogatives.

By the same token, reliance on the creation of elaborate or powerful new international institutions for the purpose of implementing a protocol could doom such a protocol, for, here, too, demanding that sovereigns surrender significant elements of their authority may be a prospect even more daunting than inducing them to agree to curb their GHG emissions. Finally, an international system for accounting for, and tracking trades in, each nation's GHG emissions must be simple, reliable and durable.

Fortunately, the FCCC itself already has laid the foundation for such a system in its existing requirements that countries file annual reports of their GHG emissions. To implement each nation's GHG emissions budget requirements and effectuate the application of GHG emissions trading they may have engaged in in meeting their respective emissions budgets, the protocol should require each nation to file an *annual* report with the following information:

EMISSIONS, REDUCTIONS AND TRADING REPORTING					
Annex I Party B					
Emissions Budgets	Domestic Emissions	Domestic Offsets	Exported Reductions	Imported Reductions	Emissions Savings
100,000	175,000	15,000	5,000	10,000	(5,000)
150,000	180,000	17,500	2,500	15,000	(10,000)
180,000	190,000	20,000	1,000	15,000	(10,000)
120,000	200,000	25,000	10,000	10,000	(45,000)
160,000	195,000	25,000	15,000	5,000	(41,000)
190,000	195,000	20,000	15,000	5,000	(41,000)
180,000	175,000	20,000	15,000	2,000	(38,000)
150,000	145,000	20,000	30,000	0	(103,000)
180,000	130,000	20,000	40,000	0	(103,000)
190,000	145,000	20,000	35,000	0	(105,000)

1. **Emissions Budget**, expressed in annualized terms by multiplying its decadal GHG emissions budget by 0.1.

2. **Actual Domestic Emissions Reported in Total and By Sector.**

3. Domestic Offsets. In this category, a nation could report *surplus* GHG emissions reductions generated as a result of actions in GHG emissions sectors not regulated under its domestic programs and not used by its sources in meeting compliance under those programs.

4. Exported Reductions. These would be reported expressly in terms of the year of their vintage, as well as being identified by their country of origin. In the case of the vintage year, this information is necessary for the purpose of calculating the emissions-value "premium" that could be earned for reductions that were "saved" and held unused over time. Since reductions, or CEUs, exported by nations whose annual reports revealed that they were exceeding their budgets would be discounted, in terms of their emissions value, before they could be applied to the importer's domestic compliance program, the identity of the country exporting the CEUs would have to be maintained.

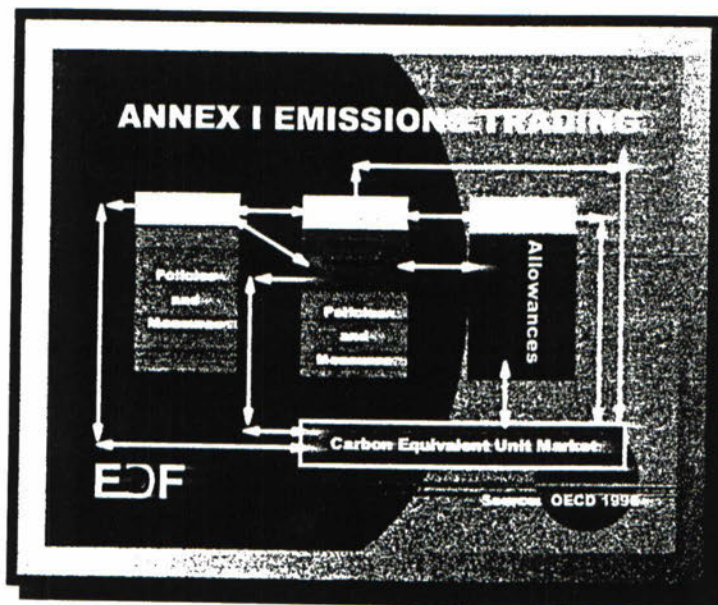
5. Imported Reductions. also reported expressly in terms of vintage year and country of origin for the same reasons.

6. Emissions Savings and End-of-Period Net. These would be the annual net of the other five entries. Of course, if in any year a nation's emissions exceeded its annualized budget as adjusted to reflect domestic offsets, exports and imports, then such savings would be expressed as a negative value. In addition, to reveal each nation's performance relative to its GHG emissions budget obligation, and thus expressed as either a net savings to be carried forward for future use or a net debit to be deducted immediately from the ensuing period's budget, reports at the end of each budget period would state a net sum of the nation's savings, either positive or negative.

This reporting approach would provide a unified mechanism for compliance and trading. It would be through each year's report that the mechanics of compliance would be automatically triggered while at the same time international emissions trading would be effectuated.

Trading

Through this approach, which is, in effect, one of double-entry record-keeping, the international emission trading system can accommodate GHG emissions trading between and among private firms in different nations while ensuring both the integration of private and sovereign trading and the full GHG emissions budget accountability of all nations. In addition, it does not presuppose any particular set of policy approaches that participating nations may use on a domestic level, nor does it rely on developing extensive new institutional authorities internationally.



In fact, under this system, virtually any firm operating under virtually any domestic policy regime can transact the international sale of purportedly surplus GHG emissions reductions. Meanwhile, the integrity of the system of accountability remains assured. This approach achieves this by requiring nations to report annually *all* emissions exports, whether initiated by the sovereign itself or any private firms operating within sovereign borders. Even private firm sales transactions, therefore, of necessity will have to be effectuated through both their being reported to the government of the selling firm and a corresponding *deduction being taken from that sovereign's budget*.

To ensure that this occurs with every such transaction, the sovereigns whose firms are purchasing such reductions -- presumably for the purpose of using the reductions to offset their own emissions and thus comply with domestic obligations -- would agree not to recognize or accept such reductions for such compliance purposes in the absence of a demonstration that the exporting sovereign had acknowledged the transfer and made the deduction from its own budget. Of course, in accepting such purchases, the importing sovereigns would be able to report either a net increase in their own budgets or a net decrease in their emissions. This approach thus makes all international GHG emissions trading take the form of inter-sovereign trading of increments of the sovereigns' GHG emissions budgets. As a result, this approach guarantees that, *by definition or as a creation of the accounting mechanism itself, all trades are for surplus reductions*. In effect, certifying that a traded reduction is surplus, often a prohibitively cumbersome process in other trading approaches, is a seamlessly built-in feature of the accounting mechanism.

Compliance

The reporting mechanism is also a crucial trigger for the protocol's two key compliance mechanisms. Since the tenth annual report in each budget period will include a summing of each nation's "savings", both positive and negative, those reports that indicate a net deficit -- that is, emissions in excess of a nation's net budget as adjusted to reflect trades -- will trigger an automatic deduction from the affected nations' budget for the ensuing period.

Similarly, at any time during the course of a budget period a nation's annual report may reveal that its cumulative emissions exceed 110% of its total decadal budget. In that case, the discount requirement would be automatically triggered for application by every other sovereign whose firms held reductions, or CEUs, exported by that nation. Again, the discount, would be applied to those CEUs that were presented by the firms that had acquired them for use in offsetting their own emissions and thus meeting their domestic emissions obligations or were otherwise used by the sovereigns themselves to augment their budgets or offset their emissions. However, the discount would take effect only beginning in the first year after a nation's "budget deficit" was revealed and would affect only those CEUs or reductions that were submitted subsequently. Nevertheless, the ability of the annual reports to reveal, essentially immediately, the creation of nations' "deficits" before the end of the budget period would allow the protocol to require that the discount be applied automatically by all participating sovereigns.

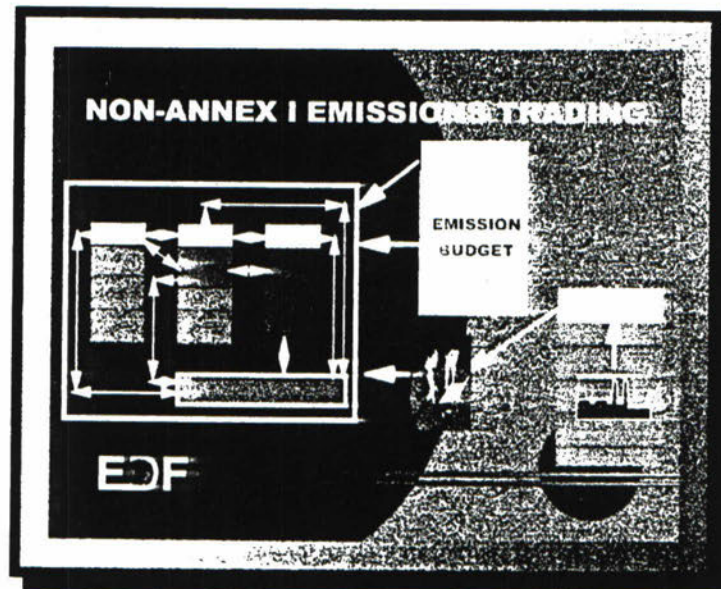
JOINT IMPLEMENTATION AND PARTICIPATION

In its January submission to the international negotiating process, among the items emphasized by the U.S. were the details of a strategy for ensuring the ultimate participation by developing countries in an GHG emissions protocol. The key elements in the U.S. proposal included a proposed requirement that these nations adopt "no regrets" policies to curb GHG emissions and that they prepare annual reports on their emissions and on measures adopted to control such emissions. In addition, the U.S. called for the establishment of a date certain for negotiations which would result in developing countries' accepting GHG emissions obligations and that included mechanisms for the eventual strengthening of those obligations.

The U.S. proposal's focus on these countries and their emissions is especially compelling from both an environmental and economic competitiveness perspective. GHG emissions from the developing world are rapidly reaching or exceeding par with those generated by the industrialized and Eastern bloc nations. Their emissions trajectory corresponds to their economies' increasing importance and activity in the

global marketplace. In fact, unless a GHG protocol creates a robust structure for encompassing these nations and their GHG emissions it will lack environmental – and economic – credibility, a conclusion recognized, much to its credit, by the U.S. proposal.

These ideas will need to be developed further in order to provide a more comprehensive answer to the question of how the developing nations will come to agree to their inclusion in a GHG emissions budget regime. Certainly, as climate science advances the threats posed by climate change will be of concern to those societies whose relative economic disadvantage may render them more vulnerable. At the same time, the traditional tools of diplomacy, which may include outright pressure from the industrial powers will play a role as well. Nevertheless, the same factors that limit the ability of the international community to *compel* routine compliance with a GHG emissions budget regime pose analogous challenges to securing the full-fledged participation of developing countries in such a regime.



Here, too, then, the economic dynamics a global GHG emissions trading market must be enlisted in meeting these challenges. Ostensibly, the most effective way of using the emissions trading market to create incentives for developing countries to participate in an international GHG regime is to condition their ability to engage in transactions in the emissions trading market on their agreement to subject themselves to a GHG emissions budget. Under this approach, "joint implementation", understood as a method by which developing countries without GHG emissions budgets can sell GHG emissions reductions, would not be available as a compliance option for firms and sovereigns subject to a GHG emissions budget.

Erecting such a barrier to developing nations' participation in trading may prove to be too crude and risky a strategy, however, while also denying opportunities for achieving environmental and economic gains. In contrast, permitting international GHG emissions trading for and with nations prior to their accepting GHG emissions budget -- that is, joint implementation -- may offer a smoother path by which developing countries can "graduate" to full participation in the emissions budget regime. Such an approach, in actuality, may enable the incentives represented by the opportunity to participate in emissions trading to function more effectively. In addition, it may create a stream of economic revenue tied to environmental investments during the current period when many developing economies are stepping up investment in long-term energy and transportation infrastructure. Furthermore, we believe that the incentives for participation can be increased by offering non-annex I Parties that take a budget a growth allowance. With a budget explicitly accommodating growth, Parties opting in would enjoy the full benefits of international greenhouse gas trading without the transactions costs that may dominate joint implementation.⁴

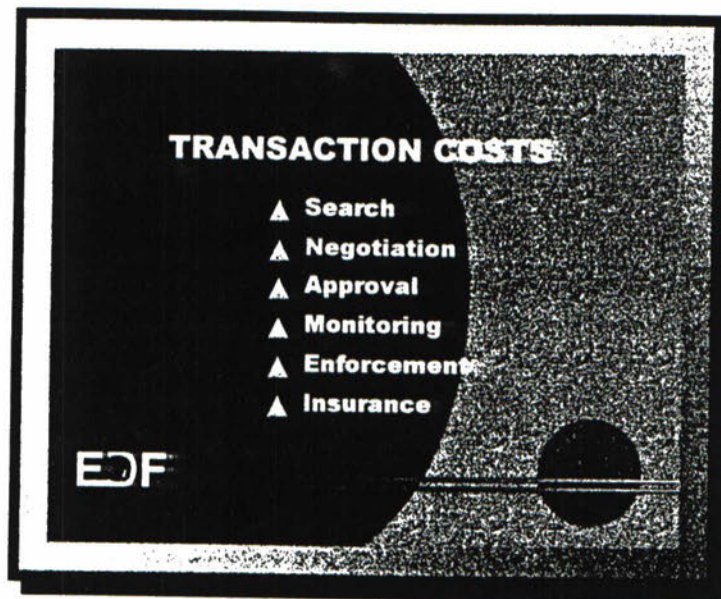
Typically, the kinds of international transactions that would result in the transfer of GHG emissions reduction credits would have the mutual economic benefits to buyer and seller characteristic of trading: sellers would gain a new, additional sources of revenue and buyers would be able to achieve compliance at lower cost. Moreover, these transactions would bring a host of benefits crucial to the credibility, durability and environmental performance of a GHG protocol. First, the very opportunity afforded firms and sovereigns in the industrialized world to meet their GHG emissions budgets at reduced cost and with greater flexibility would enhance the acceptance and credibility of an international GHG regime.

At the same time, those developing economies experiencing the greatest growth in the current economic time horizon are making substantial infrastructure investments whose environmental consequences, including GHG emissions, could have long-lasting effects for good or ill. Investments of the sort that yielded transactable GHG reductions for the host economy or the foreign investor simultaneously would help direct the host countries' economic growth along paths that were less, rather than more, GHG emissions-intensive. In addition to the environmental benefits that would result directly from this outcome, achieving growth in this way would make it that much easier for these countries to accept, eventually, a GHG emissions budget. As a result, the implicit gradualism in this strategy could speed and facilitate these countries' graduation to more rigorous international GHG obligations. In contrast, an approach which barred these countries from participating in international GHG emissions trading or joint

⁴ For a more detailed discussion of this point see Dudek, Daniel J. and Jonathan Wiener, "Joint Implementation and Transaction Costs", paper prepared for the Environment Directorate, Organization for Economic Cooperation and Development, Paris, 1996, 69 pp.

implementation *until after* they had accepted a GHG emissions budget could actually result in developing countries' finding it more difficult to accept such budgets.

By the same token, allowing developing countries to reap the benefits of engaging in GHG emissions trading even before they agreed to GHG emissions budgets could enhance the effectiveness of the incentive created by the promise of participation in trading following the imposition of a GHG emissions budget. Direct experience in the international GHG emissions trading market and direct enjoyment of the benefits of participation in the market could help persuade developing countries to move into the budget regime and to do so more quickly.

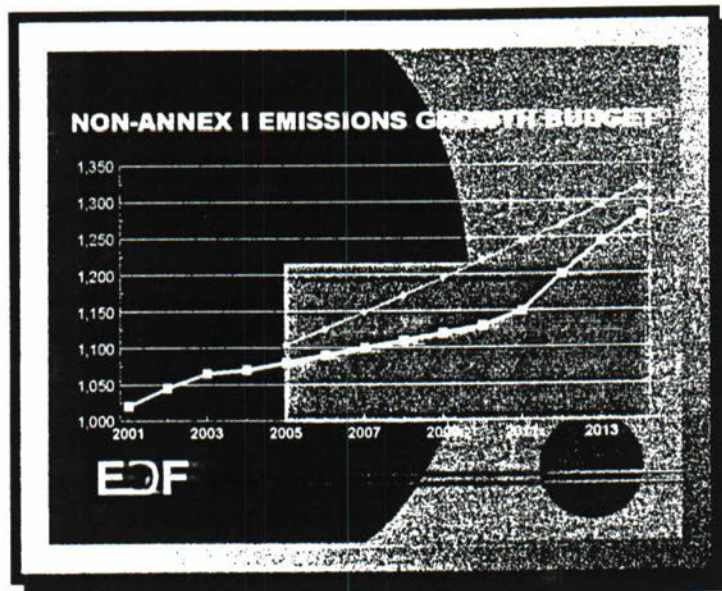


At first blush, this would seem to be a paradoxical result. Presumably, developing countries would be only too happy to reap the rewards of emissions trading without bearing the burden of a GHG emissions budget. In fact, participation in the emissions trading market under these circumstances inevitably will be significantly less advantageous and less lucrative for the exporting country than it would be for those countries that engage in trading while subject to a GHG emissions budget. It is this differential, which inevitably will be substantial, that will create the incentive for developing countries to adopt GHG emissions budget; yet, it is initially allowing countries to participate in emissions trading in the first place that will make the incentive more vivid and compelling.

This differential will arise from the contrast in transactions costs associated with trading where both affected sovereigns are subject to budgets and those associated with trades where the exporting nation is not subject to a budget. In the former case, as discussed at length above, the universal accounting and reporting system, backed by the discount and debt-carryover mechanisms, for countries subject to GHG

emissions budgets will render *all* transacted reductions surplus. As a result, firms and sovereigns engaging in such trades will have to incur few if any costs related to demonstrating that the reduction in question is surplus.

In the case of reductions exported by countries without GHG emissions budgets, however, the trading participants will be forced to incur significant costs in establishing that the reductions in question are truly surplus and can be used to offset emissions subject to GHG emissions budget requirements. This will be the case no matter how liberal the protocol may be or how dominant the constituencies seeking to encourage or facilitate joint implementation may be. In addition to meeting tests that may seek to establish not only "additionality" but "but for" causality as well, joint implementation projects may be required to demonstrate also that their emissions reductions are not merely the result of shifting emissions generation to other firms or activities. Proponents of joint implementation transactions will also incur the costs associated with seeking the approval of as many as three authorities -- that of the host country, that of the country against whose compliance requirements the reductions are being offered and possibly that of an international body that may be created for the purpose by the protocol itself.

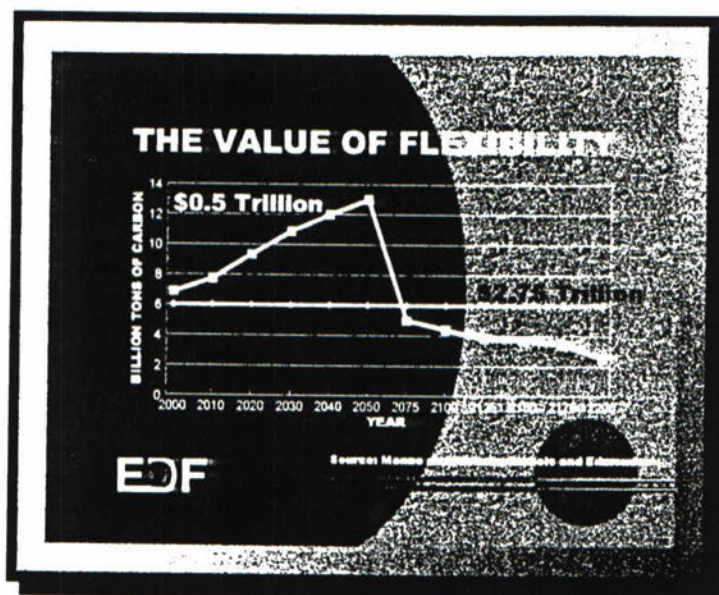


Meanwhile, thanks to the certification that reductions are surplus that is built into the very mechanics of reporting, parties to GHG trading in the emissions budget context will face none of these burdens and costs. As a result, they are likely to seek reductions from countries subject to GHG emissions budgets as a first preference and offer prices commensurate with the reliability and minimization of transactions costs characteristic of that context. In competing against that preference, sovereigns and firms without budgets will suffer smaller demand and lower prices for their reductions.

With experience, these nations will come to identify an economic advantage that the emissions trading market can confer on those that accept budgets.

To facilitate developing countries' response to this incentive, the protocol should specify a fixed formula to be universally applied to developing countries when they elect to adopt a GHG emissions budget. While the formula can include an advantage for those nations that act more quickly, applying a pre-established set of specifications, and thus eliminating case-by-case negotiations, will ensure the integrity of the system of budgets imposed on developing countries. As a result, this approach can be tailored to address the pressing demand of developing countries: that the perceived need for rapid economic growth, comparable to that enjoyed by industrialized nations earlier in their economic history be accommodated. Specifically, for the initial budget period or periods developing countries can be subject to "growth budgets" calculated, for example, as a function of current emissions with a small-percentage margin for increase over a certain time horizon. At the end of the horizon, which can be set at a length that would be greater for those nations that begin their budget commitments earlier, they would be subject to the same reduction path applicable to all nations.

CONCLUSION



This paper has attempted to articulate the framework for an international greenhouse gas trading regime and to elucidate the importance of the elements of that framework for its effective functioning. As the international community rapidly moves toward the adoption of a protocol to limit greenhouse gas emissions, building an international understanding of the practicality and desirability of emissions trading is

essential if agreement is to be reached in Kyoto. Only a system of international emissions trading can effectively span the diversity of national interests, legal systems, norms, implementation strategies, and preferences represented among the community of nations. The very essence of emissions trading is choice -- the ability to choose when, where, and how much.

At the same time, only emissions trading has the capacity to modulate both total cost as well as the distribution of costs among nations. Economic analyses of greenhouse gas control are remarkably uniform in ascribing huge cost savings to emissions trading. The key to delivering these cost savings is the creation of a framework for trading which reduces transactions costs, provides environmental and financial credibility, and rewards innovation. This paper has identified the minimum elements necessary.



Global Warming: The History of an International Scientific Consensus

1896: Arrhenius, a Swedish chemist, advances the theory that carbon dioxide emissions from combustion of coal would enhance Earth's greenhouse effect and lead to global warming.

1924: Based on 1920 coal use, Lotka, a U.S. physicist, speculates that industrial activity will double atmospheric CO₂ in 500 years.

1949: Callendar, a British scientist, speculatively links the estimated 10% increase of atmospheric CO₂ between 1850 and 1940 with the observed warming of northern Europe and North America which began in the 1880's.

1954: Hutchinson, a Yale biologist, first suggests that deforestation will increase atmospheric CO₂

1957: Revelle and Seuss, scientists with the Scripps Institute of Oceanography, report for the first time that much of the CO₂ emitted to the atmosphere is not absorbed by the oceans, as some had argued, leaving significant amounts in the atmosphere which could eventually warm the Earth. They call carbon dioxide emissions "a large-scale geophysical experiment" with Earth's climate.

1958: Keeling, a scientist with the Scripps Institute, begins the first reliable and continuous measurements of atmospheric carbon dioxide at Hawaii's Mauna Loa Observatory.

1967: The first reliable computer simulation calculates that global average temperature may increase by more than 4 degrees Fahrenheit when the atmospheric CO₂ level doubles that of pre-industrial times.

1971: Some scientists argue that cooling of the atmosphere by particulates from coal burning could be more significant than warming by greenhouse gases. Uncertainties are too large to be sure which effect will dominate.

1976: Scientists at several research institutions identify chlorofluorocarbons (CFCs), methane, and nitrous oxide as greenhouse gases.

1976: U.S. and Swedish scientists estimate that cooling by particulates from coal burning is a relatively small effect on a global average basis.

Fact Sheet ENVIRONMENTAL DEFENSE FUND

1979: The report of a National Academy of Sciences (NAS) panel on climate change advises that "A wait-and-see policy may mean waiting until it is too late" to avoid significant climate changes.

1983: An NAS report confirms that a doubling of CO₂ levels eventually would warm the Earth by 3 to 8 degrees Fahrenheit. The same year a U.S. Environmental Protection Agency (EPA) study called *Can We Delay A Greenhouse Warming?* states that as a result of warming, "agricultural conditions will be significantly altered, environmental and economic systems potentially disrupted, and political institutions stressed."

1985: A conference sponsored by the United Nations Environment Program (UNEP), the World Meteorological Organization (WMO), and the International Council of Scientific Unions forges a consensus of the international scientific community on the issue of climate change. The conference report warns that some future warming appears inevitable due to past emissions regardless of future actions and recommends consideration of a global treaty to address climatic change.

1987: An ice core from Antarctica analyzed by French and Russian scientists reveals an extremely close correlation between CO₂ and temperature going back more than 100,000 years.

1988: The Intergovernmental Panel on Climate Change (IPCC), made up of leading climate scientists from around the world, is established by UNEP and WMO to assess the scientific and economic basis of climate change policy in preparation for the 1992 Rio Earth Summit.

1990: An appeal signed by 49 Nobel prize winners and 700 members of the NAS states, "There is broad agreement within the scientific community that amplification of the Earth's natural greenhouse effect by the buildup of various gases introduced by human activity has the potential to produce dramatic changes in climate ... Only by taking action now can we insure that future generations will not be put at risk."

° The scientific working group of the IPCC, drawing on 170 scientists from 25 countries, publishes a report stating that human activity increasing greenhouse gas emissions "will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface." It calculates that an immediate 60% reduction in CO₂ emissions would stop the buildup of carbon dioxide.

° 747 participants from 116 countries take part in the Second World Climate Conference. The conference statement reports that "a clear scientific consensus has emerged on estimates of the range of global warming which can be expected during the 21st century. If the increase of greenhouse gas concentrations is not limited, the predicted climate change would place stresses on natural and social systems unprecedented in the past 10,000 years."

EDF Fact Sheet

ENVIRONMENTAL DEFENSE FUND

1991: Mt. Pinatubo, a Philippine volcano, erupts, temporarily interrupting the increase in surface temperatures.

1992: The NAS publishes a study reporting that despite uncertainties, greenhouse warming poses a potential threat, "sufficient to merit prompt responses ... Investment in mitigation measures act as insurance protection against the great uncertainties and the possibility of dramatic surprises. In addition, the panel believes that substantial mitigation can be accomplished at modest cost. In other words, insurance is cheap."

° A supplementary IPCC report updating its 1990 study finds that new research confirms the general conclusions of its earlier study. However, the report notes that reflection of sunlight by particulates may be offsetting some greenhouse warming in the Northern hemisphere.

° The United Nations Framework Convention on Climate Change is signed by 155 nations at the Rio Earth Summit.

1993: The United Nations Framework Convention on Climate Change is ratified by more than 50 nations, putting it into effect. Efforts are currently underway to implement and strengthen it world-wide.

1994: Mt. Pinatubo's cooling effect wanes, and Earth's temperature returns to high readings characteristic of the late 1980's; March through December 1994 are the warmest such period on record, according to the National Weather Service's Climate Analysis Center.

1995: The Intergovernmental Panel on Climate Change, representing the consensus of climate scientists worldwide, concludes that "... the balance of evidence suggests that there is a discernible human influence on global climate." The year 1995 matches 1990 as the hottest year on record.

1997: Parties to the Framework Convention to meet in Kyoto, Japan, in December in order to agree on binding obligations to limit emissions.

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Global Warming: Myth vs. Fact

MYTH: Although thermometers located at Earth's surface indicate that the planet's average temperature is higher today than it has been for at least 130 years, satellite measurements of the temperature of the atmosphere thousands of feet above the surface indicate a slight cooling since 1979. The surface temperature data is unreliable due to the heat-trapping effect of urban areas. Therefore, there is no compelling evidence that warming has occurred.

FACT: Since thermometers and satellites measure temperatures at two different places in the atmosphere, it is not surprising that the trends sometimes differ. At higher altitudes, temperatures fluctuate more than at the surface due to natural climate influences like sunlight-reflecting particles from volcanoes. This variability or noise in the satellite record obscures the warming trend due to the buildup of the greenhouse gases which is apparent in the global surface temperature data. Furthermore, the depletion of the ozone layer, which has occurred mostly since 1979, has had a cooling effect on the atmosphere which is more marked at higher altitudes than at the surface.

Earth's surface has warmed over both the northern and southern hemispheres, and the warming is apparent in data taken both on land and at sea. Therefore, the urban "heat island" effect could not be causing much of the observed warming.



MYTH: Changes in temperature and changes in greenhouse gas emissions over the past century did not occur simultaneously. Therefore, measured warming cannot be due to the greenhouse gases.

FACT: Many factors have influenced climate in addition to the buildup of greenhouse gases, so there is no reason to expect the two trends to match exactly. However, computer models indicate that warming due to the greenhouse gas buildup will dominate the other factors over the coming decades. These factors include small changes in the output of the sun, a haze of particles arising from volcanic eruptions and from fossil fuel burning which reflects sunlight, and natural variations of climate.

In addition, the slow heating of the oceans leads to a lag between emissions and their effect on temperature. Therefore, a simple overlay of greenhouse gas emissions and temperature data is deceptive. When global temperatures are simulated with a computer model which accounts for most of the additional influences, the result is consistent with the observed warming, and the buildup of greenhouse gases is a dominant factor.



Fact Sheet

ENVIRONMENTAL DEFENSE FUND

MYTH: Computer models are unreliable as a guide to future climate change because they do not reproduce past changes. In particular, they fail to account for the one-half degree warming over the past century.

FACT: When changes in the haze of particles as well as greenhouse gases are taken into account, the models simulate a global temperature trend over the past century which is consistent with the observed warming. In addition, there is increasing agreement between the geographical pattern of climate change predicted by the models and the measured pattern of temperature change. Models reproduce other key features of global climate, including the magnitude of the temperature variation from winter to summer and aspects of ancient climates inferred from ice cores, pollen and fossil data.



MYTH: Carbon dioxide is removed from the atmosphere fairly quickly, so if global warming turns out to be a problem, society can wait until after consequences occur to reduce greenhouse gas emissions.

FACT: Carbon dioxide, which is emitted largely by combustion of fossil fuels, is the most important human-made greenhouse gas. If emissions of carbon dioxide were halted today, it would take more than a century for the atmospheric level of carbon dioxide to approach its pre-industrial level. Furthermore, about 15% of all the carbon dioxide which has been emitted already would remain airborne for thousands of years, causing warming indefinitely. In addition, the slow warming of the ocean creates a lag between emissions and their full effect on temperature. In others words, the consequences of past emissions are not yet entirely apparent.



MYTH: Rapid warming occurred at early times without catastrophic consequences, so society and ecosystems can adapt readily to any foreseeable warming.

FACT: Rapid warming occurred in some places at the end of the last glacial period, but since then, global climate has been stable for ten thousand years. During this time, agriculture and civilization arose, leading to fixed settlements, infrastructure, and large populations in areas which are highly vulnerable to climate shifts, such as low-lying coastal zones.

Furthermore, the existence of rapid climate changes in the distant past provides only limited insight into the fate of natural ecosystems. Previously, rapid climate changes may not have occurred everywhere at once, as they are expected to in the future. Furthermore, there were no human-made barriers to inhibit adaptation by ecosystems. In contrast, human settlements, highways, and farmland will block migration of species adjusting to the warming climate of the coming century.



Fact Sheet ENVIRONMENTAL DEFENSE FUND

MYTH: Warming has been occurring largely at night, which is less of a problem than daytime warming.

FACT: Warming over the past century has occurred both during the day and at night, but night-time warming has been the greater of the two. The buildup of the haze of particles from combustion discussed above has probably contributed to this asymmetric warming. But as warming continues, the tendency toward night-time warming is expected to diminish, in part because the slow heating of the oceans causes a uniform atmospheric warming over time. In any event, night-time warming would be experienced by society and ecosystems differently than daytime warming, but may be no less problematic. For example, the northward spread of certain infectious diseases is currently limited by cold night-time temperatures.

MYTH: The IPCC has reduced its projected global warming by 1/3. If we wait a little longer, the threat of human-induced climate change may disappear altogether.

FACT: Computer models of climate have been adjusted to account for the cooling effect of particle haze, which has resulted in lower projections of global average warming by year 2100. The reflection of sunlight by particles partially masks, but does not eliminate, the buildup of the greenhouse effect. When developing countries like China move to reduce the emissions of sulfur dioxide which generate these particles (as the U.S., Europe and Japan already have in order to reduce health effects and acid rain), the hidden warming inevitably will be revealed.

MYTH: Human activities only contribute 4% of CO₂ emissions; the rest comes from natural sources like decaying vegetation and forest fires started by lightning. The human contribution is too small to have a significant effect on climate, particularly since the oceans absorb most of the extra CO₂ emissions.

FACT: Before human beings began to affect the level of CO₂ in the atmosphere, the natural emissions of CO₂ were nearly exactly balanced by natural process which remove CO₂. As a result, the amount of CO₂ in the atmosphere had changed very little for 10,000 years. The additional source of CO₂ from human activity like burning coal and oil for energy, has thrown the system out of balance. Although the oceans and forests absorb about half the CO₂ emitted by industry, the rest builds up in the atmosphere. As a result, CO₂ levels are now 30% above what they were in pre-industrial times. Similar changes of CO₂ occurred naturally tens of thousands of years ago and they were generally accompanied by large shifts in global average temperature.

Fact Sheet ENVIRONMENTAL DEFENSE FUND

MYTH: The buildup of CO₂ will lead to a "greening" of the earth because plants can utilize the extra CO₂ to speed their growth.

FACT: Under the controlled conditions which occur in a greenhouse with ample water and fertilizer, plants grow more rapidly in an atmosphere enriched by CO₂. The extent that this effect carries over into natural systems like forests is unknown. Some plants, potentially including weeds, may benefit while others may not. The consequence for forests and other ecosystems is uncertain, but it is unlikely to counteract the adverse impacts of a rapid climate change.



MYTH: If Earth has warmed since pre-industrial times, it is because the intensity of the sun has increased.

FACT: The intensity of the sun continuously changes, but there were no direct measurements of the size of these shifts before 1979. Indirect evidence suggests that the Sun's variations in the past may have been large enough over the course of centuries to affect Earth's climate significantly. However, a recent estimate indicates that the warming effect of solar variations since pre-industrial times is only about one-tenth as large as the warming effect of the greenhouse gas buildup. The Sun's variations since 1979 have been very small.



MYTH: The IPCC now predicts a global warming of only 1 to 3.5 degrees Celsius over the coming century. This small change, much less than the current daily temperature range for most major cities, is hardly a cause for concern.

FACT: The global average temperature has changed by less than a degree Celsius up or down for ten thousand years. So the projected warming is expected to exceed any climate change which has occurred during the history of civilization. In addition, even apparently small global average temperature changes will be accompanied by much larger regional climate shifts. For example, a warming which is twice as large as the global average is projected to occur at high northern latitudes. Apparently small global average changes also led to large climate shifts in the past: Earth's average temperature increased by only about 5 degrees Celsius between the end of the last ice age and today, but much of the Northern Hemisphere went from being buried under thousands of feet of ice to being ice-free.





MYTH: It is hard enough to predict the weather a few days in advance, so how can we have any confidence in projections of climate a hundred years from now?

FACT: Climate and weather are different. Weather refers to temperatures, precipitation, and storms on a given day at a particular place. Climate reflects a long term average, sometimes over a very large area, like a continent or even the entire Earth. Averages over large areas and periods of time are easier to estimate than the specific characteristics of weather. Nevertheless, scenarios for global warming always recognize a large range of uncertainty.

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Misc. Sent In

FAX COVER SHEET

'97 SEP 11 PM5:03

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IT'S A FAX FROM THE PRESIDENT !

DATE: 9/11/97PAGES INCLUDING COVER: 3TO: Todd SternFR: BRENT BLACKWELDERRECIPIENT'S PHONE: _____ RECIPIENT'S FAX: 456-2215

contact Sherri Owens on ext. 222 for transmission errors.

MESSAGE:

FRIENDS
OF
THE

earth

1025 Vermont Ave., NW, Third Floor, Washington, DC 20005-6303

4512 University Way, NE, Seattle, WA 98105-4511

September 11, 1997

Memo to: Todd Stern

From: Brent Blackwelder

Re: Ozone Protocol Meeting in Montreal and Climate Change

White House intervention is urgently needed to change the direction of the Montreal Protocol meeting which I have been attending. This matter directly links to our ability to deal with climate change.

The US and the EU are taking opposite positions on two key issues: phasing out methyl bromide and phasing out HCFCs, with the US proposing a strong position on the former and opposing a strong EU proposal on the latter. The EU is exactly the reverse.

With the EU and the US arguing against each other's phase-out proposals we are headed toward the lowest common denominator. Furthermore, the US appears ready to concede to the EU position for a 2005 phase-out of methyl bromide.

How are we going to deal with climate change matters in December in Japan where all of modern industrial civilization is involved when we can't get rid of a dangerous pesticide, where three quarters of the world's supply is made by just three industries--Great Lakes Chemical, Dead Sea Bromine, and Albemarle (a spinoff of Ethyl).

The attached release explains the concerns in more detail.

BB



Friends of the Earth
Les Amis de la Terre
Amigos de la Tierra

a member of Friends of the Earth International



EU-US TANGLE AT TENTH ANNIVERSARY OZONE TALKS 10 September, 1997

Background

The Tenth Anniversary of the Montreal Protocol meeting is underway starting September 9 to 12 in its preparatory work with the high level meetings of Ministers taking place September 15 to 17. There are 162 signatories to the Protocol which was set up to protect the ozone layer from destruction by ozone depleting chemicals like CFCs used in refrigeration and air-conditioning and halons, used in fire-fighting equipment. Methyl bromide, the chemical most recently identified as an ozone depleter is a pesticide and fumigant and now the focus of hot debate after the first day of the opening meeting.

EU-US Tangle Opening Day Threatens To Derail Progress

The European Union and the United States grappled over two key phase-out dates - those of HCFCs and methyl bromide. The European Union calls for a faster phase-out of HCFCs and a slower date for methyl bromide, while the US opposes faster phase-out of HCFCs while pushing for a 2001 early phase out for methyl bromide. This disagreement is likely to result in a position that satisfies no one and fails to provide the necessary protection for the ozone layer. By setting up this face-off, the most likely outcome will prove to be the lowest common denominator on both decisions, especially since a large number of developing countries made statements that clearly showed their desire to dodge the decision entirely and have no phase-out date set for methyl bromide in their countries.

The US spoke out strongly against accelerating the phase-out of HCFCs, arguing that manufacturers and users who chose these transitional chemicals to replace CFCs require time to recoup their investment. The European Union points out that HCFCs are ozone-depleters coming into stronger use at the very time the ozone layer is at its most vulnerable. In the European Union, hydrocarbon technology is the selected substitute for CFCs in refrigeration, a choice that receives strong support by environmentalists.

On methyl bromide, the US is supporting an accelerated phase-out date of 2001 rather than 2010 for industrialized countries - a date which mirrors its domestic commitment under the Clean Air Act. The European Union is sticking with 2005 as the earliest date they can accommodate with Italy and Spain opposing anything more rapid. Seventy-five percent of the world's methyl bromide is manufactured by three companies - Great Lakes Chemicals, Dead Sea Bromine and Albemarle, a spin-off of Ethyl Corporation.

Friends of the Earth calls for a 2001 phase-out date for methyl bromide use and production in industrialized countries along with 2006 for developing countries. For HCFCs, Friends of the Earth calls for 2010 accelerated phase-out with a five year delay for developing countries.

For more information: Angela Vincelli, Friends of the Earth,
anytime at 1 (613) 795 5758

Mtg. Requested

ALCALDE & FAY

GOVERNMENT & PUBLIC AFFAIRS CONSULTANTS

'97 SEP 10 PM5:04

FACSIMILE TRANSMISSION

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COMMENTS:

Melissa

[Signature]

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GOVERNMENT & PUBLIC AFFAIRS CONSULTANTS

September 10, 1997

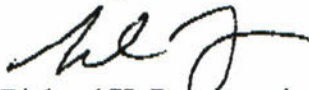
Mr. Jonathon Adashek
Assistant to the Staff Secretary
The White House
1600 Pennsylvania Avenue, NW
Washington, D.C.

Dear Jonathon:

The purpose of this letter is to request a meeting with Mr. Stern for me and Kevin Lynch, Director of Government Affairs for PacifiCorp. As you know, Mr. Fred Buckman, CEO of PacifiCorp attended the meeting with the President on the issue of climate change on August 4. We would like to discuss that issue with Mr. Stern anytime beginning mid morning on Tuesday, September 16 through the rest of the day. Mr. Lynch is also available early Wednesday morning, and from 11:00am until 2:00pm and after 5:00pm.

I will follow-up with you to determine Mr. Stern's availability for such a meeting. Thank you in advance for your attention to this request. Should you require any additional information, please do not hesitate to contact me at (703) 516-4139.

Sincerely,



Richard H. Rosenzweig