



WORLD RESOURCES INSTITUTE

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Tim.
*An excellent letter from Repetto on how the new
particulate/ozone standards lower the implicit
cost of carbon* *Poddyx*

Todd Stern
White House

**COPY FOR YOUR
INFORMATION**

WRI

'97 SEP 30 AM 10:13

August 29, 1997

Dr. Janet L. Yellen
Chair
Council of Economic Advisors
314 Old Executive Office Building
17th & Pennsylvania Avenue, NW
Washington, D.C. 20502

Dear Dr. Yellen:

I've been thinking about the concerns you expressed recently over the size of the implicit carbon tax that would be needed to achieve a stabilization target at 1990 levels by 2010. Earlier on, at Dr. Munnell's request we had undertaken a meta-analysis of modeling results on this issue and found that, like the GDP impacts, the predicted tax level was quite sensitive to underlying modeling assumptions. In short, the more flexibility and substitutability assumed in the economy, the lower the predicted implicit tax. Lower bound estimates were about \$50 per ton of carbon, about half the level that the IAT analysis inferred from the DRI model. These lower estimates are consistent with the recent findings of DOE's national labs study.

The predicted tax to achieve stabilization is also sensitive to the baseline assumptions that determine future energy demands, fuel mix and energy costs in the absence of any climate policy interventions. In my review comments on the IAT analysis, I pointed out that those baseline assumptions largely ignored considerations of air quality, transport congestion, and energy security in forecasting energy costs and energy demands. Consequently, the baseline assumptions probably overstated energy demands and understated energy costs.

In particular, the modeling underlying the IAT analysis ignored the recently adopted revisions to the air quality standards for ozone and fine particulates, which will require tighter emissions standards for utilities and industries in many regions. Since those regulations had not been finalized when the IAT analysis was underway, the omission is understandable. Nonetheless, those new regulations are significant because they will force many utilities to retrofit older coal-fired thermal plants with expensive NOx reduction equipment in order to keep them operating. This additional capital expenditure requirement alters the economics of replacing older coal-fired plants with new higher-efficiency combined-cycle gas-fired plants. By adding to the costs of keeping the older plants in operation, it lowers the implicit carbon tax that would be

necessary to make new gas-fired plants competitive. Since utilities are the main market for coal and reducing coal use is the key to achieving stabilization of carbon emissions, the economics of backing out coal from electricity generation are crucial.

WRI has undertaken some preliminary calculations exploring the magnitude of this effect. We compared generating costs from a fully-amortized, baseload coal plant operating at 33% fuel efficiency and a new gas-fired plant capable of 50% efficiency. We found that ignoring retrofit cost a carbon tax of approximately \$78 per ton would be needed to make it economical to scrap the coal plant and build or buy electricity from a new gas-fired plant. However, when estimated retrofit costs of about \$100/KW for additional NOx controls are factored in, the required tax drops to \$64 per ton of carbon. Naturally, these calculations are sensitive to various parameters, such as capacity factors, fuel efficiency, fuel prices, and retrofit costs, so that a detailed analysis would have to be based on actual utility plant and system characteristics. Nonetheless, these preliminary results suggest that in ignoring the impact of the new air quality restrictions, the IAT analysis substantially overestimated the implicit carbon tax needed to achieve stabilization. I'd be happy to send your staff the details of the calculations, if that would be useful.

Sincerely,

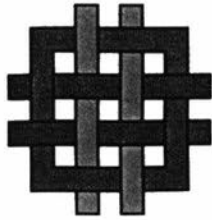
A handwritten signature in cursive script, reading "Robert Repetto".

Robert Repetto
VP & Sr. Economist

cc: Dr. Jeffrey Frankel, Chief Economist, CEA
Hon. Tim Worth, Under Secretary Department Of State

97 SEP 22 AM 9:08

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Jonathan Lash, President

18 September 1997

Dear Todd,

Three more pieces you will find useful as you did the "Cost of Climate Protection".

Reed and Goldemberg examine the reductions made by China and other non Annex I countries as they raised energy prices. "Climate Protection and the National Interest" is a very clear basic primer on the greenhouse effect and its consequences.

In "Planetary Roulette" on P. 84 of FOREIGN POLICY, Repetto and I examine the geopolitics of the issue.

More coming soon on human health, competitiveness, and the cost of waiting.

Jonath

9/24

B.O. government
JL



JULY 1997

ARE DEVELOPING COUNTRIES ALREADY DOING AS MUCH AS INDUSTRIALIZED COUNTRIES TO SLOW CLIMATE CHANGE?

BY WALTER V. REID AND JOSÉ GOLDEMBERG

Developing countries are already effective participants in global efforts to reduce greenhouse gas emissions. Indeed, since the signing of the 1992 Framework Convention on Climate Change (FCCC) developing countries may have achieved greater carbon dioxide emission savings than industrialized countries.

Negotiations to strengthen the Climate Convention risk being derailed by the increasingly popular argument that industrialized countries should not commit to greenhouse gas reductions unless developing countries agree to reductions. This position backtracks on the pivotal compromise reached in the Framework Convention on Climate Change (FCCC), which balanced the timing and strength of actions by industrialized countries (which are largely responsible for the climate change that is now underway) with those of developing countries (which ultimately will be the major source of emissions). But the position also rests on a faulty assumption. Even without commitments to limit emissions, developing countries are already taking significant steps to rein in greenhouse gas emissions.

Industrialized countries account for more than two-thirds of annual carbon dioxide emissions worldwide and an even larger share of the radiative forcing of greenhouse gases.

Consequently, under the FCCC these nations accepted a greater burden than developing countries for slowing the growth of greenhouse gas emissions. However, by 2020, developing country emissions are projected to exceed those of industrialized countries.¹ To prevent dangerous impacts from climate change, developing countries will eventually need to reduce the rate of growth, and, ultimately, the level of their emissions.

In keeping with the principle of "common but differentiated responsibilities" agreed to in the FCCC, countries in the Organization for Economic Cooperation and Development (OECD) set voluntary targets of stabilizing carbon dioxide (CO₂) emissions at 1990 levels by the year 2000. These countries will largely fail to meet their voluntary commitments: Of the nine OECD countries with 1990 emissions greater

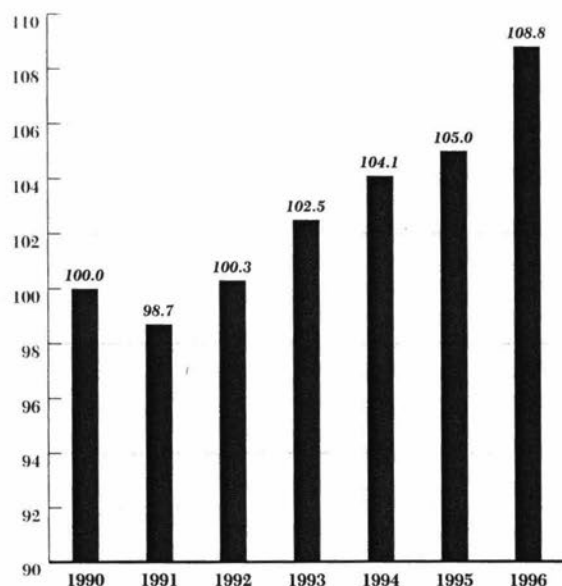
than 50 million metric tons of carbon (MtC) only two—the United Kingdom and Germany—are likely to have emissions at or below 1990 levels in 2000.² U.S. emissions have increased each year since 1991 and now appear likely to be 13 percent above the promised target in 2000³ (Figure 1).

Even without commitments to limit emissions, developing countries are already taking significant steps to rein in greenhouse gas emissions.

In April 1995, parties to the Climate Convention agreed to the "Berlin Mandate," which established a two-year negotiating process to develop a protocol that will set quantified limitation and reduction objectives after 2000, in all likelihood including a cap on emissions among Annex I countries (i.e., OECD and countries with economies in transition). The parties agreed not to introduce new commitments for developing countries in that protocol; however, the Berlin Mandate does specify that developing countries should advance the implementation of their existing commitments.



Figure 1

Relative US CO₂ Emission (1990=100)

The figure shows percentage change in U.S. CO₂ emissions relative to a 1990 baseline. For example, emissions in 1996 were almost 9 percent greater than in 1990.

But this agreement is now being called into question. In a July 1995 letter to President Clinton, CEOs of 119 leading U.S. companies stated, "Agreements cannot exempt developing nations, which are expected to be the major contributors to greenhouse gases in the 21st Century." According to the President of the United Mine Workers of America, "The United States made a fundamental negotiating error when it agreed in Berlin to negotiate binding commitments on industrial countries while letting fast-growing developing countries such as China, India, Korea, Mexico, and Brazil off the hook."⁴ And, a Sense of the Senate resolution circulated by Senator Robert Byrd states, "The United States should not be a signatory to any protocol to, or other agreement regarding the United Nations Convention for Climate Change of

1992, ...which would mandate new commitments to mitigate greenhouse gas emissions for the Developed Country Parties, unless the protocol or other agreement also mandates specific scheduled commitments within the same compliance period to mitigate greenhouse gas emissions for Developing Country Parties."

There are many reasons why governments premised the Convention on a differentiation between the commitments of industrialized and developing nations. The bulk of past greenhouse gas emissions came from industrialized nations. And, although annual developing world emissions will equal those of industrialized nations by 2020, it will take considerable time before their cumulative releases—a better index of overall contributions to the global warming—match those of industrialized countries. Moreover, much of the growth in emissions in developing countries results from the provision of basic human needs for their growing populations, while that in industrialized countries contributes to growth in a standard of living that is already far above that of the average person worldwide.

1992, ...which would mandate new commitments to mitigate greenhouse gas emissions for the Developed Country Parties, unless the protocol or other agreement also mandates specific scheduled commitments within the same compliance period to mitigate greenhouse gas emissions for Developing Country Parties."

Even beyond these basic reasons, however, it appears that developing countries are already doing a great deal to limit emissions—a fact largely overlooked in the current debate. Some examples of the actions being taken by developing countries are the following.

PRICE REFORM

Between 1990–91 and 1995–96, total fossil fuel subsidies in 14 developing countries that account for 25 percent of global carbon emissions from industrial sources declined 45 percent, from \$60 billion to about \$33 billion.⁵ (During this same period, OECD subsidies declined by 20.5 percent, from \$12.5 billion to \$9.9 billion.) Reduced subsidies lead to higher fuel prices and reduced rates of growth in consumption and carbon emissions.

The most significant carbon savings over the past decade have occurred in China, which accounts for 12 percent of total world energy-related CO₂ emissions, second only to the United States. China's energy-related carbon emissions tripled between 1971 and 1993, largely due to growth in coal-fired power production, which accounted for 83 percent of its emissions.⁶ Beginning in the 1980's, however, China substantially reformed energy pricing, with coal subsidies falling from 37 percent in 1984 to 29 percent in 1995, and petroleum subsidies falling from 55 percent in 1990 to 2 percent in 1995. Although annual carbon emissions grew by 228 MtC between 1980 and 1990, emissions would have been 155 MtC higher in 1990 without the energy efficiency gains achieved over this period.⁷ The World Bank esti-



mated in 1996 that further efficiency gains in China have the potential of yielding savings of 1,000 to 1,700 million tons of coal equivalents per year by 2020—an amount greater than China's total energy consumption in 1990.⁸

Within the past six years, India, Mexico, South Africa, Saudi Arabia, and Brazil—all of which rank among the top-25 countries for industrial CO₂ emissions—also cut fossil fuel subsidies significantly. Using World Bank estimates of price elasticities of demand and inflation-adjusted internal fuel prices, carbon savings of to 26 MtC per year (Table 1) should result in these countries from the fuel price reforms. An additional 19.5 MtC in savings should result from fuel price reforms on petroleum products in China over this same time period.

PROMOTION OF EFFICIENCY AND RENEWABLE ENERGY

Many developing countries are also actively promoting energy efficiency and renewable energy. By the end of 1993, 12 percent of China's installed electrical generation capacity—14.6 gigawatts of electricity—was produced through cogeneration. The Ministry of Energy now requires all large industrial boilers to be converted to cogeneration facilities.⁹ By the end of 1995, the annual utilization rate of renewable energy reached 300 million tons of coal, accounting for one quarter of the total national consumption of primary energy and over 47 percent of energy consumption in rural areas.

Mexico, India, and Brazil have launched specific energy efficiency and renewable energy programs. Mexico's National Commission for Energy Conservation has developed energy efficiency standards for new boilers, refrigerators, small air conditioners, buildings, and electric motors. It is undertaking voluntary programs with industry for energy conservation and energy audits. India subsidizes the development of renewable energy. Wind turbine equipment, for example, currently qualifies for 100 percent accelerated depreciation in the year of installa-

Much of the growth in emissions in developing countries results from the provision of basic human needs for their growing populations, while that in industrialized countries contributes to growth in a standard of living that is already far above that of the average person worldwide.

tion, and the equipment and components qualify for concessional customs duty or full exemption.¹⁰ India's current Five Year Plan (1992–1997) also includes a National Energy Efficiency Programme, which has the potential to save 5,000 MW in the electricity sector and 6 million tons of oil in the petroleum sector over the five-year period.¹¹

In 1976, Brazil initiated an aggressive program to use ethyl alcohol (ethanol) from sugar cane in automobiles. Production rapidly grew to about 200,000 barrels a day, replacing one-half of the gasoline that otherwise would have been used. Since

ethanol from sugarcane is a renewable resource, 9.45 MtC per year, or approximately 15 percent of Brazil's total emissions from fossil fuels, is avoided.¹² Brazil also instituted an electricity conservation program, PROCEL, which, although modest in the early 1980s, will receive \$400 million in 1997 and 1998 to improve the efficiency of refrigerators, air conditioners, lighting, and other appliances. This program will avoid the installation of 1,600 MW of new electricity generation at one quarter of the cost of generating the additional power.

JOINT IMPLEMENTATION

Under the Climate Convention's pilot phase for "Activities Implemented Jointly" (AIJ), Annex 1 countries can invest in greenhouse gas reduction projects in other countries, although the investing country is not allowed to apply emission

reductions against their own national commitments. If emission credits are allowed for joint implementation projects after the pilot phase, they are likely to be shared between the investing and recipient country, thus, developing countries would take some credit for the carbon savings stemming from these projects. Net carbon savings for 20 approved AIJ pilot projects in developing countries that will be achieved over the next 20 years (if the projects are fully funded) amount to 138 MtC (135 MtC in forestry projects, 3 MtC in energy projects).¹³ If credits were currently allowed for these projects and one assumes that half of the emission



reduction from such projects should be attributed to implementing countries, developing countries would be responsible for about 69 MtC offset over the twenty-year period. (Note that on an annual basis, this value is only a small fraction of the savings being achieved through energy policy reforms.)

SIDE BENEFITS VERSUS “NO REGRETS”

None of these carbon savings in developing countries have resulted from domestic climate mitigation policies. Instead, carbon-saving has been a side benefit of policy changes and projects designed to meet national economic, social, and public health needs. For example, severe energy shortages in China have already placed constraints on its economic development, contributing to an estimated 25 to 30 percent underutilization of its manufacturing capacity.¹⁴ One study of the economic benefits of 16 energy efficiency projects in China's manufacturing sector found that all had internal rates of return well over 12 percent, while three-quarters had rates of 20 percent or more.¹⁵

Developing countries are facing significant public health problems from air pollution, largely due to fossil fuel use. If unhealthy levels of suspended particulate matter were brought down to meet World Health Organization standards, between 300,000 and 700,000 premature deaths per year could be avoided in developing countries.¹⁶ In Mexico, economic damages due to the health

impacts of air pollution are estimated at \$1.5 billion per year. Particulates are estimated to cause 12,500 extra deaths and 11.2 million lost workdays per year.¹⁷

Brazil's alcohol fuel program was established to reduce the country's dependence on imported oil and to help stabilize sugar production in the face of cyclic fluctuations of international prices. The program has been a source of employment opportunities for both skilled and unskilled workers, particularly since it was almost entirely based on locally manufactured equipment. It has helped to establish a strong agro-industrial system, generated 700,000 jobs, and reduced urban pollution.

Similar to developing countries, emission savings by OECD countries resulted from actions initiated for other reasons. In fact, the only two large OECD countries that are likely to achieve the goal of returning to 1990 levels of emissions—the United Kingdom and Germany—will do so largely because of factors not included in the policies and measures they established to mitigate climate change. In the United Kingdom, two-thirds of the nation's emission reductions expected by 2000 will result from the replacement of coal-fired power plants with combined cycle gas turbines (which produce half the carbon per unit of electricity)—a result of energy utility privatization of over the past decade. Germany's carbon savings result primarily from

Carbon-saving has been a side benefit of policy changes and projects designed to meet national economic, social, and public health needs.

the shift from inefficient coal to natural gas in the former East Germany following unification.

More generally, the Intergovernmental Panel on Climate Change concluded that over the short term the costs of stabilizing CO₂ emissions at 1990 levels in OECD countries—a goal that the countries will not meet in any event—may be negligible.¹⁸ Economist Dale Jorgenson calculates that under a variety of policies for recycling taxes collected on U.S. carbon emissions, taxes set high enough to internalize the economic damages from climate change would be economically justified based on lessened health and welfare damages from air pollution alone.¹⁹ More generally, those economic models that make the most realistic assumptions about the policies that are put in place to reduce emissions (e.g., the use of market approaches, efficient recycling to the economy of revenue generated from taxes on fossil fuel use) and about the response of private firms (e.g., that such policies would stimulate technological innovation and substitution) show that policies to reduce greenhouse gas emissions will have neutral or positive impacts on the U.S. economy.²⁰

How do our estimates of the savings in CO₂ emissions in developing countries since the signing of the FCCC compare to savings in OECD



Table 1

Estimated Carbon Emission Savings Resulting From Recent Fossil Fuel Price Changes

	1992 Emissions (1000 tons Carbon) from fuel type	Real Price Change (Percent)	Time Interval	Elasticity of Demand	Emission Reduction (Percent)	Emission Reduction (1000 tons Carbon)
COAL 1990–1994*						
India	150,627	106	1990–1994	0.60	4	5,594
South Africa	65,267	119	1991–1994	0.60	10	6,360
PETROLEUM PRODUCTS 1990–1995*						
Brazil	41,892	122	1991–1995	0.50	10	3,989
China	108,704	221	1991–1994	0.25	18	19,541
India	44,032	102	1990–1995	0.60	1	397
Mexico	68,532	138	1990–1995	0.30	9	6,311
Saudi Arabia	33,948	150	1990–1995	0.30	12	3,933
TOTAL (without China)	404,298					26,584
TOTAL (with China)	513,002					46,125
ALL FOSSIL FUELS 1980–1990						
China**	686,828		1980–1990		22	155,000

* Long term elasticities are in the range of -0.5 to -1.0 for coal and -0.7 to -1.5 for petroleum. Following Larsen and Shaw,²³ more conservative estimates of elasticity were used, particularly for substantial price changes. The possibility of fuel switching adds uncertainty to these estimates.

** Carbon savings due to change in energy intensity of the economy over this time period; source.⁶

countries? Under “business as usual” projections, OECD emissions would be expected to increase from 2809 MtC in 1990 to 2922 MtC in 2000—an increase of 113 MtC. If these countries did succeed in meeting their stated objective of returning emissions to 1990 levels through actions to reduce the rate of growth of emissions, annual emissions would thus be 113 MtC lower than expected, a savings equivalent to about 4 percent of 1990 emissions.²¹ In contrast, fuel price reforms since 1990 in the six developing countries listed in Table 1 should yield savings of 46 MtC. (Because data were not available to estimate the impacts of price reform on coal use in China over this time period, the CO₂ emission savings may in fact be significantly greater than this estimate.) Although these CO₂ savings are smaller than

the commitments that OECD countries made in absolute terms, they are a larger fraction of the emissions for the specific fuel types examined in these six countries, representing 9 percent of the 1992 emission levels (Table 1).

Since OECD countries overall will fail to meet the voluntary targets for returning emissions to 1990 levels, it thus appears that developing countries may be achieving equivalent or greater CO₂ emissions savings than OECD countries in absolute terms and, since they are starting from a lower baseline, significantly greater savings as a percentage of their emissions.

All parties to the Climate Convention, including developing countries, have already committed to

“promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce, or prevent anthropogenic emissions of greenhouse gases...” In keeping with this commitment, policy changes and conservation and renewable energy programs in developing countries are leading to significant carbon emission savings. As called for in the Berlin Mandate, new actions and policy reforms in these countries should seek to further the progress already being made. Economically attractive options to increase energy efficiency in developing countries are more widespread than in the OECD countries. But given the fact that developing countries are aggressively pursuing these options while OECD countries will fail to meet



their voluntary targets one questions whether industrialized countries are leaders or laggards in mitigating climate change.²²

ABOUT THE AUTHORS

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- The authors thank Tricia McGinnis and Paige Brown for research assistance, Kirk Hamilton for assistance with obtaining data on fuel prices, and Liz Cook, Paul Faeth, Tom Fox, James MacKenzie, Alan Miller, Kiliparti Ramakrishna, and Robert Repetto for comments on earlier drafts of this publication. WRI's work on international climate policy receives support from the Nathan Cummings Foundation and the U.S. Environmental Protection Agency.
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FOREIGN POLICY

FALL 1997

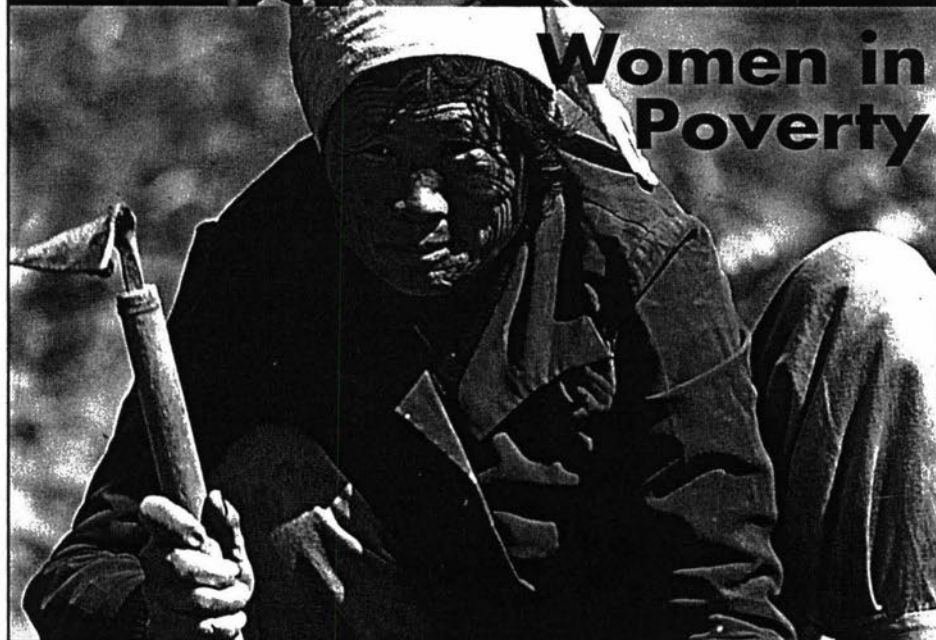
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Planetary Roulette: Gambling with the Climate

by Robert Repetto & Jonathan Lash

Because of human actions, the Earth's climate is changing more rapidly than it has at any time in human history. This December, the 167 nations that ratified the 1992 United Nations Framework Convention on Climate Change (FCCC) will meet in Kyoto, Japan, to negotiate over how to prevent climate from moving outside the range of human experience. Among the issues they will have to confront are a global environment facing unprecedented risks, reduced dependence on the fossil fuels that have powered the world economy since the Industrial Revolution, new economic and political relations between the world's developed North and developing South, and potentially burdensome restrictions on nations' economic sovereignty. Rarely have the mechanisms for national decision-making and international cooperation been subjected to comparable strains. In short, what happens in Kyoto will signal the prospects for managing what could prove to be the most momentous environmental problem in human history.

Driving these negotiations is the certainty that rising greenhouse gas emissions, if left unchecked, will cause ever more serious climate change. Fossil fuel burning, agriculture, and deforestation are putting

ROBERT REPETTO is vice president and senior economist of the World Resources Institute. JONATHAN LASH is president of the World Resources Institute and co-chair of the Presidential Council on Sustainable Development.

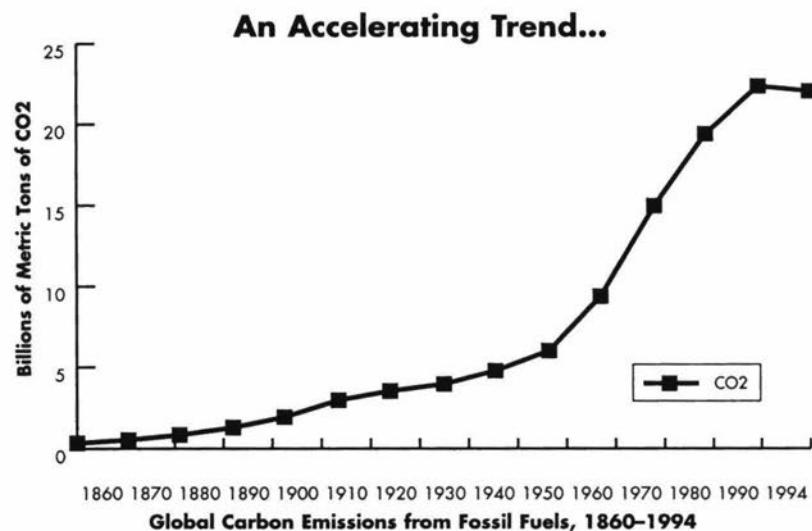
Repetto & Lash

carbon dioxide, methane, nitrous oxides, and other greenhouse gases into the atmosphere faster than natural processes remove them. Carbon dioxide (CO₂) concentrations have risen by 30 percent and methane concentrations have doubled since preindustrial times. These gases raise the Earth's surface temperature by letting solar radiation through while blocking the reflection of infrared radiation back into space, as a greenhouse does. The existence of the greenhouse effect is indisputable: Without it, the Earth would be too cold to inhabit. The latest assessment by the Intergovernmental Panel on Climate Change (IPCC), a scientific body set up to coordinate and assess climate research, concludes that accumulating greenhouse gases have already produced a discernible effect on today's climate.

*Rain and snowfall, wind
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change drastically.*

Since some greenhouse gases stay aloft for long periods and because the oceans store a huge amount of heat, warming will continue and persist irreversibly for centuries even after accumulation stops. Consequently, the observable change in the climate, at any time before equilibrium is restored, will be much less than what emissions up to that point have made inevitable. Put simply, the climate problem will always be worse than it appears to be.

Unfortunately, climate change implies much more than gradually rising temperatures. Rain and snowfall, wind and ocean currents, evaporation rates, water runoff into rivers and lakes, and other aspects of climate are likely to change drastically. Heavy rains and snowstorms in higher latitudes—like those that caused devastating flooding in the upper midwestern United States last spring, and in Poland and the Czech Republic last summer—may become more common. Intense hurricanes and cyclones like those that hit Florida and the Caribbean during this decade may occur more frequently. These possibilities have alarmed property insurance and reinsurance providers about their exposure to catastrophic loss claims of \$50 billion or more for single events. Farming regions in the interiors of Africa, Asia, and North America may experience drought and punishing heat waves. Paradoxically, shifts



Source: "Trends '93, A Compendium of Data on Global Change," Carbon Dioxide Information Center, Oak Ridge National Laboratory.

in the Gulf Stream could make northern Europe much colder. The disintegration of the Antarctic ice cap would raise sea levels. No country is exempt from the risks of climate change.

The biological consequences of climate change are pervasive but uncertain. The range and lifecycle of organisms from trees to coral reefs to mosquitoes are sensitive to climatic changes. In agriculture, wetter weather, a longer growing season, and more carbon dioxide in the air would be good for crops; but increased evaporation of moisture from the soil, destructive rainfall in heavy storms, and weather more hospitable to pests would not.

The only way to avoid these risks is to stabilize the atmospheric concentrations of greenhouse gases. That would ultimately require reducing current global emissions by 50 to 60 percent over the next century, even as population and economic output grow. No small task, this means using natural gas, a low-carbon fuel, instead of coal and oil in most applications. Noncarbon energy sources such as hydroelectric, solar, and nuclear energy will have to provide much more of the total supply. Buildings, transport systems, and industrial processes will have to be redesigned to use energy much more efficiently.

Since it takes decades to replace existing capital stock and technologies, a gradual transformation is the only option. The efficient way to start this transformation is by raising fossil energy prices persistently,

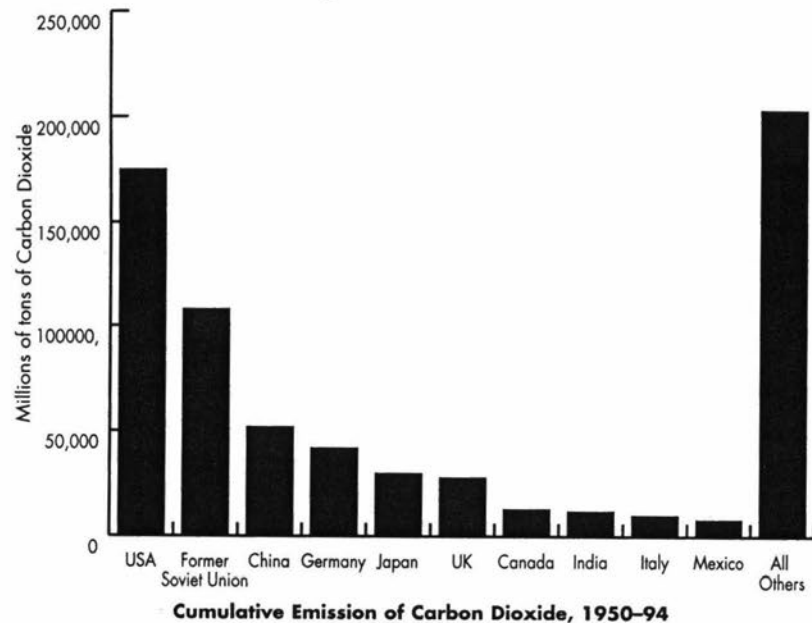
preferably by imposing carbon taxes. Even if phased in over decades, the necessary rise in fossil energy prices would affect economies profoundly: Energy-intensive industries would face higher costs; coal, the most carbon-intensive fuel, would be virtually phased out; coal- and oil-exporting countries would lose markets, and consumers' costs of living would rise. Inevitably, the adjustments would create economic losers in entire industries, regions, and nations.

WINNERS AND LOSERS

Although the fear of loss, and not the hope of gain, has dominated industrial strategies, there would also be winners. Higher fossil fuel prices would provide attractive incentives for producers of alternative energy and of energy-saving products and technologies. As nations are forced to restructure their tax systems by using energy tax revenues to replace other business and consumer taxes, firms and households that use energy more efficiently would come out ahead. High-tech industries would probably gain, on balance. Moreover, reduced coal and oil combustion would cut back on health and environmental damages caused by ordinary air pollution, even without the need for additional pollution-control equipment. Balancing these costs and benefits, economic models predict that achieving interim emissions-reduction targets of the magnitude likely to be discussed at Kyoto would have modest macroeconomic impacts—but that provides scant comfort to potential losers.

International political conflicts also create roadblocks: Although no one country or region can unilaterally prevent climate change, industrialized and developing nations assess responsibilities for the problem differently. The United States, the largest source of current and prior emissions, now contributes only about 22 percent of global carbon dioxide emissions, so even a total shutdown of the American economy would not solve the problem. Emissions from developing countries are rising rapidly, although they are still minuscule in per capita terms. Merely to hold global emissions stable over the next 10 years in the face of probable increases in developing country emissions would require a 35 percent reduction among Organization for Economic Cooperation and Development countries from current levels—and an even greater reduction if expected trends continue. Many U.S. policymakers oppose any cuts unless developing countries also limit emissions. Developing countries, however, say that they should not be held responsible for

Top Ten Polluters



Source: *The World Resources Report, 1996-97.*

solving a problem that is almost entirely due to the cumulative effect of prior emissions from wealthy nations. Now, they argue, rich countries can afford to cut back on lavish energy consumption, but the developing world needs more energy in order to eliminate widespread poverty.

Although international cooperation is essential, countries' interests differ depending on whether they have coal, oil, gas, hydro-, or nuclear energy resources, or none; whether their industries are energy-, labor-, or technology-intensive; and whether geography, current climate, and economic structure make them more or less vulnerable to the foreseeable effects of climate change. Canada and Russia might actually benefit from warmer nights, warmer winters, and longer growing seasons. Globalized postindustrial economies, like that of the United States, can adapt to the direct effects of climate change. Underdeveloped deltaic regions such as Bangladesh and low-lying island nations may lose much of their territories to flood surges and rising seas.

China, India, and other developing countries with meager per capita energy consumption, substantial coal reserves, and pressing economic growth imperatives will oppose limitations on their energy use.

Fuel-exporting Australia and Organization of Petroleum Exporting Countries (OPEC) members will oppose a potential loss of markets and foreign exchange earnings. Japan, which uses energy much more efficiently and has much lower per capita emissions than the United States, is reluctant to make equivalent percentage reductions. France and Norway, which already rely little on coal and oil and so have relatively fewer emissions to reduce, also argue for special consideration. Britain, which phased out an inefficient coal industry in the early 1990s, supports sharp reductions but only if they are measured from a 1990 base line.

Public opinion, although strongly supportive of environmental protection, has exerted little political force on the climate issue. People mobilize much more readily around immediate and tangible environmental problems, such as water pollution and acid rain, than around an uncertain threat that will mainly affect succeeding generations. In the absence of any defining event comparable to the discovery of the Antarctic "ozone hole," scientific uncertainties remain paralyzing. The extraordinary weather events of the last several years may be a consequence of climate change, but they also may not. Scientific models that factor in the effect of clouds, air pollution, and ocean temperature can now track large-scale climate patterns and trends more accurately, but they still cannot predict confidently how the climate will change in specific locations—and that is what concerns people most.

Against these odds, the international community has already begun to build new institutional mechanisms for cooperative action. The FCCC signed at the 1992 Earth Summit in Rio de Janeiro, Brazil, laid the groundwork for subsequent negotiations. The IPCC, instituted in 1988, is one of the largest international scientific collaborations ever. Its work has helped to shift the debate from scientific uncertainty to policy responses. The Global Environmental Facility (GEF), created in 1991 with the participation of the United Nations Development Programme, the United Nations Environment Programme, and the World Bank, along with financial contributions from many nations, is a new multilateral vehicle for financial transfers to help resolve global environmental issues. It is the interim funding mechanism for the FCCC and supports the incremental costs of projects that seek to curtail greenhouse gas emissions.

Even so, mechanisms to negotiate national commitments, to coordinate policy approaches, to monitor and enforce implementation, to

A Climate of Disagreement

When and how will the climate change?

Scientists agree that greenhouse gases warm the Earth but debate how clouds, oceans, and other factors affect this trend, how soon warming will occur, and how regional climate and overall weather patterns will change.

Will the effects of climate change be benign, adverse, or catastrophic?

Some predict tempests, floods, and pestilence. Others suggest an outcome of milder winters, longer growing seasons, and more fertile farmland.

How much will it cost to control climate change?

Economic models can demonstrate that limiting carbon dioxide emissions may result in either severe economic costs or net economic benefits. The results depend heavily on the assumptions used to construct the models.

Do we need to act now, or can we wait?

Some argue that waiting for better knowledge and technology makes sense. Others insist that waiting will only make the problem worse.

What countries should be responsible for reducing emissions?

Developing countries say the rich countries created the problem, have the resources to solve it, and should focus on such long-term environmental issues. Developed countries argue that it makes no sense for them to reduce emissions if developing countries continue to increase their own.

How should countries reduce their emissions?

Americans argue in favor of market mechanisms such as energy taxes and international carbon-trading but maintain that countries should choose their own approaches. Europeans argue for a coordinated policy approach but against market mechanisms. Developing countries resist commitments to initiate any particular measures but have already raised energy prices and reduced energy subsidies considerably.

What should serve as the base line for measuring emissions reductions?

Developed countries favor using 1990 emissions, which would reflect historical patterns of energy use. However, they have reservations about applying that base line to the former Soviet Union, whose heavy industries collapsed shortly thereafter. Developing countries favor a base line reflecting equal per capita energy use (i.e., one person equals one ton of coal).

Should all developed nations cut emissions by an equal percentage?

Most countries agree on an across-the-board figure in principle but assert that their special circumstances should be given exceptional consideration.

bring about large-scale international transfers of financial and technical resources, and to adapt these actions to evolving scientific understanding have yet to be developed. Few people believe that existing international organizations are adequate to meet the challenge or that the required institutional mechanisms could be easily created, even if nations shared a common purpose. The widely different priorities nations and interest groups assign to the climate problem make progress doubly difficult. Failure by most industrialized nations to meet the stabilization targets voluntarily assumed at the Rio Conference does not bode well for their willingness to assume and implement binding commitments at Kyoto.

Nonetheless, tangible, consistent progress in overcoming these obstacles is crucial. Continuing to emit greenhouse gases even at today's levels will produce atmospheric concentrations double their preindustrial levels by 2060. The longer cuts are delayed and emissions are allowed to continue increasing, the steeper will be the reductions required to stabilize atmospheric concentrations, and the higher will be the atmospheric concentrations when stabilization is achieved.

If action is delayed, the stock of investments embodying carbon-rich technologies will grow, making the adjustment more painful when it finally occurs. By contrast, with appropriate policies and economic incentives in place, new and replacement investments would be planned for the carbon-limited world to come. New power plants built in Asia and Latin America—China alone is building 50 large power plants a year—would be designed for gas instead of coal or for easy conversion between them. If planned carefully, the transition can be made more gradual and the dislocations milder.

If the world is to avoid the worst effects of climate change, nations must not only cut emissions but adopt new policies toward infrastructure and the use of natural resources. Economies could be made less vulnerable to climate change by placing infrastructure and new construction away from flood and storm-prone areas. Agricultural research can develop more

Few people believe that existing international organizations are adequate to meet the challenge of that the required institutional mechanisms could be easily created

adaptable crop varieties. Reforestation can convert carbon dioxide into useful trees through photosynthesis. However, without a definite shift in policy, coastal regions will become more damage-prone; agriculture will become more genetically specialized; and forests and other ecosystems will continue to shrink. The potential for calamity will increase.

Confronted with other serious risks, whether from military threats or from the spread of epidemic diseases, governments usually defend against worst-case eventualities. Responding to this new threat to global security, the FCCC foreshadowed such a stance, proclaiming that a buildup of greenhouse gases to potentially dangerous levels should be avoided. The Kyoto meetings will test nations' commitment to follow through on that policy with action.

EMISSIONS REDUCTIONS FOR BEGINNERS

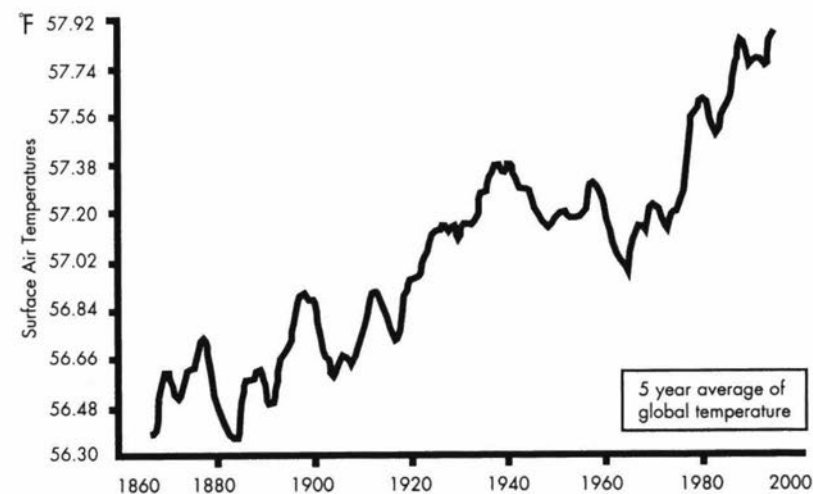
Although a prompt start is essential, the climate problem is too complex to deal with all at once. A solution will have to be built in successive steps, as uncertainties, political conflicts, and institutional deficiencies are resolved. Fortunately, the initial steps are relatively easy. In almost all countries, some greenhouse gas emissions can be reduced at little or no cost. For example, many countries are still venting large amounts of methane from coal mines, oil fields, pipelines, and landfills into the atmosphere. These emissions can be stopped or captured for energy, often at substantial cost-savings. In most countries, upgrading equipment, appliances, and buildings to meet higher energy efficiency standards can pay back the investment costs within a year or two through lower energy bills, and yield attractive returns thereafter. In nations emerging from state-dominated economic regimes, including China, India, Mexico, and the former Soviet Union, the scope for reducing energy use through profitable investments is enormous. Throughout the world, wherever natural gas is available, modern gas turbine power plants can generate electricity at lower cost than older model coal-fired power plants, reducing CO₂ emissions and improving air quality.

Other low-cost options include reforestation of degraded land, which helps to take carbon dioxide out of the air even as it relieves the scarcity of wood products, protects watersheds, and provides ecological and recreational benefits. As in international trade negotiations, most countries could table a range of "no-regrets" policies that would be in their own interests to carry out, even without corresponding actions by other nations.

National governments can also use economic incentives to reduce emissions and raise productivity. Although many countries, for purely economic and fiscal reasons, have already eliminated energy subsidies and have reformed their energy industries to improve efficiency, others have not. Some European countries have considered a further step—raising energy taxes and using the revenues to lower payroll taxes. This kind of "tax shift" could reduce CO₂ emissions as well as Europe's high unemployment rate. The U.S. government is wary of proposing any new tax, but the United States would benefit if energy taxes were raised and taxes on investment incomes were correspondingly lowered. This would curtail America's lavish energy consumption and raise its low savings rate. The overall effects on economic growth and environmental quality would be positive.

Once national policies are in place it will be essential to create an international market for emissions reductions. Such a mechanism would enable nations that can cut emissions at low costs to "trade" emissions reductions for the foreign financial and technological investments that generate more efficient growth. This mechanism, called "joint implementation," allows a private or public entity in one country to meet an emissions-reduction target by contracting

A Warmer World



Source: NASA Goddard Institute for Space Studies.

An Industrialist's Response

The following opposing viewpoint is an abridged version of an op-ed by Chrysler chairman Robert Eaton from the July 17, 1997, edition of the Washington Post.

In response to uncertain science and pressure from environmental activists and from countries eager for our jobs and our living standards, the Clinton administration seems poised to agree to a United Nations global warming treaty next December in Kyoto that would compel us—probably unilaterally—to curtail our fossil-fuel energy use in the next dozen years by more than 20 percent, one certain consequence of which would be a decline in the country's economic growth by a similar amount.

It would be an unwise and unnecessary move even if scientists could agree that the Earth's atmosphere is getting warmer because of man-made carbon dioxide and other gases. It becomes more so given the fact that they can't . . .

The Kyoto document, as currently being drafted, would bind the United States and other developed nations to use no more fossil fuel energy in 2010 than they did in 1990. But the 130 developing countries—such as China, India, Indonesia and all of Africa and Latin America—would be exempt from the mandate on the theory that we've used more energy on a per capita basis for a long time, and now we should back off and give them a turn.

Of course, without that higher energy use in the past, we would not be a "developed" nation in the first place, and without it in the future, we're not likely to remain so.

Theoretically, the rest of the First World would share our sacrifice and our fate, but I don't believe that for a minute. For one thing, who's going to police it? Our unique court system would guarantee our compliance, but I don't believe any other people would allow their feet to be held to the fire as we would . . .

This has become a trade, economic and foreign-aid issue disguised as environmentalism, and we're moving toward a solution involving a massive

transfer of American wealth that won't do a thing to keep the polar ice caps from melting, but would severely undermine this country's international competitiveness.

If, in fact, we are in a period of global warming, and if man is contributing to it, and if there's something we can do to slow it down, then we should act. And it may be prudent to assume the worst until we know better. But we should act intelligently.

One model for action is the Partnership for a New Generation of Vehicles (PNGV), also called the "Supercar" project. It combines the research capabilities of the Big Three automakers, our suppliers and some key national laboratories like Argonne and Sandia to produce a car some time early in the next century that will get about 80 miles per gallon and produce less than half the CO₂ of today's vehicles, but with roughly the same cost, performance and comfort of a midsize family sedan of today. . . .

Cars are part of the mix, but only a small part. The Supercar project will address that part, and it can serve as a model for a much broader joint research effort involving all the major industries in the country and all the research resources of the federal government.

But this effort would dwarf the Manhattan Project and the space program in scope and cost. It would have to be a global program to be feasible, with everybody taking his fair share of the responsibility, sacrifice and cost.

This is the sensible approach to global warming, not an international treaty based on inconclusive science that would have no chance of solving the problem (if we have one) but which would have disastrous economic consequences for all Americans. It is sensible because only new technology will allow us to continue to grow our economy while managing the level of CO₂ output.

. . . Science may eventually tell us that dimming the lights, turning off the air conditioning, sacrificing some of our industrial competitiveness and curtailing economic growth is the responsible thing to do. If so, we should do it. But if so, it should be the last thing we do, not the first.

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and paying for the reduction to be engineered by a counterparty in another country. A multinational company headquartered in the United States, for example, could meet its obligation to cut overall U.S. emissions in part by improving energy efficiency in its plant in Brazil or by converting someone else's plant in Poland from coal to natural gas. Since abatement costs vary widely from country to country, joint implementation can substantially lower the global costs of

attaining emissions reductions, just as international trade lowers production costs by "sourcing" production where costs are cheapest.

The G-77 group of developing countries has opposed joint implementation, fearing that the rich countries will buy their way out of the problem by restricting energy supplies in the developing world and paying poor countries not to grow. In fact, joint implementation would generate large private-sector capital and technology flows to developing

countries, including many that now receive little foreign investment and dwindling foreign aid.

A few emerging-market countries do see large potential benefits from joint implementation and may now be willing to accept binding emissions limits and effective monitoring and enforcement mechanisms in order to participate. Central Europe and Russia can improve energy efficiency while modernizing their economies; they can also replace coal with gas, provided the necessary investment funds are available. Colombia and Costa Rica see opportunities to finance the protection of their remaining tropical forests as carbon storehouses through joint implementation, which should evolve as a key mechanism for efficiently and equitably distributing international burdens.

THE BEGINNINGS OF A SOLUTION

Faced with formidable political constraints, negotiations at Kyoto are likely to focus on modest interim abatement targets for advanced industrial countries. Stabilizing national emissions at 1990 levels by the year 2010 is the leading U.S. proposal under consideration, although congressional approval of even such a modest step is not assured if developing countries do not follow suit. Europeans have proposed cuts 15 percent below 1990 levels. Developing countries are likely to resist any such commitments in the Kyoto round of negotiations.

Even a modest beginning such as the U.S. proposal would be useful if ratified and supported by implementing legislation that provides clear economic and policy signals. Unless the United States accepts and implements binding emissions-reduction targets and timetables, no other country will do so. Kyoto will be a failure.

However, this limited success would still leave the long-term climate problem largely untouched. More significant progress would require an agreement that includes the following three elements:

A Long-Term Goal

A stabilization target for atmospheric greenhouse gas concentrations implies limits both on the amount of climate change in store and on the cumulative total of global greenhouse gases that can be emitted. A doubling from preindustrial concentrations is about as little as can realistically be expected, although scientists predict that even this would force the average global temperature 1.5–3.5 degrees centigrade above its long-term mean. Setting a prudent limit on concentrations would clear-

ly indicate the magnitude of emissions reductions that eventually will be necessary and thus would shape future negotiations.

A Fair Allocation of Responsibility

Because the industrialized nations cannot stabilize greenhouse gas concentrations unless developing nations cooperate, developing countries have considerable leverage to insist that the final agreement acknowledge their smaller cumulative contribution to the problem and their need for economic growth. The terms of the FCCC and the mandate agreed to by the parties in Berlin three years later specify that the developed countries should take the lead in reducing emissions and that developing countries need not adopt binding targets and timetables at Kyoto. It is reasonable that industrialized countries take the first step this December by committing to reduce emissions to, or below, 1990 levels by 2010, and to implement potential further reductions thereafter. For their part, developing countries should pledge to enact no-regrets policies that would be in their own self-interest regardless of climate impacts and agree to adopt binding emissions limits in a later round of negotiations. If developing countries quickly adopted all of their no-regrets policy options, the resulting reduction of their greenhouse gas emissions would be very substantial. For example, developing countries could pledge at Kyoto to eliminate energy subsidies, maintain fuel prices at world levels or above, eliminate barriers to the use of gas or renewable energy sources in electricity generation, restructure their energy sectors to promote greater efficiency, and eliminate policies that promote deforestation. Many developing countries are already well embarked on such policy reforms. The World Bank could have a role in monitoring these policy commitments, since it already maintains an active dialogue about them with borrowing countries.

Efficient Implementation

Developed countries should reach an agreement on the use of joint implementation among themselves and work to construct institutional arrangements for certifying, monitoring, and enforcing such transactions. The GEF could have a useful role in brokering and certifying these arrangements. Developing and transitional countries that wish to participate in joint implementation should be able to do so by agreeing to binding emissions-reduction targets and timetables based on the implementation of no-regrets policies. Incorporating the permanent protection of forests as

carbon storehouses in joint implementation agreements would conserve biodiversity as well as climate.

Without an agreement that embodies these essential elements, the countries of the world are embarked on an unprecedented gamble, irreversibly changing the climate within which human civilization has evolved. For much of humanity, including many of the world's least well-off people, the results could be disastrous. Nations have cooperated to promote military and economic security and to forestall ecological crises as diverse as the depletion of ocean fisheries, the destruction of stratospheric ozone, and the extinction of endangered species. Although climate change is the most complex threat the global environment has ever faced, the technical, economic, and policy measures to prevent it are available. The world's future need not be risked.

WANT TO KNOW MORE?

For good short overviews of climate science, see John Houghton's *Global Warming, the Complete Briefing* (Oxford: Lion Press, 1994) and Thomas Graedel & Paul Crutzen's *Atmosphere, Climate, and Change* (New York: W.H. Freeman and Company, 1995), a Scientific American book. A skeptical view of climate change can be found in *Are Human Activities Causing Global Warming?* (Washington, D.C.: George C. Marshall Institute, 1996). *Energy Innovations: A Prosperous Path to a Clean Environment* (Washington, D.C.: Alliance to Save Energy, 1997) explores the technological options for reducing CO₂ emissions. Issues related to joint implementation and carbon trading are discussed in *Controlling Carbon Dioxide Emissions: The Tradeable Permit System* (Geneva: U.N. Conference on Trade and Development, 1995). For more details on the economic impacts of controlling emissions and a guide to the economic modeling literature on this topic, see *The Costs of Climate Projection: a Guide for the Perplexed* (Washington, D.C.: World Resources Institute, 1997). Readers may find useful a summary of the Conference of the Parties' most recent meeting in Geneva in the October 2, 1996, issue of *International Environment Reporter*.

Finally, many online resources exist for researchers. The reports of the Intergovernmental Panel on Climate Change contain the most comprehensive data on climate change and can be ordered via their Web site. Likewise, the electronic edition of *Global Change* provides up-to-date information on climate and ozone depletion. Both sites, as well as others, can be accessed via our Web site at www.foreignpolicy.com.

In Government We Don't Trust

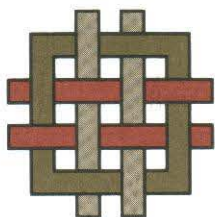
by Joseph S. Nye, Jr.

President Bill Clinton has proclaimed that the age of big government is over. He may be right. Certainly American confidence in government has declined. In 1964, three-quarters of the American public said that they trusted the federal government to do the right thing most of the time. In recent years, depending on the polls, only one-quarter to one-third do. The numbers are only slightly better for state and local government.

The United States is not alone. In fact, at a time when the United States and the West are celebrating victory in the Cold War, confidence in many Western governments seems to be declining. In a pair of polls taken in 11 European countries in 1981 and 1990, public confidence in government institutions declined in six (Belgium, France, Italy, Norway, Spain, and Sweden), was mixed in four (Germany, Great Britain, Iceland, and the Netherlands), and rose in Denmark. Polls in Canada show a decline similar to that in the United States. In Japan, polls show a low regard for politicians throughout the postwar period; more recently, there has been a decline in confidence in the bureaucracy as well. In a survey of 43 countries in 1981 and 1990, political scientist Ronald Inglehart found that people in low-income societies accept governmental authority more readily than do citizens of wealthier societies.

We are not experiencing the alleged "crisis of democracy" popularized in the 1970s. If you ask Americans what is the best place in the world to live, 80 percent say the United States. If you ask them whether they like

JOSEPH S. NYE, JR., is dean of the John F. Kennedy School of Government at Harvard University. This article is drawn from *Why People Don't Trust Government*, Joseph Nye, Philip Zelikow, & David King, eds. (Cambridge: Harvard University Press, forthcoming).



Jonathan Lash, President

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18 September 1997

Dear Todd,

Three more pieces you will find useful as you did the "Cost of Climate Protection".

Reed and Goldemberg examine the reductions made by China and other non Annex I countries as they raised energy prices. "Climate Protection and the National Interest" is a very clear basic primer on the greenhouse effect and its consequences.

In "Planetary Roulette" on p. 84 of FOREIGN POLICY, Repetto and I examine the geopolitics of the issue.

More coming soon on human health, competitiveness, and the cost of waiting.

Jonath

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JULY 1997

ARE DEVELOPING COUNTRIES ALREADY DOING AS MUCH AS INDUSTRIALIZED COUNTRIES TO SLOW CLIMATE CHANGE?

BY WALTER V. REID AND JOSÉ GOLDEMBERG

Developing countries are already effective participants in global efforts to reduce greenhouse gas emissions. Indeed, since the signing of the 1992 Framework Convention on Climate Change (FCCC) developing countries may have achieved greater carbon dioxide emission savings than industrialized countries.

Negotiations to strengthen the Climate Convention risk being derailed by the increasingly popular argument that industrialized countries should not commit to greenhouse gas reductions unless developing countries agree to reductions. This position backtracks on the pivotal compromise reached in the Framework Convention on Climate Change (FCCC), which balanced the timing and strength of actions by industrialized countries (which are largely responsible for the climate change that is now underway) with those of developing countries (which ultimately will be the major source of emissions). But the position also rests on a faulty assumption. Even without commitments to limit emissions, developing countries are already taking significant steps to rein in greenhouse gas emissions.

Industrialized countries account for more than two-thirds of annual carbon dioxide emissions worldwide and an even larger share of the radiative forcing of greenhouse gases.

Consequently, under the FCCC these nations accepted a greater burden than developing countries for slowing the growth of greenhouse gas emissions. However, by 2020, developing country emissions are projected to exceed those of industrialized countries.¹ To

prevent dangerous impacts from climate change, developing countries will eventually need to reduce the rate of growth, and, ultimately, the level of their emissions.

In keeping with the principle of "common but differentiated responsibilities" agreed to in the FCCC, countries in the Organization for Economic Cooperation and Development (OECD) set voluntary targets of stabilizing carbon dioxide (CO₂) emissions at 1990 levels by the year 2000. These countries will largely fail to meet their voluntary commitments: Of the nine OECD countries with 1990 emissions greater

than 50 million metric tons of carbon (MtC) only two—the United Kingdom and Germany—are likely to have emissions at or below 1990 levels in 2000.² U.S. emissions have increased each year since 1991 and now appear likely to be 13 percent above the promised target in 2000³ (Figure 1).

Even without commitments to limit emissions, developing countries are already taking significant steps to rein in greenhouse gas emissions.

In April 1995, parties to the Climate Convention agreed to the "Berlin Mandate," which established a two-year negotiating process to develop a protocol that will set quantified limitation and reduction objectives after 2000, in all likelihood including a cap on emissions among Annex I countries (i.e., OECD and countries with economies in transition). The parties agreed not to introduce new commitments for developing countries in that protocol; however, the Berlin Mandate does specify that developing countries should advance the implementation of their existing commitments.



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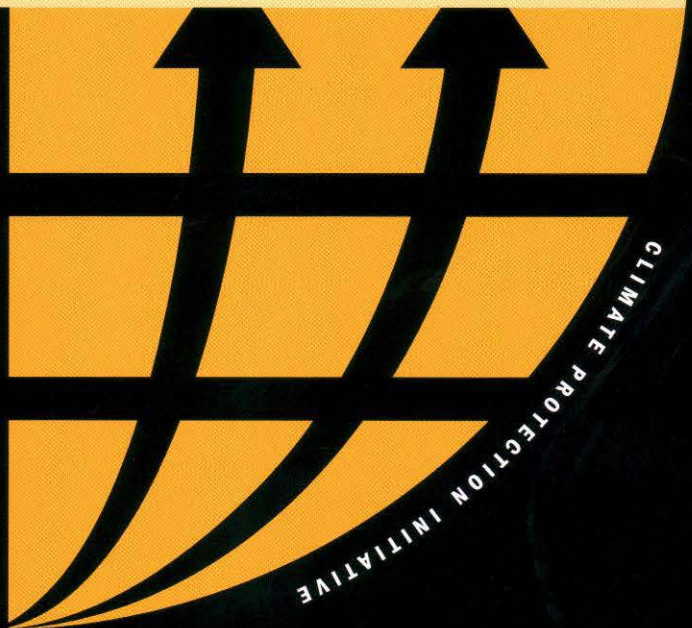
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CLIMATE PROTECTION INITIATIVE



CLIMATE PROTECTION AND THE NATIONAL INTEREST



JAMES J. MACKENZIE