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THE WORLD BANK

Washington, D.C.

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Pre-Brief: White House Conference
on Climate Change

Monday, October 6, 1997
1:45 - 2:10 p.m.
JDW Office

White House Conference on Climate
Change: The Challenge of Global
Warming

Monday, October 6, 1997
2:30 - 3:30 p.m.
Gaston Hall
Georgetown University

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President Wolfensohn - Briefings Books for Presidents Meetings - Meeting Material
Pre-Brief and Meeting - White House Conference on Climate Change - The

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A. CLASSIFICATION

☒ Meeting Material
☐ Trips
☐ Speeches

☐ Annual Meetings
☐ Corporate Management
☐ Communications with Staff

☐ Phone Logs
☐ Calendar
☐ Press Clippings/Photos

☐ JDW Transcripts
☐ Social Events
☐ Other

B. SUBJECT: PRE-BRIEF: WHITE HOUSE CONFERENCE ON CLIMATE CHANGE (B) (N) // VENUE: MC 12-750 (OFFICE) // CONTACT: ISABEL @ 31755 // IN ATTENDANCE: JDW, WATSON, MARISELA // (B) BY WATSON // DUE WEDNESDAY, OCT. 2 // EXC: MM // LFG (9/24)
WHITE HOUSE CONFERENCE ON CLIMATE CHANGE: THE CHALLENGE OF GLOBAL WARMING (B) (N) // VENUE: GASTON HALL, GEORGETOWN UNIVERSITY // CONTACT: CODY @ 456-5378 (TODD STERN'S OFFICE) // FAX: 456-5334 // BILL ANTHOLIS @ 456-2198 // NOTE: JDW TO SERVE AS A PANELIST ON THE INTERNATIONAL PANEL TO DISCUSS THE KYOTO CONFERENCE AND EFFORTS TO CRAFT AN INTERNATIONAL FRAMEWORK AGREEMENT TO REDUCE GREENHOUSE GASES. // PLEASE NOTE THAT THERE WILL BE A REGISTRATION TABLE FOR PANELISTS--AFTER REGISTERING YOU MAY GO UPSTAIRS TO THE HOLDING ROOM LOCATED ON THE SECOND FLOOR IN THE HALL OF CARDINALS // AGENDA: PRESENTATION BY SECRETARY OF STATE, MADELEINE ALBRIGHT // PANELISTS: JESSICA TUCHMAN MATHEWS, PRESIDENT, CARNEGIE ENDOWMENT FOR INT'L PEACE; JAMES D. WOLFENSOHN, PRESIDENT, WORLD BANK; E. LINN DRAPER, CHAIRMAN, PRESIDENT, AND CEO, AMERICAN ELECTRIC POWER; FRED KRUPP, EXECUTIVE DIRECTOR, ENVIRONMENTAL DEFENSE FUND; DANIEL YERGIN, PRESIDENT, CAMBRIDGE ENERGY RESEARCH ASSOCIATES; AUTHOR OF THE PRIZE: THE EPIC QUEST FOR OIL, MONEY AND POWER, WINNER OF THE PULITZER PRIZE; MAE JEMISON, PRESIDENT, JEMISON GROUP, INC., AND JEMISON INSTITUTE FOR ADVANCING TECHNOLOGY IN DEVELOPING COUNTRIES AT DARTMOUTH UNIVERSITY. FORMER NASA ASTRONAUT; RICHARD SCHMALENSEE, PROFESSOR OF ECONOMICS AND MANAGEMENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY; DIRECTOR OF MIT CENTER FOR ENERGY AND ENVIRONMENTAL POLICY RESEARCH; MEMBER OF ECONOMIC ADVISERS, 1989-91 // (B) BY WATSON // DUE THURSDAY, OCT. 2 // EXC: MM // LFG (9/24)

Brief Includes:

- Cover Note from Robert Watson
- Draft Agenda
- Talking Points
- Reaction
- The Byrd Resolution
- Background Information from Ismail Serageldin
- "Climate: Making Sense and Making Money" Amory B. Lovins & Hunter Lovins -- Rocky Mountain Institute (Strictly confidential and embargoed)

DATE: 10/06/97

C. VPU

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D. EXTERNAL PARTNER

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☐ Part II
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E. COMMENTS:**File Location**

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Cleared By

Marisela Montoliu

Date:

10/08/97

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OFFICE MEMORANDUM

DATE: October 2, 1997

TO: Mr. James D. Wolfensohn, EXC

FROM: Robert T. Watson, ENV

EXTENSION: 36965

SUBJECT: **Information and Talking Points**
White House Conference Meeting on Climate Change

(Dictated)

1. This memorandum contains information which will be useful for your participation in **Panel III: Kyoto Conference and U. S. National Interests** at the White House Conference on Climate Change. The one hour panel will be chaired by Vice President Gore. The opening five minute statement will be by Secretary of State, Ms. Madeleine Albright. The other panelists are: Jessica Matthews (Carnegie Endowment for International Peace); E. Linn Draper (American Electric Power); Fred Krupp (Environmental Defense Fund); Daniel Yergin (Cambridge Energy Research Associates); Mae Jemison (Dartmouth University); and Richard Schmalensee (MIT).

2. This briefing note includes as attachments:

- a) the complete agenda, including the panelists' affiliations;
- b) draft talking points, largely taken from the Tim Wirth lunch talking points;
- c) a summary of the international reaction of the U. S. positions on greenhouse gas targets and timetables, emissions trading/joint implementation and developing country commitments; and
- d) the Byrd resolution.

I understand you already received a significant amount of other relevant material from Ismail Serageldin.

3. If you want me to further develop any of the points, I can do so before Monday.

*memorandum goes way up
- climate has changed
- if no global initiative
bill is up and will
sea level is up - warmer
advance effect on human health
- effect on agricultural productivity
- effect on water
- sea level will*

*- Subcommittees
Panel on Climate
Change
- 2,000 participants
- Another director for Environment*

*- how much is Canada
with lunch in St. Louis
- Memorandum will be passed in
funding countries*

*- Urban waste land
- byproducts
- Travel the models*

*This is what I sent.
Attached Ismail's note
+ Maureen Cropper's
input.*

*To remove Tokyo
= damage Tokyo
decades of
technology
to the world*

White House Conference on Climate Change:
The Challenge of Global Warming

October 6, 1997

Draft Agenda

Vice President Gore: *Welcome attendees; Introduces President Clinton*

President Clinton: *Opening Remarks: Importance of Global Warming and Climate Change for the American People.*

Panel I: The Science of Global Warming and Climate Change

Presentation: John Holdren, Professor, Department of Earth and Planetary Sciences and the John F. Kennedy School of Government, Harvard University. Head of President's Council of Advisors on Science and Technology (PCAST).

Panelists: Robert Watson, Incoming Chair of the Intergovernmental Panel on Climate Change (IPCC); Director for Environment, World Bank.
Tom Karl, Senior Scientist, NOAA, National Climatic Data Center.
Diana Liverman, Chair, National Academy of Sciences
Committee on Human Dimensions of Global Change; Director, Latin American Studies Program, University of Arizona.
Don Willhite, Director, National Drought Mitigation Center, University of Nebraska.

Vice President Gore: *Where we've come from; Where we're going.*

Panel II: The Role of Technology in Reducing Greenhouse Gas Emissions

Presentation: Federico Peña, Secretary of Energy.

Panelists: Maxine Savitz, General Manager, AlliedSignal Aerospace Company's Ceramic Components Unit. Member of the President's Council of Advisors on Science and Technology (PCAST).
Tom Casten, President & CEO, Trigen Energy Corporation.
Michael Bonsignore, President and CEO, Honeywell Corporation.
Mason Willrich, CEO, EnergyWorks, a renewable energy joint venture between Bechtel and Pacificorp.
Kurt Yaeger, President, Electric Power Research Institute, a non-profit collaborative research enterprise of the electric power industry.

Lunch: Breakout Discussions with the Cabinet

Remarks by First Lady Hillary Rodham Clinton

Panel III: Kyoto Conference and U.S. National Interests

Presentation: Madeleine Albright, Secretary of State.

Panelists: Jessica Tuchman Mathews, President, Carnegie Endowment for International Peace.

James D. Wolfensohn, President, World Bank.

E. Linn Draper, Chairman, President, and Chief Executive Officer, American Electric Power.

Fred Krupp, Executive Director, Environmental Defense Fund.

Daniel Yergin, President, Cambridge Energy Research Associates; author of "The Prize: The Epic Quest for Oil, Money and Power," winner of the Pulitzer Prize.

Mae Jemison, President, Jemison Group, Inc. and Jemison Institute for Advancing Technology in Developing Countries at Dartmouth University. Former NASA astronaut.

Richard Schmalensee, Professor of Economics and Management, Massachusetts Institute of Technology; Director of MIT Center for Energy and Environmental Policy Research; member of Council of Economic Advisers, 1989-91.

Panel IV: Climate Change Policy and the U.S. Economy

Presentation: Larry Summers, Deputy Secretary of the Treasury.

Panelists: Robert Repetto, Vice President and Senior Economist, World Resources Institute. Co-author, "The Costs of Climate Protection: A Guide for the Perplexed."

William Nordhaus, Whitney Griswold Professor of Economics, Yale University. Author of "Efficient Use of Energy Resources," "Managing the Global Commons."

Robert Stavins, Professor of Public Policy and Chair of Environment and Natural Resources Program, the John F. Kennedy School of Government, Harvard University.

Richard Sandor, Chairman & Chief Executive, Centra Financial Products Limited; Vice-Chair of Chicago Board of Trade.

John Sweeney, President, AFL-CIO.

Talking Points for Mr. James D. Wolfensohn
White House Conference on Climate Change:
The Challenge of Global Warming

October 6, 1997

Panel III has been asked to address the importance of the climate change issue from a national interest perspective, including: national security, flexibility (emissions trading/joint implementation), and developing country commitments. The White House would like you to focus your opening statement of five minutes on the issue of climate change and developing countries. This is a particularly important issue because of the Senate Byrd Resolution, which passed 93-0 and stated that the U. S. should not sign any protocol that does not require developing countries commitments in the same time frame as Annex I countries (developed countries and countries with economies in transition). The basic argument of the Byrd resolution is that the climate system cannot be protected without a global commitment, and that American jobs will go abroad to developing countries because they will not be saddled with expensive controls on the use of fossil fuels.

It is quite likely that at least one panel member will take the Byrd resolution position and urge the American public not to support any protocol that does not include developing countries. Hence, I believe you may want to make the following five points:

- (i) The scientific evidence that human activities are causing climate to change is convincing, and developing countries are the most vulnerable i.e. developed countries and countries with economies in transition are causing the problem (emissions in developing countries are still much lower than in developed countries, both in absolute and per capita terms), but developing countries will suffer most.
- (ii) While it is clear that in the long-term all countries will need to limit their greenhouse gas emissions, in the near-term, Annex I countries will need to take the lead in reducing their emissions. This is appropriate given the current and historical sources of emissions of greenhouse gases, and because developed countries have the economic, technical, and institutional capabilities to start to address the issue in a cost-effective manner.
- (iii) Increased energy services in developing countries are critical to alleviate poverty and underdevelopment. A few statistics might be useful: 1.3 billion people live on less than \$1 per day; 3 billion people live on less than \$2 per day; 2 billion people without electricity (hence, they cook using traditional fuels that lead to a high incidence of respiratory infections, diseases and death); and 1.3 billion people live without clean water.
- (iv) Developed countries need to assist developing countries expand their production and consumption of energy in the most efficient and environmentally benign manner.

*We deal with a kind of Deposition (Acid Rain - SO₂)
Particulates a kind of Deposition (Acid Rain - SO₂)
in each cost way but do not add burden
of global externalities - These can be funded
for concessional services to pay for the kind of GEF*

- (v) The World Bank Group stands ready to assist developing countries limit their greenhouse gas emissions, but it will not ask them to be burdened with the extra costs of being climate friendly—at least not in the short-term.

Therefore, I suggest you focus your remarks around the following points as you did at the Tim Wirth lunch, but with an increased emphasis on the equity issue and the need for developing countries to increase their production and consumption of energy to alleviate poverty and underdevelopment. I have only made minor modifications to the Tim Wirth talking points as it was that lunch-time speech that impressed the U. S. Administration, and contributed to their request for your participation in the October 6 panel. I have asked Maureen Cropper, who works with Joe Stiglitz, to provide me with some more information, before the meeting on Monday, on the potential job losses in the U.S. if Annex I countries agree to greenhouse limitations without obligations on developing countries. If Maureen comes with interesting information, I will brief you on Monday before your speech.

*GEF 100 mil
but not 7
which
200 mil
is limited
change
friendly*

Some of the points you might want to make follow in bold—while the rest of the text is primarily background information, you may want to use some of it in your talking points.

A. The IPCC makes a convincing case that human activities are already changing the Earth's Climate System, and that unless there is a concerted effort to reduce the projected emissions in greenhouse gases the Earth's climate will warm significantly, sea level will rise and precipitation patterns will change.

- The atmospheric concentrations of greenhouse gases (especially carbon dioxide and methane) are increasing because of human activities—primarily due to energy and land-use practices.
- The Earth's atmosphere has warmed by about 0.5 degrees Centigrade (one degree Fahrenheit) over the last 100 years; sea level has increased by 10-25 cms; glaciers have retreated globally; and in some regions there is evidence of an increase in heavy precipitation events.
- The observed changes in temperature cannot be explained by natural phenomena, but are consistent with the theoretical models that take the observed changes in greenhouse gases and aerosols into account—hence the IPCC concluded the scientific evidence suggests there is a discernible human influence on the Earth's climate system.
- Without climate-specific policies, IPCC projects an increase in global mean temperatures of 1.0 to 3.5 degrees Centigrade (1.5 to 6.5 degrees Fahrenheit) by the year 2100.
- These projected increases in temperature would be accompanied by an increase in sea level of 15-95 cms by 2100;
- These increases in temperature would be accompanied by changes in precipitation—in particular increases in heavy precipitation events and a decrease in gentle rain—this will lead to more floods and droughts.

B. These projected changes in climate will, in many regions of the world, have adverse effects on :

- ◆ **human health (increase in vector-borne diseases such as malaria and dengue);**
 - ◆ **ecological systems (especially coral reefs);**
 - ◆ **agriculture (decreased production in the tropics), forestry, and fisheries;**
 - ◆ **human settlements—tens of millions of people will be displaced by sea level rise and whole cultures may disappear—small Island States.**
- Significant increase in vector-borne diseases (especially malaria and dengue), especially in the tropics and sub-tropics, areas with a high burden of disease today;
 - While global food production may not be adversely affected by climate change, agricultural production is projected to decrease in the tropics and sub-tropics, areas with famine and hunger today.
 - A one-meter sea level rise would threaten the viability of many small Island States (e.g. Maldives) and would displace tens of millions of people in low-lying deltaic regions (Bangladesh, Egypt, and China).
 - Complex ecological systems are likely to be adversely affected, particularly forests and coral reefs—many forest species will not be able to migrate as fast as needed to keep pace with the projected rates of change in temperature—many coral reefs may die because of increases in sea temperatures.
 - There will be significant shifts in precipitation and evaporation leading to changes in water supply and run-off—unfortunately our ability to predict where and when changes will occur is not possible with the accuracy required for water management decisions.

C. Developing countries will be more vulnerable than developed countries, especially the poor in these countries.

- Bank client countries in the tropics and sub-tropics are most vulnerable to climate change—increases in vector-borne diseases, reductions in agricultural production, loss of land because of sea level rise and more uncertain water supplies.
- The economic costs of climate change in a doubled carbon dioxide world (late next century) could be 5-9% of GDP in developing countries—this estimate is very uncertain.

D. Progress in reducing greenhouse gas emissions since Rio has been very disappointing, hence Kyoto needs to be a success if the climate system is to be protected

- Only three OECD countries will have limited their greenhouse gas emissions in the year 2000 to the 1990 levels as agreed in Rio.
- Greenhouse gas emissions in countries with economies in transition have decreased, but because of poor economic performance not because of climate change policies.
- Greenhouse gas emissions have risen sharply in a number of developing countries because of economic growth.

E. While there is no debate that protection of the climate system will eventually need all countries to limit their greenhouse gas emissions, it is imperative that developed countries (in particular the U. S.) and countries with economies in transition take the lead and agree to limit their greenhouse gas emissions—this should be quite feasible given that many cost-effective strategies (technologies, policies and practices) exist to start limiting greenhouse gas emissions.

- While the integrity of the climate system can only be ensured with all countries eventually assuming obligations to limit their greenhouse gas concentrations, it is clear that Annex I countries should demonstrate their willingness to reduce their emissions first:
 - ◊ Annex I countries should decrease their emissions because of the current and historic patterns of emissions (historically most emissions have come from Annex I countries—Annex I per capita emissions are significantly greater than developing country per capita emissions), coupled with the financial and technical capabilities of Annex I countries—in spite of the demands of the U. S. Congress that developing countries assume obligations in the near-timeframe—U. S. failure to advocate specific targets and timetables is undermining the possibility of a successful outcome in Kyoto.
- Energy supply options to reduce greenhouse gas emissions:
 - ◊ more efficient production of energy from fossil fuels;
 - ◊ fuel switching (coal to gas);
 - ◊ carbon dioxide sequestration;
 - ◊ renewable energies (wind, solar, modern biomass, etc.)
 - ◊ nuclear (assuming safety/waste disposition/fissile material containment considerations and public acceptability);
- Energy use options to reduce greenhouse gas emissions
 - ◊ transportation (e.g., efficient vehicles);
 - ◊ buildings (e.g., efficient building structures, appliances, etc.);
 - ◊ industry (e.g. waste and energy minimization, recycling, etc.).

F. In the near-term, developing countries need to increase their production and consumption of energy to alleviate poverty and underdevelopment. At a later date they too will need to limit their greenhouse gas emissions, recognizing they would have differentiated responsibilities.

- Increased energy services in developing countries are critical to alleviate poverty and underdevelopment;
 - ◊ 1.3 billion people live on less than \$1 per day;
 - ◊ 3 billion people live on less than \$2 per day;
 - ◊ 2 billion people without electricity (hence, they cook using traditional fuels that lead to a high incidence of respiratory infections, diseases and death);
 - ◊ 1.3 billion people live without clean water.

G. The Bank believes that the Convention would be facilitated, and so would all Parties to the Convention, if joint implementation with crediting were allowed:

- **the Bank is willing to develop a Global Carbon Fund (an approach to trading carbon whereby developing countries and countries with economies in transition get new technologies and a share of the OECD cost savings).**

H. The challenge is to assist developing countries produce and consume energy in the most climate-friendly manner even if they have no specific obligations to reduce greenhouse gas emissions. In addition to the Global Carbon Fund, the World Bank is ready to assist by:

- **Working with them to develop appropriate sector and macro-economic frameworks that encourage the efficient production and consumption of energy and stimulate private sector investment**
- **Mobilizing grant resources through the Global Environment Facility to pay for the incremental costs of more climate-friendly technologies**
- A three-fold energy-environment strategy is being developed that will allow Bank clients to meet their energy service needs while minimizing local, regional, and global environmental damage. The strategy will include promoting:
 - ◇ *economic efficiency* by continuing to promote macro- and sectoral reform (e.g. subsidy elimination); international gas trade; hydroelectric power that is environmentally and socially sustainable;
 - ◇ Bank clients to internalize local and regional environmental degradation (particles, ozone, and acid deposition);
 - ◇ climate friendly alternatives (see next entry).
- All Bank-funded energy sector work will consider climate change, including assessing greenhouse gas emissions, and identifying and costing climate friendly alternatives—known as the “Global Overlays Program”;
- Bank is aggressively supporting the replenishment of the GEF—the US failure to pay its agreed contribution is threatening the long-term viability of the GEF;
- Bank and GEF staff are evaluating how to develop a more strategic Bank-GEF partnership to increase the competitiveness of new and renewable non-greenhouse gas emitting technologies—could possibly develop into a \$1 billion per year program;

The Bank is developing a number of Market Transformation Initiatives (e.g., Forest, photovoltaic)—these will result in a reduction in net emissions of carbon dioxide.

THE INTERNATIONAL REACTION

The U.S. has proposed a three-part framework for a climate change agreement in Kyoto:

I. Binding emissions targets for developed nations.

Almost all developed countries, including the United States, will fall short of the non-binding aim in the current Climate Convention, which calls on nations to reduce emissions to 1990 levels by 2000. Shifting to a binding, realistic, and achievable target should spur greater commitment and action by countries to limit greenhouse gas emissions. The United States has not yet proposed a specific target and timetable.

International Reaction. The concept of binding targets for industrialized nations was widely embraced at the Second Conference of the Parties to the Climate Convention in Geneva in July 1996. Since then, several countries, or blocks of countries, have made more specific proposals. The European Union has called for a 15% reduction in emissions below 1990 levels by 2010. The Association of Small Island States has proposed a 20% reduction below 1990 levels in 2005. The U.S. has rejected both of these targets as unrealistic and overly stringent. Japan, Norway, and Australia have all proposed some form of differentiated regime, whereby developed nations would take on different levels of commitments. The U.S. has largely opposed this approach, arguing that it would be unworkable to negotiate a sensible differentiation scheme in time for Kyoto. By and large, developing nations have urged a stringent target be adopted for the industrialized world.

II. Flexibility to achieve cost-effective reductions.

The U.S. supports provisions designed to ensure that the greatest reductions are gained at the least cost. These include the ability to trade emissions rights internationally and to conduct projects with developing countries to cut emissions (joint implementation).

International Reaction. The U.S. has had a difficult time building support for emissions trading and joint implementation (JI). The EU has largely opposed trading, even though their own 15% target in fact represents a sort of trading scheme in itself. (Under the EU "bubble" approach, certain countries would be allowed to increase their emissions while others would decrease, as long as the net effect was a 15% reduction below 1990 levels by 2010). The EU has also been largely negative on JI. The lack of a specific U.S. proposal for targets and timetables has probably made it more difficult for much progress to be made here. With regard to the developing

world, JI remains quite contentious. Countries seem to have some combination of concerns that (a) JI amounts to the U.S. shirking its own responsibilities to cut emissions, (b) JI would be filled with too many loopholes and would not be credible, and (c) JI would use up all of the cheapest developing country emissions reductions so that when developing countries accept targets at a future point, they will be left with only the most expensive reductions. The exception is Latin America, where several countries have expressed some degree of support for a JI regime.

III. Participation of developing countries.

The U.S. currently has the most extensive proposal for developing country participation in a new climate agreement. The key parts of the proposal include strengthening language on existing developing country commitments under the 1992 Climate Convention, encouraging certain developing nations (i.e. those joining the OECD) to voluntarily accept binding emissions limits, and obtaining an agreement that all developing nations will take on binding targets over time. Partially in light of the Byrd Resolution (adopted 95-0 by the Senate this summer), the U.S. is considering strengthening this proposal further. The Byrd Resolution essentially calls on developing nations to accept binding limits in the same compliance period as industrialized nations, though it does not specify what the specific nature of those commitments should be.

International Reaction. The U.S. does not currently have much public support internationally for its developing country proposals, particularly those dealing with emissions targets. Developing nations have argued that the proposals are inconsistent with the negotiating mandate agreed to in Berlin in 1995, that they do not reflect the fact that most every developed nation will miss the original Climate Convention goal of reducing emissions to 1990 levels by 2000, and that they are fundamentally inequitable. The EU has been largely silent on the issue of developing countries. Given their "bubble" approach (which, for example, would allow Portuguese emissions to grow some 40% over the next decade), they are not in a strong position to take a tough stance. Those closest to the U.S. position include Australia, Canada, and New Zealand.

The Byrd Resolution

Bill 32 of 43

There are 2 other versions of this bill.

GPO's PDF version of this bill	References to this bill in the Congressional Record	Link to the Bill Digest file.	Download this bill. (7,832 bytes).
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Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations... (Reported in the Senate)

SRES 98 RS

Calendar No. 120

105th CONGRESS

1st Session

S. RES. 98

[Report No. 105-54]

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations Framework Convention on Climate Change.

IN THE SENATE OF THE UNITED STATES

June 12, 1997

Mr. BYRD (for himself, Mr. HAGEL, Mr. HOLLINGS, Mr. CRAIG, Mr. INOUE, Mr. WARNER, Mr. FORD, Mr. THOMAS, Mr. DORGAN, Mr. HELMS, Mr. LEVIN, Mr. ROBERTS, Mr. ABRAHAM, Mr. MCCONNELL, Mr. ASHCROFT, Mr. BROWNBACK, Mr. KEMPTHORNE, Mr. THURMOND, Mr. BURNS, Mr. CONRAD, Mr. GLENN, Mr. ENZI, Mr. INHOFE, Mr. BOND, Mr. COVERDELL, Mr. DEWINE, Mrs. HUTCHISON, Mr. GORTON, Mr. HATCH, Mr. BREAUX, Mr. CLELAND, Mr. DURBIN, Mr. HUTCHINSON, Mr. JOHNSON, Ms. LANDRIEU, Ms. MIKULSKI, Mr. NICKLES, Mr. SANTORUM, Mr. SHELBY, Mr. SMITH of Oregon, Mr. BENNETT, Mr. FAIRCLOTH, Mr. FRIST, Mr. GRASSLEY, Mr. ALLARD, Mr. MURKOWSKI, Mr. AKAKA, Mr. COATS, Mr. COCHRAN, Mr. DOMENICI, Mr. GRAMM, Mr. GRAMS, Mr. LOTI, Ms. MOSELEY-BRAUN, Mr. ROBB, Mr. ROCKEFELLER, Mr. SESSIONS, Mr. SMITH of New Hampshire, Mr. SPECTER, and Mr. STEVENS) submitted the following resolution; which was referred to the Committee on Foreign Relations

July 21, 1997

Reported by Mr. HELMS, without amendment

RESOLUTION

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations Framework Convention on Climate Change.

Whereas the United Nations Framework Convention on Climate Change (in this resolution referred to as the 'Convention'), adopted in May 1992, entered into force in 1994 and is not yet fully implemented;

Whereas the Convention, intended to address climate change on a global basis, identifies the former Soviet Union and the countries of Eastern Europe and the Organization For Economic Co-operation and Development (OECD), including the United States, as 'Annex I Parties', and the remaining 129 countries, including China, Mexico, India, Brazil, and South Korea, as 'Developing Country Parties';

Whereas in April 1995, the Convention's 'Conference of the Parties' adopted the so-called 'Berlin Mandate';

Whereas the 'Berlin Mandate' calls for the adoption, as soon as December 1997, in Kyoto, Japan, of a protocol or another legal instrument that strengthens commitments to limit greenhouse gas emissions by Annex I Parties for the post-2000 period and establishes a negotiation process called the 'Ad Hoc Group on the Berlin Mandate';

Whereas the 'Berlin Mandate' specifically exempts all Developing Country Parties from any new commitments in such negotiation process for the post-2000 period;

Whereas although the Convention, approved by the United States Senate, called on all signatory parties to adopt policies and programs aimed at limiting their greenhouse gas (GHG) emissions, in July 1996 the Undersecretary of State for Global Affairs called for the first time for 'legally binding' emission limitation targets and timetables for Annex I Parties, a position reiterated by the Secretary of State in testimony before the Committee on Foreign Relations of the Senate on January 8, 1997;

Whereas greenhouse gas emissions of Developing Country Parties are rapidly increasing and are expected to surpass emissions of the United States and other OECD countries as early as 2015;

Whereas the Department of State has declared that it is critical for the Parties to the Convention to include Developing Country Parties in the next steps for global action and, therefore, has proposed that consideration of additional steps to include limitations on Developing Country Parties' greenhouse gas emissions would not begin until after a protocol or other legal instrument is adopted in Kyoto, Japan in December 1997;

Whereas the exemption for Developing Country Parties is inconsistent with the need for global action on climate change and is environmentally flawed;

Whereas the Senate strongly believes that the proposals under negotiation, because of the disparity of treatment between Annex I Parties and Developing Countries and the level of required emission reductions, could result in serious harm to the United States economy, including significant job loss, trade disadvantages, increased energy and consumer costs, or any combination thereof; and

Whereas it is desirable that a bipartisan group of Senators be appointed by the Majority and Minority Leaders of the Senate for the purpose of monitoring the status of negotiations on Global Climate Change and reporting periodically to the Senate on those negotiations: Now, therefore, be it

Resolved, That it is the sense of the Senate that--

(1) the United States should not be a signatory to any protocol to, or other agreement regarding, the United Nations Framework Convention on Climate Change of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would--

(A) mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period, or

(B) would result in serious harm to the economy of the United States; and

(2) any such protocol or other agreement which would require the advice and consent of the Senate to ratification should be accompanied by a detailed explanation of any legislation or regulatory actions that may be required to implement the protocol or other agreement and should also be accompanied by an analysis of the detailed financial costs and other impacts on the economy of the United States which would be incurred by the implementation of the protocol or other agreement.

SEC. 2. The Secretary of the Senate shall transmit a copy of this resolution to the President.

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S. RES. 98

[Report No. 105-54]

RESOLUTION

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations Framework Convention on Climate Change.

July 21, 1997

Reported without amendment

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- Air quality
- Speed of decision

① Agree on Science { Climate
Precipitation
Floods
Drought
climate change

② Particularly concerned
because developing countries
won't get - People's
ellevations

③ Current problem created
by developed world

④ Common but differentiated
responsibilities 4

All countries

When • How

Principle - meaningful but equitable
obligations for all nations 4

→ no ability to binding goals
but US must provide leadership —

① Not threaten economic growth.

[But ^{Bank concerned}
GEF → Not included & that

there is no issue of

costs of action — costs of inaction

Hidden costs — What will we
— Post

Moral - Ethical issue for future
generations —

② Economic cost — GAPP

The balance
book is prepared to help
what steps can we take

Cost

Technology

if you do

Cost if you do not

JOINT IMPLEMENTATION

Not adequate resources now

must supplement - GEF,
- Board
to + Technology transfer
→ energy efficiency

It is feasible →

Joint Implementation

- Carbon Fund. / measurement and assurance
early credit

① Agree on the Science - it will affect our
 climate - and environment - Policy is
 science -
 - Precipitation
 - Floods
 - Islands - Woods -

② Impact on the Poor -

= Vector borne diseases
 = Ecological systems

= contribute 5-9% of GDP.

Asthma

Malaria

2.1 million
 cases of death

Diarrheal
 diseases

May Clinton { 113 Bill Wale
 19 - Santanu
 20 Bill -

= Food Security can be affected -

③ When we talk of economic cost -

we are talking G.A.P. - But they should

be generally accepted - There is one

of depletion of resources - There are

economic cost if an children will not be

able to eat - in forest implementation
 ④ Kyoto Economic cost -

*Sixth-draft full content (to be edited to various forms & lengths)
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Climate: Making Sense and Making Money

DECLASSIFIED

JUN 23 2025

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WBG ARCHIVES

On 19 May 1997, the chief executive of British Petroleum said: "[T]here is now an effective consensus among the world's leading scientists and serious and well informed people outside the scientific community that there is a discernible human influence on the climate, and a link between the concentration of carbon dioxide and the increase in temperature." He continued: "[W]e must now focus on what can and what should be done, not because we can be certain climate change is happening, but because the possibility can't be ignored."

The prospect of having to reduce carbon emissions has aroused dismay, foreboding, and resistance among many in the business community who fear it would hurt profits and growth. That is unfortunate, especially because their reaction stems from one unexamined assumption—which is incorrect.

Predictions of dire consequences from those on all sides—climate-protectors and cost-avoiders, interventionists and laissez-fairers, those concerned about their grandchildren and about their shareholders—freeze stakeholders into seemingly opposed positions. Their preoccupation with defending those positions masks vast opportunities for mutual gain. It might be more productive for all sides to acknowledge the hopes they share. All of us want to be safe, prudent, profitable, productive, and competitive. All want flexibility, entrepreneurship, and markets doing what they do best. All want the poor, at home and abroad, to have a fair chance to live better. And nearly all can get what they want, simultaneously and without compromise—a stable climate *and* a vibrant economy—if practical business experience is allowed to replace theoretical assumptions.

Robert J. Samuelson, in the 14 July 1997 *Newsweek*, concluded: "It would be political suicide to do anything serious about [climate]....So shrewd politicians are learning to dance around the dilemma." Climate policy is in this rut because such influential commentators *assume* that protecting the climate will be costly: in Samuelson's widely held view, saving a ton of carbon emissions would happen only under a roughly \$100 tax, a level he thinks might only cut 2010 emissions back to 1990 levels. Thus "Without a breakthrough in alternative energy—nuclear, solar, something—no one knows how to lower emissions adequately without crushing the world economy." Congress "won't impose pain on voters for no obvious gain to solve a hypothetical problem. And if the United States won't, neither will anyone else."

This articulate columnist holds that belief because it's the conclusion reached by many economic computer models. He may not realize, however, that the models find carbon abatement to be costly *because that's what they assume*. This assumption masquerading as a fact has been so widely repeated as the input and hence the output of supposedly authoritative models that it's often deemed infallible.

Yet an enormous body of overlooked empiricism, including government-sponsored studies [e.g., ICF 1990, NAS *Pol Implns of Grnhs Wrng*, D J Evans ed, 1992, & E S Rubin et al., "Realistic Mitigation Options for Global Warming," *Sci* 257:148ff, 10 July 1992; Okken et al. 1991, Krause, MDLevine&MABrown *Scenarios for U.S. Carbon Reduction* LBNL-40533 9/97] and worldwide business practice, shows that the breakthrough Samuelson seeks has already happened. Protecting the climate can be *not costly but profitable*—just as many industries are al-

ready turning the costs of environmental compliance into the profits from pollution prevention.¹ To prove that, this paper will:

- show how firms are starting to capture these profit opportunities, and can greatly broaden and intensify that success even on a national and global scale;
- examine how eight kinds of practical obstacles that have retarded implementation can be turned into lucrative business opportunities;
- explain how climate/economic models ignore those opportunities and wrongly assume that rapid adoption requires high energy prices;
- clarify how least-cost climate solutions can foster vibrant competitiveness and employment; and
- demonstrate that the climate issue represents a largely unexploited and underrecognized business bonanza.

Consider a few examples. Southwire, the top independent U.S. maker of rod, wire, and cable (a very energy-intensive business), cut its electricity use per pound of product by 40%, gas by 60%, during 1981–87—then kept on saving even more energy and money, still within two-year paybacks. The resulting savings created nearly all the company's profits in a tough period when competitors were going under. The two engineers who led the effort may have saved four thousand jobs at ten plants in six states. The lead engineer, Jim Clarkson, says the technologies are all simple and available; their effective use takes only "an act of management will and design mentality, consistently applied." Indeed, Southwire found that such dramatic energy savings both require and facilitate better management and production systems that are vital anyhow for competitiveness, so the energy savings—sufficient "to cut American industrial energy use in half," as Southwire did—tag along almost for free.

In 1981, Dow Chemical's 2,400-worker Louisiana division started prospecting for overlooked savings. Engineer Ken Nelson quietly set up a shop-floor-level contest for energy-saving ideas. Proposals had to offer at least 50% annual return on investment. The first year's 27 projects averaged 173% ROI. Startled at this unexpected bounty, though expecting it to peter out quickly, Nelson persevered. The next year, 32 projects averaged 340% ROI. Twelve years and almost 900 implemented projects later, the workers had averaged (in the 575 projects subjected to *ex post* audit) 202% predicted and 204% audited ROI. In the later years, the returns and the savings were both getting bigger, because the engineers were learning faster than they were exhausting the "negawatt" resource. In only one year did returns dip into double digits (97% annual ROI). The whole suite of projects paid Dow's shareholders \$110 million every year.

DuPont expects to save the equivalent of 18 million tons of CO₂ by 2000 through simple measures that will also save \$31 million each year. Roche Vitamins (Belvedere, NJ) has profitably cut its steam use per unit of production by more than half in five years. A new chiller and related improvements at a Kraft ice-cream plant saved 33% of its electricity and 2,500 tons of CO₂ a year; productivity rose 10% and the plant turned from a money-loser into one of the most competitive. A process innovation at Blandin Paper Company (Grand Rapids, MN) saved each year 37,000 tons of CO₂ and more than \$1.8 million.² The first two years of billion-dollar carpetmaker Interface Corporation's efficiency efforts, *The Wall Street Journal* reports [11 July 1997 p B1], have saved "a stunning \$25 million..., with another \$50 million expected the next two years." Greenville Tube Corporation's demonstration of new drivesystems under DOE's Motor Challenge program boosted productivity 15% and energy efficiency 30%, reduced scrap 15%, and saved \$77,000 a year with a five-month payback [Romm present'n]. And Southern Company's 1984–94 improvements in the thermal efficiency of its fossil-fueled power plants saved 400,000 tons of SO₂, 35 million tons of CO₂, and an annual \$108 million.

Because such examples are the exception, not yet the rule, America is confronted, as Pogo said, by insurmountable opportunities. Those opportunities can create enough practical ways to mitigate climatic concerns *and* save more money than they cost, without ascribing any value to the abatement itself, to turn climate change into an unnecessary artifact of the uneconomically wasteful use of resources. Specifically³:

- Over half⁴ of the threat to climate disappears if energy is used in a way that saves money. In general, *it's far cheaper to save fuel than to burn it.*
- Another one-fourth or so of the threat can be abated by farming and forestry practices that take carbon out of the air and put it back in the soil and plants where it belongs, in the rich tilth and diverse biota that create lasting value. Soil-conserving and -building practices are generally at least as profitable as soil-mining, chemical-dependent methods [NRC 1989, AREE], so let's call them at least a breakeven.

- The rest of the threat vanishes when we replace CFCs with the new substitutes which, thanks to industrial innovation, work the same or better and typically cost about the same or less. (They're also required by global treaty to protect the stratospheric ozone layer.)

So if the "cost" of protecting the climate ranges from strongly negative to roughly zero or irrelevant, what are we waiting for?

Assuming the conclusion

Climate policy has been held hostage to a tacit presumption that if saving a lot more energy were possible at an affordable price, it would already have been implemented. That's like not picking up a \$100 bill from the sidewalk because if it were real, someone would previously have picked it up; or like an entrepreneur who abandons a good business idea because if it were sound, it would have been done earlier.

All economists know that real markets are far from theoretical perfection. But most climate/economy models assume that almost all profitable energy savings must already have been bought—as if in a perfect market. On this basis, the modelers suppose, buying significantly bigger savings will be worthwhile only at higher energy prices. They then use big computer models to calculate how big an energy tax is needed (based on historic elasticities), how much that will depress the economy, and hence what the "cost" of protecting the climate must be.

Those models have driven policy for the past two decades. They may get the amount of money about right—but flowing in the wrong direction. A model popular in the Reagan-Bush years trumpeted the notion that meeting the Toronto carbon-reduction goals would *cost* the U.S. about \$200 billion a year; but the empirical evidence of what energy savings actually cost showed that saving that much fossil fuel would *save* the U.S. about \$200 billion a year compared with buying and burning that fuel. Ever more elaborate models, discussed further below, continue to be built on the same fundamental assumption—that saving energy isn't profitable at present prices and hence will require higher prices that will burden firms and the national economy.

Had those theorists ever run an energy-saving business, they'd know better. GE Chairman Jack Welch said of American industry [*Fortune* Cover Conversation, 11Dec95], "Our productivity is at the beginning stages. There's so much waste. There's so much more to get, it's unbelievable. And somehow or other people think all these things are finite." Practitioners often find that the more the waste that pervades industry is corrected, the more new opportunities emerge to save even *more* resources, even faster and cheaper—especially electricity, which is the costliest and most climate-affecting form of energy.⁵

Big, cheap energy savings

Consider a simple example about pumping—the biggest use of electric motors. Leading American carpet-maker Interface was recently building a factory in Shanghai. One of its processes required 14 pumps. The top Western specialist firm sized them to total 95 horsepower. But a fresh look by Interface/Holland's engineer Jan Schilham, applying methods learned from Singapore expert Eng Lock Lee, cut the design's pumping power to only 7 hp—a 92% or 12-fold energy saving. It also *reduced* the system's capital cost, and made it easier to build and maintain and more reliable and controllable.

These astonishing results required two changes in design. First, Schilham chose big pipes and small pumps instead of small pipes and big pumps: friction falls as nearly the fifth power of pipe diameter. Second, he laid out the pipes first, then installed the equipment, not the reverse: the pipes are therefore short and straight, with far less friction, requiring still smaller and cheaper pumps, motors, inverters, and electricals. The straighter pipes also allowed him to add more insulation, saving 70 kilowatts of heat loss with a two-month payback.

Schilham marveled at how he and his colleagues could have overlooked such simple opportunities for decades. His redesign required, as inventor Edwin Land used to say, not so much having a new idea as stopping having an old idea; not rocket science but rather correcting a common error in engineering economics. The original specification used a rule-of-thumb that balanced the extra capital cost of fatter pipe only against the saved *operating* cost of reduced pumping energy. The new design instead optimized for lifecycle savings in pumping energy *plus* capital cost—not just of the pipes but the *whole system*. The extra cost of the slightly bigger pipes was far smaller than the cost reduction for the dramatically smaller pumps and drivesystems. Such whole-system lifecycle costing is widely

used in principle but rarely in practice. Optimizing energy-using components in isolation tends to pessimize the whole system and hence the bottom line.

Such opportunities exist in more than just pumping. Major energy savings are available in valves, ducts, dampers, fans, motors, wires, heat exchangers, insulation, and most other technical design elements, in most technical systems that use energy, in most applications, in all sectors. Virtually all energy uses are designed using rules-of-thumb that are wrong by about three- to tenfold. Substituting economically rational design would therefore save much of the energy used by industry, while *reducing* capital costs. Many of those savings can also be profitably retrofitted into existing plants, either immediately or as part of routine renovations and expansions.

Similar rethinking of building design has lately yielded, among hundreds of examples,

- houses that are comfortable with no heating or cooling equipment in climates ranging from -47°F in the Colorado Rockies [H1] to $+115^{\circ}\text{F}$ in central California [ACT² refs, TM-93-5], yet cost less to build;
- air-conditioning savings ranging from 90% in a new Bangkok house, at no extra cost [Suntoorn], to 97% in a cost-effective California office retrofit design [F4];
- total energy savings from over 50% to nearly 90% in cost-effective U.S. house and small-office retrofits [F4, ACT² Sunset/ENSAR]; and
- a retrofit design to save 75% of the energy in a typical 20-year-old Chicago curtainwall office tower [ASHRAE J], providing far greater comfort and a simple payback of -5 to $+9$ months.⁶

A particularly effective retrofit strategy, illustrated by the last example, is to coordinate energy efficiency with renovations needed anyhow, such as replacing aging glazings and mechanical systems. New superwindows can insulate fourfold better and let in six times as much daylight but a tenth less unwanted heat. That can trigger further savings, notably in lighting, that can cut air-conditioning needs fourfold. Then the mechanical system can be replaced with a redesigned version four times smaller, four times as efficient, and cheaper than renovating the old one. That saves about enough money to pay for the extra costs of the superwindows and other improvements. Every city in America has such buildings ripe for similar treatment—100,000 of them nationwide.

Careful scrutiny of actual market prices for equipment (“In God we trust; all others bring data”) reveals that even at the single-component level, many technical devices—motors, valves, pumps, rooftop chillers, etc.—show no correlation whatever between efficiency and price. A 100-hp American motor, for example, can be cheaper at 95.8% efficiency than an otherwise identical 91.7%-efficient model. But if you don’t know that—if you assume, as economic theory predicts, that more efficient models always cost more—then you probably won’t shop for it. And that can be costly. If the motor runs continuously, then each one-percentage-point gain adds about \$50 per horsepower to the bottom line, so not choosing the most efficient 100-hp motor can slash present-valued profits by \$20,000.

Again, the key is not so much adopting new technologies, though they’re important, as using proper recipes for combining the best available technologies in the optimal manner, sequence, and proportions. Some of the recipes are embarrassingly obvious. In hot cities, heat-reflecting roofs can save nearly 70% of cooling energy. Up to 40%—90% for houses—can be saved by combining light-colored paints and pavement with revegetation to help bounce solar heat away. An urban tree keeps about 10–14 times as much carbon out of the air as the same tree planted in a forest where it can’t also save air-conditioning energy by keeping people and buildings cooled and shaded. Such effects multiply: traditional passive cooling methods formerly provided summer comfort even in steamy Bangkok, and can do so again if superefficient cars and buildings are gradually introduced so the waste heat from cars’ engines and air conditioners stops making the city too hot.⁷

Proven examples abound in every kind of business:

- Properly choosing office equipment and commercial and household appliances has saved over two-thirds of their energy use with the same or better service and comparable or lower cost [Shepard et al. 1990]. (Such choices cut our household electric bill to \$5 a month with a 10-month payback using 1983 technology.)
- Skilled retrofits have saved 70–90% of office and retail lighting energy, yet the light quality is more attractive and the occupants can see better. In many cases, the better lighting equipment more than pays for itself by costing less to maintain [Lovins & Sardinsky 1988, Piette et al. 1989].
- Motors use three-fourths of industrial electricity, three-fifths of all electricity, and more primary energy than highway vehicles. This use is highly concentrated: about half of all motor electricity is used in the million larg-

est motors, three-fourths in the three million largest. Since big motors use their own capital cost's worth of electricity every few *weeks*, switching to more efficient motors can pay back quickly. This plus retrofitting the rest of the motor system saves about half its energy and pays back in around 16 months [Lovins et al. 1989, Fickett et al. 1990]. Doing this right requires integrating up to 35 kinds of improvements to the motors, controls, electrical supply, and drivetrains, but the resulting saving is twice as big, yet one-fifth as costly, as conventional retrofits that use only two kinds of improvements.

- The chemical industry saved half its energy per unit of product during 1973–90 by plugging steam leaks, installing insulation, and recovering lost heat. Now it's discovered that better catalysts and matching heat to the required temperature can often save 70% or so of what's left, yet pay back within two years.⁸ Next-generation industrial plant design, now moving from the chemical industry into semiconductors, is uncovering 50–75% savings with lower capital cost, faster construction, and better performance. Early adopters will prosper.

Many of these examples illustrate a new design concept: that whole-system engineering can often make it cheaper to save a large than a small fraction of energy use. This “tunneling through the cost barrier” typically comes from integrating the design of an entire package of measures so they do multiple duty (such as saving on both energy *and* equipment costs), or piggyback on renovations being done anyway for other reasons, or both. Good engineers think this is fun. Most economic theorists assume it's impossible.

Moreover, the cornucopia of efficiency opportunities keeps expanding far into the future:

- Just selling “waste” heat to other users could cost-effectively save up to about 30% of U.S. and 45% of Japanese industrial energy. (America's power stations waste more heat than Japan's total energy use.)
- Still largely unexploited are new kinds of heat exchangers and motors, membrane separators and smart materials, sensors and controls, rapid prototyping and ultraprecision fabrication, and radically more frugal processes using enzymes, bacteria, and biological design principles.
- Saving materials also saves the energy needed to produce, process, transport, and dispose of them. Product longevity, minimum-materials design and manufacturing, recovery of any scrap not designed out, repair, reuse, remanufacturing, and recycling together present a formidable menu of business opportunities that also save energy, pollution, mining, and landfilling. Japan cut its materials intensity by 40% just during 1973–84; but far more is yet to come. Americans throw away enough aluminum to rebuild the country's commercial aircraft fleet every three months, even though recycling aluminum takes 95% less energy than making it from scratch. Smart manufacturers now take their products back for profitable remanufacturing, as IBM just did with computers in Japan and Xerox does with photocopiers worldwide. Interface, the world's top carpet-tile maker, reckons to cut its materials flow by about tenfold, ultimately by a hundredfold, by leasing floor-covering services instead of selling carpet, remanufacturing old carpet, and ultimately mining nylon from landfilled carpet.
- Innovative new approaches also seem about to solve the most intractable part of the climate problem—road vehicles.⁹ Ultralight, ultralow-drag, hybrid-electric “hypercars” [refs] with 70–90% fuel savings, better performance in all respects¹⁰, and competitive costs have attracted about \$2.5 billion of private investment by 25-plus firms worldwide, half of them new market entrants. GM has announced it's developing cars with half the weight, half the drag, and hybrid drive (hypercars in all but name). In autumn 1997, Ford will test a dozen 40%-lighter 6-passenger cars (including two kinds with hybrid drive), meeting essentially the goals of the government's tripled-efficiency car program but 3–6 years early, while Toyota will mass-market in Japan a hybrid Corolla-class car with doubled efficiency, tenfold lower emissions, and only \$4,000 higher initial price. Daimler-Benz has pledged to be making 100,000 fuel-cell cars a year by 2005. With such progress being *announced*, imagine what's going on behind closed doors. Ultimately hypercars will save, probably at a handsome profit, as much oil worldwide as OPEC now sells.
- Many energy savings reduce climatic threats from more gases than just CO₂. Advanced refrigerators, using vacuum insulation and helium-engine coolers, can save over 90% of standard refrigerators' energy, thus avoid burning enough coal to fill the refrigerator every year. This also eliminates climate- and ozone-disrupting CFCs from insulation and refrigerant. Landfill and coal-mine gas recovery turns heat-trapping and hazardous methane emissions into a valuable fuel while making electricity that displaces coal-burning. Recycling paper (the average person in a rich country uses as much wood for paper, mostly wasted, as the average person in a poor country uses for fuel) saves it from turning cellulose's carbon into landfill methane, and also saves fossil-fueled manufacturing and transportation. Superefficient cars simultaneously reduce at least eight classes of heat-trapping gases. These and scores more examples represent business opportunities with multiple profit streams.

Providing the energy that a severalfold larger global population, many of them desperately poor, will need for a decent life mainly requires much more efficient use. This offers about threefold greater relative scope, and meets an even more urgent developmental need, in the South than in the North. But it will also require energy production. Where will that energy come from if not fossil fuels?

Such firms as British Petroleum and Enron are investing heavily in renewables—for good reason [Romm & Curtis *Atl* 4/96 “Mideast Oil Forever?”]. London’s Delphi Group advised its institutional investors in 1995 that alternative energy industries not only help “offset the risks of climate change,” but also offer “greater growth prospects than the carbon fuel industry” [Mansley rpt on Gelbspan 87]. In 1990, five U.S. National Laboratories reported that either fair competition plus restored research priority¹¹; or proper counting of environmental benefits, could cost-effectively expand renewables to a level equivalent to three-fifths as much energy as the United States uses today; renewable electricity supply could be one-fifth *more* than present usage [SERI 1990]. In 1997, a new five-Labs study [Levine & Brown 97] found that efficiency, renewables, and other low-carbon options could profitably or very cheaply hold 2010 U.S. carbon emissions at about the 1990 level—reducing the carbon intensity of the economy at a 1997–2010 average rate of 2.3–2.5% per year.¹² Just in the buildings sector, reducing the 1990–2010 carbon increase from 26% to 4% would save about \$22 billion a year more (1995 \$ in 2010) than it would cost [*id.* 3.6].

Best of all, sunlight is most abundant where most of the world’s poorest people live. In every part of the world between the polar circles, freely distributed and efficiently used renewable energy is adequate to support a good life continuously, indefinitely, and economically using present technologies [Sørensen 1979, Reddy & Goldemberg 1988, Lovins et al. 1981, Johansson et al. 1989, 1992]. And this potential, once considered visionary, is starting to be validated in the marketplace. The world’s fastest-growing energy source, outpacing even energy savings, is now...windpower, up 26% during 1995–1996, and led by Germany (which just overtook American installed capacity), India, Denmark, and Spain. Double-digit annual growth in solar cell shipments is bringing costs steadily down, and counting some of the dozens of kinds of “distributed benefits” can make those cells cost-effective right now in many uses [Lovins & Lehmann 1997]. (The Sacramento utility even found it’s cheaper to hook alley lights to solar cells than to the existing wires.) Adding other advanced renewables can cut utilities’ carbon emissions by as much as 97% with unchanged reliability and essentially the same cost [Johansson et al. *rens. bk.* 1992 pp 23ff].

Meanwhile, doubled-efficiency combined-cycle gas turbines, with only one-fourth the carbon-intensity of coal-fired power plants, have quietly grabbed more than half the market. The new dark horse is low-temperature polymer fuel cells: equally efficient but silent, clean, reliable, scaleable from large to computer-battery-sized, and likely to transform global power markets. Indeed, converting wellhead natural gas to hydrogen for fuel cells could offer a new option. That separation is already cost-justified by the fuel cell’s high efficiency, so its free byproduct—CO₂—can be reinjected into a depleted gasfield. This cheaply sequesters all the carbon—up to about twice as much as the field’s natural gas originally contained—and is nearly paid for by the extra gas recovered by repressurizing the field [Williams 1996].

In contrast, the products of socialized costs and central planning have not fared well. The world’s slowest-growing energy source is nuclear power—under 1% in 1996, with no prospect of improvement. Despite strenuous effort, its global capacity in 2000 will be a tenth, and its ordering rate is now only a hundredth, of the lowest official forecasts made a quarter-century ago. In America, civilian nuclear technology ate \$1 trillion, yet delivers less energy than wood. It died of an incurable attack of market forces. The only question is whether, as many analysts believe, a third or more of U.S. nuclear plants will retire early because their operating and repair bills are unaffordable. The writing is on the wall: worldwide, around 90 nuclear plants have already retired after serving fewer than 17 years. Even in France, nuclear expansion was far outpaced by its poor cousin—unheralded, unnoticed, unsupported, but more cost-effective energy efficiency.

The collapse of nuclear power—once the great hope for displacing coal-burning—might at first appear to be bad for climate. But since nuclear power is the costliest way to displace fossil fuels, every dollar spent on it displaces less climatic risk than would have been avoided by spending that same dollar on the best buys first. This opportunity cost is why nuclear power actually makes climatic threats worse rather than better.

Whole countries, especially heavily industrialized ones, can achieve big energy savings, and alternative supplies, just by adding up individual ones. During 1979–86, in the wake of second oil shock, America got nearly five times as much new energy from savings as from all net expansions of supply, and 14% more energy from sun, wind, water, and wood but 10% less from oil, gas, coal, and uranium. By 1986, CO₂ emissions were one-third lower than they would have been at 1973 efficiency levels. The average new car burned half the fuel (4% of that gain came from making cars smaller, 96% from making them smarter) and emitted almost a ton less carbon per year. Annual energy bills fell by ~\$150 billion. Annual oil-and-gas savings grew to become three-fifths as large as OPEC's capacity [Rosenfeld et al. 1990a in AREE]. In those seven years, GDP rose 19% but energy use shrank 6%. No problem.

All that effort in the '80s only scratched the surface. In 1989, the Swedish State Power Board (Vattenfall) published—without, by order of its CEO, the usual disclaimer saying it didn't represent official policy—a thorough and conservative technical study of Sweden's further potential to save electricity and heat (which are often made jointly, or "cogenerated") [ref]. The team found that fully using mid-1980s technologies could save half of Sweden's electricity, 78% more cheaply than making more. That plus switching to less carbon-intensive fuels and relying most on the least carbon-intensive power stations could enable Sweden simultaneously to

- achieve the forecast 54% GDP growth during 1987–2010,
- complete the voter-mandated phaseout of the nuclear half of the nation's power supply,
- reduce the utilities' carbon releases by one-third, and
- reduce the private internal cost of electrical services by nearly \$1 billion per year.

If this is possible in a country that's full of energy-intensive heavy industry, cold, cloudy, very far north, and among the most energy-efficient in the world to start with, then countries not so handicapped must have important opportunities too. A year later, a study for the Indian state of Karnataka found that even a limited menu—several simple efficiency improvements, small hydro, cogeneration from sugarcane waste, biogas, a small amount of natural gas, and solar water heaters—would achieve far greater and earlier development progress than the fossil-fueled plan of the state utility, with two-fifths less electricity, two-thirds lower cost, and 95% less fossil-fuel CO₂ (Reddy & Goldemberg 1990).¹³ These two analyses spanned essentially the full global range of energy intensity and efficiency, technology, climate, wealth, income distribution disparities, and social conditions. Yet they both found that efficiency plus renewables yielded a highly profitable carbon-reducing investment package.

That Karnataka study exposes the twin canards that climate is the North's problem and that reducing the South's carbon emissions would inequitably cripple development. Precisely because energy waste hobbles economic progress, some governments in the South and East have lately been quietly cutting subsidies to energy-intensive industries and even to fossil fuels themselves—the latter more than twice as fast in the South as in the North. Reformers are also opening up the energy sector to greater competition, innovation, and efficiency. Such policies have achieved better overall economic efficiency *and*, as a free byproduct, much lower carbon emissions. Such countries are saving carbon about twice as fast as OECD countries have committed to do, and they're probably saving more carbon in absolute terms than OECD countries actually will do, while boosting their own economic growth. In short, they're saving energy for *economic* reasons and reaping the incidental environmental benefits. Among the strongest economic advantages is that building superwindow and efficient-lamp factories instead of power stations and transmission lines can use a thousandfold less capital [Gadgil] and recover it ten times as fast for reinvestment—thus liberating for other development needs the one-fourth of global development capital now consumed by the power sector [Asian paper].

China has three times the energy intensity of Japan (which itself has surprisingly big efficiency opportunities still untapped). But China is improving rapidly. Spurred by energy shortages that idle an estimated 25–30% of its manufacturing capacity, China now gets a quarter of its total primary energy from renewables and over an eighth of its electricity from cogeneration. It's converting all large industrial boilers to cogeneration. It's cut its coal subsidies from 37% to 29% (1984–95) and its oil subsidies from 55% to 2% (1990–95). These and other policy initiatives reduced the 1980–90 growth in China's carbon emissions by 40%. Now, encouraged by internal rates of return on recent manufacturing energy efficiency projects all exceeding 12% and usually exceeding 20%, China is tackling a further savings potential which the World Bank last year estimated would reach in 2020 a level greater than China's entire 1990 energy consumption [Reid & Goldemberg 1997]: in steelmaking alone, best practice could reduce the typical 1990 energy per ton by 64% promptly and 82% ultimately [UNDP 1997 p 72].

Similar conclusions have been found at scales ranging from New England (Krause et al. 1991a) and California (Calwell et al. 1990) to the five largest western European economies (Krause et al. 1991) to the world (LCE, Goldemberg et al. 1988). Studies for the governments of Canada (DPA Group 1989) and Australia (Greene 1990) confirmed that ~20% CO₂ cuts would be highly profitable. In Australia, for example, a 36% energy and 19% CO₂ reduction from projected 2005 levels would save \$6.5 billion (Australian) of private costs per year by 2005, because each \$5 invested in efficiency would save \$15 worth of fuel purchases and 1 ton of CO₂. A new U.S. study [E Innovns 6/97] similarly found that saving 26% of carbon emissions and 15% of primary energy by 2010 would also save 13% of national energy costs—\$85 billion a year, or \$205 per ton of avoided carbon emissions, or \$530 per household per year—and create nearly 800,000 net jobs. Investments in more efficient energy-using devices to 2010 would average \$29 billion a year, but direct monetary savings would average \$48 billion a year, excluding any value of stabler climate and cleaner air.

Such profitably efficient energy futures are simply a logical extension of past achievements. Energy savings since 1973 have cut this country's energy bill by \$150–200 billion a year¹⁴ and carbon emissions by one-fourth. We did all that quietly, easily, and profitably—but now we know how to do far better: America, and the world, have barely begun to capture the energy efficiency that's available and worth buying. Modern cars, after a century of devoted engineering refinement, use only 1% of their fuel energy to move the driver. An ordinary light-bulb converts only 3% of the power-plant fuel into light. The entire U.S. economy is only about 2% energy-efficient compared with what the laws of physics permit. National materials efficiency is even worse: only about 1% of all mobilized materials are actually put into and remain in the average product six weeks after its sale. Thus despite impressive achievements so far, America still wastes upwards of \$300 billion a year worth of energy: more than the entire military budget, far more than the federal budget deficit, and enough to increase personal wealth by more than \$1,000 per American per year. That waste begs to be turned into profits.

Marketplace energy savings: turning obstacles into opportunities

So if such big savings are both feasible and profitable, why haven't they all been done? Because the free market, effective though it is, is burdened by subtle imperfections that inhibit the efficient allocation and use of resources. It is necessary at the outset, writes Professor Stephen DeCanio, Senior Staff Economist for President Reagan's Council of Economic Advisers [sp sic][cite JGM],

...to discard the baggage carried by most economists (the author confesses membership of that much-maligned group) that immersion in a market environment guarantees efficient behavior by the market participants. Much of modern economic theory practically *defines* efficiency as the outcome of competitive market exchanges. But the bloodless "competition" of mathematical general equilibrium models bears only a partial relationship to the actual experience of real firms.

This is tacitly conceded whenever market economists, as a senior government official recently wrote, "are unpersuaded that just because an act seems to make good economic sense it will happen." That is true—precisely because of real-world obstacles and complexities that aren't reflected in the perfect-market economic models relied upon for the conventional conclusion that saving much energy will require much higher energy prices. In fact, those barriers block economically optimal investment in efficient use of energy in at least eight main ways. The good news is that *each of these obstacles represents a business opportunity* [F4Pt2]. Some examples of how they match up:

Obstacles

Opportunities

Capital misallocation

Energy is only 1–2% of most industries' costs, and most managers pay little attention to seemingly small line-items, even though small savings can look big on the bottom line. Surprisingly many executives focus on the top line and forget where saved overheads go; and without their attention, nothing happens. In addition, manufacturing firms tend to be biased toward investments that increase output or market share and away from those that cut operating costs [Levine & Brown 1997 p. 2.2].

A few years ago, one of us was able to tell the CEO of a Fortune 100 company that one of his sites had an outstanding energy manager who was saving \$3.50 per square foot-year. The CEO said, "That's nice—it's a million-square-foot facility, isn't it? So that guy must be adding \$3.5 million a year to our bottom line." He got that right—until he added in his next breath, "I can't really get excited about energy, though—it's only a few percent of my cost of doing business." He had to be

shown the arithmetic to realize that similar results, if hypothetically achieved in his 90-odd million square feet of facilities worldwide, would boost his corporation's net earnings that year by 56%. The energy manager was quickly promoted so he could spread his practices across the company.

About four-fifths of firms don't assess potential energy savings using discounted-cashflow criteria, as sound business practice requires; instead, they require a simple payback whose median is 1.9 years [DeCanio JGM]. At (say) a 36% total marginal tax rate, a 1.9-year payback means a 71% real aftertax rate of return, or around six times the marginal cost of capital. (For example, before state and then federal standards required them, high-efficiency magnetic ballasts, with a 60% real internal rate of return, won only a 9% market share [Levine et al AREE '95]. Many capital-constrained industries use even more absurd hurdle rates: in some, the energy managers can't buy anything beyond a six-month payback.

Many supposedly sophisticated firms count lifecycle cost only for big items and make routine "small" purchases based on first cost alone. Thus 90% of the 1.5 million electric distribution transformers bought every year, including the ones on utility poles, are bought for low first cost—passing up an aftertax ROI of at least 14% a year and many operational advantages, and misallocating \$1 billion a year.¹⁵

If you invest to save energy in your business or home, you probably want your money back within a couple of years, whereas utilities are content to recover their power-plant investments in 20–30 years—about ten times as long. Thus both managers and householders typically require about tenfold higher returns for saving energy than for producing it.¹⁶ This is equivalent to a tenfold price distortion. It makes us buy far too much energy and too little efficiency. Not fairly comparing ways to save with ways to supply energy means not choosing the best buys first, hence grossly misallocating capital—lots of capital. Until the late '80s, the U.S. wasted on uneconomic power plants and their subsidies (each roughly \$30 billion a year) about as much as it invested in all durable-goods manufacturing industries. This misallocation badly crimped the nation's competitiveness.

High consumer discount rates are especially tough: folks used to paying fifty cents for an incandescent light-bulb are often unwilling or unable to pay \$15–20 for a compact fluorescent lamp which, over its life (about 13 times that of the incandescent lamp), keeps nearly a ton of CO₂ out of the air and saves tens of dollars more in power-plant fuel, replacement lamps, and installation labor than it costs. It's a good deal, but sounds like too much

Top finance firms have joined the U.S. Department of Energy in an International Performance Measurement and Verification Protocol [IPMVP, DOE/EE-0081(97), 9/97, www.ipmvp.org]. This industry-consensus approach, like FHA mortgage rules, standardizes streams of energy-cost savings so they can be aggregated and securitized. That's creating a booming market in which loans to finance energy and water savings can be originated as fast as they can be sold into the new secondary market. Achieving the savings therefore no longer requires one's own capital, can be affordably financed, and needn't compete with other internal investment needs.

A new generation of building is overcoming the psychological barrier of supposedly higher capital cost. A hundred case-studies [GDS bk] demonstrate that energy savings of 75% or more can come with superior comfort, amenity, and real-estate market and financial performance—yet *identical or lower* capital cost, because integrated design creates synergies that drastically cut equipment and infrastructure costs. Major developers are starting to move such buildings into mainstream practice.

Arbitrageurs make fortunes from spreads of a tenth of a percentage point. The spread between the discount rates used in buying energy savings and supply are often hundreds of times bigger than that—surely big enough to overcome the transaction costs of marketing and delivering lots of small savings.¹⁷ (Scores of utilities proved this in well-designed '80s and early '90s programs that delivered efficiency improvements at total costs far cheaper than just *operating* existing thermal power stations [Nadel, ABL/Joskow].) This is the basis of the Energy Service Company concept, where entrepreneurs offer to help cut your energy bills for nothing up front—just a share of the savings. Skilled firms of this type are flourishing worldwide, although the domestic ESCO industry is still in its shakeout phase.

Southern California Edison Company gave away more than a million compact fluorescent lamps because that cost less than running power stations. SCE then cut the lamps' retail price by about 70% via a temporary subsidy paid not to buyers but to lamp manufacturers, thus leveraging all the markups. Some other utilities *lease* the lamps for, say, \$0.20 per lamp per month, with free replacements; customers can thus pay over time, just as

money.

Most international vehicles for investing in national or utility-level electric power systems consider only supply-side, not demand-side, options and have no way to compare them. The resulting misallocation is like the recipe for Elephant and Rabbit Stew—one elephant, one rabbit—and it's the wrong way around.¹⁸

Organizational failures

Old habits die hard. A famous company that hasn't needed steam for years still runs a big boiler plant, with round-the-clock licensed operators, simply to heat distribution pipes (many uninsulated and leaking) lest they fail from thermal cycling; nobody has gotten around to shutting the system down. Why rock the boat to make someone else look good? Why stick your neck out when the status quo seems to work and nobody's squawking?

Schedules conquer sensible design. One of us once called the chief engineer of a huge firm to introduce opportunities like a cleanroom that uses a small fraction of the energy he was used to, performs better, costs less, and builds faster. His reply: "Sounds great, but I pay a \$100,000-an-hour penalty if I don't have the drawings for our next plant done by Wednesday noon, so I can't talk to you. Sorry. Bye." The result is "infectious repetitis"—like the semiconductor plant where a pipe took an inexplicable jog in mid-air as if it were going around some invisible obstacle. The piping design had been copied from another plant that did have a structural pillar in that location. In short, intense schedule pressures combine with design professionals' poor compensation and prestige, overspecialized training, and utterly disintegrated processes to yield commoditized and pervasively poor technical design.

Few firms carefully measure how their buildings and processes actually work. Their design assumptions are therefore untested and often incorrect. Their design process is linear—require, design, build, repeat—rather than cyclic—require, design, build, measure, analyze, improve, repeat. No measurement, no improvement. And no discoveries—like the plant that for decades had been unwittingly running a 40-kilowatt electric heater year-round under its parking lot to melt snow. Nobody remembered or noticed until measurement found the books didn't balance, and the wiring was traced to track down the discrepancy.

Departments often don't or can't cooperate. A noted firm calculated that its proposed new office building should get all-new, superefficient office equipment, because the

they now pay for power stations, but the lamps are cheaper.

Rapidly growing new investment funds, partly funded by the climate-risk-averse insurance industry, are bypassing utilities altogether and investing directly in developing-countries' house-level "leapfrog" efficiency-plus-solar power systems. Those often cost less than villagers typically pay now for lighting kerosene and radio batteries, and represent a new market of two billion people.

Columbia University had entrenched practices too. When a tough new energy manager, Lindsay Audin, was told to cut 10% off its \$10-million-a-year energy bill, with uncompromised service and no upfront capital, authorizations were painfully slow—until he showed they were costing \$3,000 a day in lost savings, more than the delayers' monthly paychecks. Five years later he was saving \$2.8 million a year, 60% of it just in lighting; had won 9 awards and \$3 million in grants and rebates; and had brought 16 new efficiency products to market [CS-94-1].

Both such designers and their clients can get away with this, and probably won't notice it, so long as their competitors use the same methods, consultants, and vendors. But once such striking improvements are introduced to a given market segment, the laggards must adopt them or lose market share. Thus competitive forces can do automatically much of the marketing and outreach normally required. Rocky Mountain Institute, having successfully promoted superefficient buildings and cars by this method, is now helping with a new initiative to overhaul the semiconductor industry, which has \$100 billion worth of fabrication plants on the drawing boards worldwide, all inefficient. The opportunity for clean-sheet redesign is intriguing industry leaders who now understand that they cannot compete without leapfrogging over old methods.

The late economist Kenneth Boulding said hierarchies are "an ordered arrangement of wastebaskets, designed to prevent information from reaching the executive." But letting viscous information flow freely to those who need it stimulates intelligence, curiosity, and profits. At a large hard-disk factory, the cleanroom operator started saving lots of money once the gauge that showed when to change dirty filters was marked not just in green and red zones but in "cents per drive" and "thousand dollars' profit per year." In another plant, just labeling the light-switches, so everyone could see which switches controlled which lights, saved \$30,000 in the first year.

Electric utilities traditionally dis-integrate their operations too. But Canada's giant Ontario Hydro inverted its culture to make end-use efficiency and distribution plan-

extra cost of buying it early (rather than waiting for normal turnover) would be less than the up-front savings from smaller cooling equipment. No deal: the chiller was in one budget, office equipment in another. Similarly, Federal buildings are bought from one budget, then operated by a different organization from another; in some cases, they're prohibited from sharing investments so as to reduce taxpayers' total costs.

If you save, the beancounters simply cut your budget some more. Institutional or personal rewards for cutting energy costs are rare, even in the private sector.

Corporate turmoil spoils continuity. Many firms, assuming they'd already done all the worthwhile energy savings, downsized their energy managers right out of a job, stuffed the task onto other overloaded agendas, and watched it slip to an invisible priority. How many economists does it take to screw in a compact fluorescent lamp? None, goes the joke—the free market will do it. But we all know that somebody actually has to get the lamp from shelf to socket; otherwise the wealth isn't created. In many firms, that somebody doesn't exist.

Companies full of smart, competent, rational, and profit-oriented people often fail to optimize because of even deeper kinds of inherent organizational failures well described in the economic literature.¹⁹

Regulatory failures

All but a handful of states and nations reward regulated utilities for selling more energy²⁰ and penalize them for cutting your bill, so shareholders and customers have opposite goals—with predictable results. Many proposed restructuring efforts would enshrine the same perverse incentive in new commodity-based market rules—rewarding the sale of as many kilowatt-hours as possible at the lowest possible price, rather than rewarding better service at lower cost [Negawatts: 12 Transitions].

In some (though increasingly rare) cases, obsolete codes, standards (as for cement composition [Levine & Brown 97 4.41]), specifications (including those for corporate and military procurement), and laws actually prohibit sound and efficient practices. Far more often, standards meant to set a floor—like “meets code” (euphemism for “the worst building you can put up without being put in jail”), or the British expression “CATNAP” (Cheapest Available Technology Narrowly Avoiding Prosecution)—are misinterpreted as a ceiling or as an economic optimum.

ning its primary focus and generation an afterthought. Its first three experiments in meeting customers' needs by the cheapest means—typically demand-side investments plus better wires management—rather than reflexively building transmission and generating capacity cut its investment needs by up to 90%, saving US\$600 million. Such achievements can motivate deep structural and cultural reforms.

Washington State routinely shares the savings between their achievers, the General Fund, and an account reserved for reinvestment in more savings.

After Ken Nelson, the sparkplug of the remarkable Dow/Louisiana savings, retired in 1993, a reorganization disbanded his organizing committee, tracking ceased, and it became impossible to evaluate how much progress, if any, continued without him. (Lacking a champion, the neighboring Texas division reportedly never undertook a comparable effort in the first place.) But now Mr. Nelson, like Southwire's Mr. Clarkson, is an independent consultant, sharing his skills with more firms.

Proper measurement and incentives help: a utility that started paying its efficiency marketing staff a dollar for every measured kilowatt they saved quickly found that verified savings got bigger and cheaper—both by an order of magnitude.

Simple accounting innovations in a few states decouple utilities' profits from their sales volumes, and let utilities keep as extra profit part of whatever they save off their customers' bills. The nation's largest investor-owned utility, PG&E, thus added over \$40 million of riskless return to its 1992 bottom line while saving customers nine times that much. In California alone, Governor Wilson's PUC found that efficiency investments rewarded and motivated by this incentive system's emulation of efficient market outcomes, just during 1990–93, had saved customers a net present value of nearly \$2 billion. Thoughtful utility restructuring can do the same.

To encourage developers to exceed the minimal energy-saving requirements of building codes, Santa Barbara County entitled overcompliers (by 15–45+%) to jump the queue for approvals—a valuable reward at no cost. Elsewhere, some builders of superinsulated homes that leapfrogged far beyond code requirements have won credibility, and dominant market share, by offering to pay any heating bills over, say, \$100 a year, or all utility bills for the first five years' ownership.

The transportation sector is the fastest-growing and seemingly most intractable source of carbon emissions precisely because it is the most socialized, subsidized²¹, and centrally planned sector of the U.S. economy—at least for favored modes like road transport and aviation. It has the least true competition among modes, and the most untruthful prices, with hidden costs of hundreds of billions of dollars per year per year for U.S. road vehicles alone [refs]. These distortions leverage more billions into otherwise uneconomic infrastructure and locational decisions.

The dispersion of uses that causes so much excessive driving is mandated by obsolete single-use zoning rules meant to segregate noxious industries that scarcely exist today. Congestion is specifically caused by non-pricing or underpricing of the road resource: most roads are supported by taxes, not users, so they look free to drivers who behave much as Soviet customers did in demanding a great deal of energy when it looked free. Congestion is further exacerbated by building more subsidized roads that elicit even more traffic, and by requiring developers to provide as much parking as people use when they pay nothing for it. Future generations will marvel that the incredible social costs of these policies—costs deeply intertwined with many inner-city ills—went so long unremarked and uncorrected.

Thailand loses a sixth of its GDP to Bangkok traffic jams, so it's building Los Angeles-style freeways that will create more traffic.

Informational failures

The extremely high returns implicitly required for buying efficiency often reflect a paucity of accurate and up-to-date information. Do you know where to get everything you would need to optimize your own energy use, how to shop for it, how to get it properly installed, who would stand behind it? If any of the preceding examples of big, cheap savings surprised you, you've just observed a market barrier: if you didn't know something is possible, you can't choose to do it.

Strong evidence is emerging that co-locating where people live, play, shop, and work creates such desirable, friendly, low-crime, walking-and-biking-dominated neighborhoods that they yield exceptional market performance. Such co-location, and land-use policies that integrate housing and jobs with transit, can be further encouraged by "locationally efficient mortgages"—the subject of a \$1-billion Fannie Mae experiment—that effectively let homebuyers capitalize the avoided costs of a car they no longer need in order to get to work.

Employers can profit from "cashing out" employee parking spaces—charging fair market value for each space, and paying each employee a "commuting allowance" of equal aftertax value. By monetizing competition between all means of getting to work (or, through telecommuting, of not needing to), this will typically reduce demand for parking spaces, which often cost \$10–30,000 apiece, by more than it enriches the Treasury through the newly taxable perk.

Real-estate developers can profit from annuitizing perpetual transit passes rather than providing a \$25,000 parking place with each housing unit (which yields less but costlier housing). Allowing residents to rent out their daytime parking spaces can pay their home property tax [Shoup 1997].

Singapore is almost congestion-free because it charges drivers their true social cost and invests the proceeds in effective public transit and coordinated land-use.

Labeling tells buyers how competing models compare. Some voluntary labeling systems (as of a quarter-million San Francisco houses in 1978–80) have swept the market because buyers quickly became suspicious of any house that *wasn't* labeled. EPA's voluntary Energy Star standard for office equipment did the same, now embracing over 2,000 products by more than 400 manufacturers, because the efficient machines worked better, cost the same or less, and were therefore mandated for federal purchasing. They're saving a half-billion dollars a year, and promise a profitable ten-million-ton-a-year carbon saving by 2005. Other voluntary programs that provide informational, technical, and trade-ally support, like EPA's Green Lights [www.epa.gov/appdstar/green/glb-home.html], are succeeding because they create competitive advantage. Involving more than 2,300 organizations, Green Lights' retrofits save over half the lighting energy with 30% ROI and unchanged or improved lighting quality. The national potential for this effort alone is a \$16-billion annual saving, plus a 12% reduction in utilities' carbon and other emissions.

"Hassle factor" and transaction costs prevent efficient microdecisions in day-to-day life. For example, how much do you pay at home for a kilowatt-hour of electricity, and how many kilowatt-hours does your refrigerator—typically the biggest single user in the household unless you have electric space or water heating—use each year? If you don't know, because you're too busy living to delve into such minutiae, then you're part of another market barrier. And if you do know, then there's probably another barrier, because for the same price, you could have bought a seemingly identical refrigerator 2–3-fold more efficient, or nearer 20-fold with advanced techniques not yet brought to the mass market.

Risks to manufacturers and distributors

Industry lacks information too—about what customers really want and whether they'll put their money where their mouths are. Manufacturers often hesitate to take the risk of developing and making new energy-saving products, because of limited confidence that they'll sell in the face of all the obstacles listed here.

Efficient equipment often isn't available when and where it's needed—as anyone knows who's tried to replace a burned-out water-heater, furnace, refrigerator, etc. on short notice. Yet distributors, aware of the slow uptake of efficient devices, don't want to take the risk of carrying inventory that may sell slowly or not at all. Thus British Columbia Hydro found that the huge motors in that Province's mining and pulp-and-paper mills were virtually all inefficient, simply because that's what local vendors customarily stocked; anything else took too long to order, and the mills couldn't afford to wait.

Perverse incentives

Compensation to architects and engineers worldwide is based directly or indirectly on a percentage of the *cost* of the building or equipment specified. Designers who work harder to eliminate costly equipment therefore end up with lower fees, or at best with the same fees for more work. Such backwards incentives have led the U.S. to misallocate about \$1 trillion to air-conditioning equipment (and utility systems to power them) that wouldn't have been bought if the same buildings had been optimally designed to produce the same or better comfort at least cost [SOA:SC or ?SCTA or SIP2].

The real-estate value chain is full of incentives so perverse that each of the 25 or so parties in a typical large

It's precisely to make such decisions hassle-free—and because most appliances are bought not by billpayers but by landlords, homebuilders, and public housing authorities—that Congress almost unanimously approved mandatory efficiency standards for household appliances. They merit further extension to commercial and industrial devices. Such standards knock the worst equipment off the market and reward manufacturers for continuous improvement. That's largely why careless shopping for a same-priced refrigerator can sacrifice only 2–3-fold efficiency gains in America, vs. 6-fold in Europe. Smart utilities also reinforce standards by rewarding customers for beating them.

Swedish official Hans Nilsson pioneered contests for bringing efficient devices into the mass market. A major public-sector purchasing office issues a Request for Proposal guaranteeing to buy a large number of devices, bid from certain prices, if they meet certain technical specifications, including energy savings highly cost-effective to the user. This explicit expression of market demand has already elicited many important innovations giving a strong advantage to Swedish industry in both home and export markets. A "golden carrot" devised by Dr. David Goldstein of the Natural Resources Defense Council followed suit with improved U.S. refrigerators.

BC Hydro paid a small, temporary subsidy to stock only efficient models, so vendors' extra carrying cost was covered. In three years, premium-efficiency motors' market share soared from 3% to 60%. The subsidy was then phased out, supported by a modest backup standard. Similarly, PG&E found in the '80s that rather than paying customers a rebate for buying efficient refrigerators, it could improve refrigerator efficiencies faster, at less than a third the cost, by paying retailers a small bonus for each efficient model stocked, but nothing for stocking inefficient ones. The inefficient models quickly vanished from the shops, so when you wanted the next unit the dealer could put on the truck, it'd be efficient, because that's all they'd have.

Pilot projects launched by RMI are now testing how much more efficient buildings become if their designers are rewarded for what they save, not what they spend, by letting them keep several years' measured energy savings as extra profit. Early results are highly encouraging. The German and Swiss architectural associations are pursuing similar reforms.

Careful case-studies are revealing that in well-designed, highly efficient buildings, the better visual, acoustic, and

deal is systematically rewarded for inefficiency and penalized for efficiency [SIP2]. The 75% energy saving designed for the Chicago office tower mentioned earlier, with instant payback, wasn't bought: the property was controlled by a local leasing office, incentivized on dealflow, that didn't want to delay its commissions a few months by retrofitting before leasing up the building. The building then proved unmarketably costly and disagreeable, so it had to be sold off to a bottom-feeder. Yet the owner wasn't unsophisticated—it was one of the world's largest fiduciaries.

Split incentives—one party selecting the technology, another paying its energy costs—limit ultimate consumers' choices by substituting intermediaries who don't bear the cost of their poor decisions [DOE '96 @ 5L 2.2]. This issue is ubiquitous. Why should you fix up your rented premises if you don't own them? Why should the landlord do it if you pay the energy bills? Alternatively, if you *don't* pay the bills, why use energy thoughtfully (for example, why maintain or efficiently drive a company car whose costs are paid for you)? In the Shanghai pumping example above, the pipefitters don't mind putting in lots of extra bends, because they're paid by the hour and they won't pay the equipment or electricity bills.

Similar split incentives apply to the makers and users of all kinds of equipment used in buildings and factories. Such equipment is almost always inefficient, optimized on first cost alone, since those who sell it won't pay the operating costs and most buyers won't shop carefully. (Indeed, for most kinds of equipment, efficient equipment simply isn't available—until a big customer demands better, as Wal-Mart successfully did for day-lighting and air-conditioning equipment.)

In one respect the market works all too well: wasteful old equipment often gets salvaged for resale in the secondary market—mainly to poor people who can least afford the high running costs that motivated the scrappage in the first place. Such “negative technology transfer” can cripple development efforts [Asian paper].

False or absent price signals

Energy prices are often badly distorted by subsidies and by uncounted external (larcenous) costs not internalized by the Clean Air Act's laudable trading system. The U.S. still subsidizes energy supply by about \$21–36 billion per year [Koplow ASE93 for '89; EIA92 omits many terms], mostly for the least competitive options and essentially all for supply—implying significant costless reductions in carbon emissions just by removing subsidies [Shelby et al. 1995]. And that doesn't count an even

thermal comfort enables people to do about 6–16% more and better work. In a typical office, where people cost 100 times as much as energy, that boost in labor productivity is about 6–16 times as valuable to the bottom line as eliminating the entire energy bill! Analogous benefits, big enough to create decisive competitive advantage, are also being found in retail sales and manufacturing. These results may help to explain why firms participating in EPA's voluntary Green Lights lighting-efficiency programs showed stronger earnings growth than nonparticipants [cite DeCanio in Feldman bk]. Increasingly educated tenants will not long tolerate buildings that don't contribute to their success.

Lease riders can fairly share savings between landlords and tenants so both have an incentive to achieve them. Energy utilities could also (as some water/wastewater utilities already do) apply “feebates” to new building hookups: you pay a fee or get a rebate to connect to the system, but which and how big depends on how efficient you are, and each year the fees pay for the rebates. Unlike building codes and appliance standards—which are better than nothing, but become instantly obsolete and offer no incentive to do better—such a revenue-neutral economic instrument drives continuous improvement. It also signals lifecycle costs up front when long-lived investments are being made.

The world's largest maker of air conditioners, Carrier Corporation, is leasing comfort services—much as elevator-maker Schindler leases vertical transportation services and Dow leases solvent services. This improves not only resource efficiency but also incentives: the *more* efficient, durable, and flexible Carrier's air-conditioning systems become, the *greater* its profits, and the better the service it provides at lower cost to more customers. Service leasing aligns the providers' incentive with its customers' objective.

Some big California utilities buy up inefficient old motors, refrigerators, and other devices in order to scrap them before they enter the second-hand market: they're worth far more dead than alive. Unocal even bought and scrapped polluting old cars in order to gain pollution credits for its refinery near Los Angeles.

Subsidies are under increasing pressure by a more skeptical Congress and a better-informed public. Utility regulators in about 30 of the United States also take account of some externalities in considering utilities' proposed resource acquisition decisions. Some proposals for industry restructuring would worsen but others would help to correct these longstanding distortions.

bigger item: subsidies to security of supply that make the true cost over \$100 per barrel²² for Persian Gulf oil, all of it unnecessary.²³ (Yes, more was at stake in the Gulf War than just oil, but we'd hardly have sent a half-million troops there if Kuwait just grew broccoli.)

Energy price signals are diluted by other costs. For example, U.S. gasoline, cheaper than bottled water, is only an eighth of the total cost of driving, even though the car is cheaper per pound than a Big Mac. Why buy a 50- instead of a 20-mpg car when both cost about the same per mile to own and run?

Few firms track energy costs as a line-item for which profit centers are accountable. Firms in rented space may have energy bills prorated rather than submetered. Most billing systems give no end-use information that lets customers link costs to specific devices. Many firms, especially chains and franchises, never even see their energy bills, which are sent directly to a remote accounting department for payment. Some large firms still assume that utility bills are a fixed cost not worth examining.

Appraisers rarely credit efficient buildings for their actual energy savings, so efficiency's value isn't capitalized. Most leasing brokers base pro forma financials on average assumed operating costs, not actual ones. Few buildings have efficiency labels. Few renters have access to past energy bills.

Tax asymmetries further distort energy choices. For example, energy purchases are deductible business expenses, but investments to save energy get capitalized.

Market prices don't include many environmental costs and risks: the Clean Air Act, for example, creates a cap-and-trade regime for sulfur but not for carbon emissions.

Incomplete markets and property rights

There is no market in saved energy: "negawatts" aren't yet a fungible commodity subject to competitive bidding, arbitrage, secondary markets, derivatives, and all the other mechanisms that make real markets in copper, wheat, and sowbellies. You can't yet go bounty-hunting for wasted energy, trade negawatt futures and options (or bid them in a spot market against megawatts), or even, in general, bid them fairly against expansions of energy supply. You can seldom sell reduced demand or reduced uncertainty of demand; yet both are valuable resources that deserve markets. Property rights in most forms of depletion and pollution are incomplete or absent and hence cannot be traded.

Feebates (above) can reward turning over big capital stocks like car fleets more quickly, so we get the worst ones off the road soonest. This offers a huge new market opportunity—especially if the rebate for your efficient new car depends on the *difference* in efficiency between the new one you buy and the old one you scrap.

New bill-paying and -minimizing service companies are springing up to meet exactly this need. Many provide submetering and two-way communications to pinpoint opportunities for improvement. Such simple efforts as ensuring that each meter generating a bill is actually on the customer's premises often generate big savings.

Some jurisdictions have right-to-know laws; others get similar results by training renters and buyers to be assertively inquisitive. Smart leasing brokers are distinguishing their services by offering valuable advice on minimizing occupancy costs. Home and commercial-building energy rating systems are rapidly emerging.

Some countries do better. When the Japanese government wanted to clean up sulfur emissions from power plants, it allowed them to be expensed the same year.

Natural Resources Defense Council published an index of relative exposure to carbon-tax risks for all U.S. utilities and let capital markets adjust ratings accordingly.

When Morro Bay, California, ran short of water, it simply required any developer wanting a building permit to save, somewhere else in town, twice as much water as the new building would use. Many creative transactions occurred as developers discovered what saved water is worth. Two-fifths of the houses were retrofitted with efficient fixtures in the first four years. A more comprehensive market transformation effort enabled Goleta, California, to cut per-capital residential water use by over 50%, and total water use by over 30%, in one year and with no loss of service quality—thereby deferring indefinitely a multi-million-dollar wastewater-treatment-plant expansion.

So which models are unreliable?

Critics of climate protection often cast doubt on the elaborate computer models that simulate the physical processes of the earth's climate. But those models, which now closely fit the climate data, are far more detailed and realistic than the climate-economics models used to claim that climate protection is too costly. The pervasive barriers to buying energy efficiency make the economic models' perfect-market assumption as otherworldly as if the physical climate models omitted atmosphere, clouds, and oceans, and relied instead on a theoretical assumption based on a simple historical regression linking CO₂ levels to global average temperatures.

Compare the "actually existing market" in the left column above with the requirements of a *theoretical* free market: perfect information about the future, perfectly accurate and complete price signals, perfect competition, no monopoly or monopsony (sole buyer), no unemployment or underemployment of any resource, no transaction cost, no subsidy, and so forth. It's a different universe. Ignoring those real-world distinctions leaves most of the climate-economics models riddled with flaws: for example,

- The economic models all forget that renewable sources get cheaper as you produce them in higher volumes, as they've done for decades—leading Royal Dutch/Shell Group Planning to consider it plausible that over the next half-century, renewables could grow to supply more than half the world's energy [Sustained Growth scenario, Kassler 1994, from UNDP 1997 p 110].
- The economic models also don't let technologies improve as price incentives increase, even though rising prices are well known to spur innovation [Newell et al 1996, Grubb et al 1995, Goulder & Schneider 1996].
- Most models quietly assume that carbon-tax or -permit-auction revenues are simply rebated (which lowers GDP) instead of being used to displace the distorting taxes that discourage savings, work, or investment (which would raise GDP) [WRI pp 23-26].
- The relatively few models that allow international trading of emissions and reductions assume that all countries have essentially perfect market economies—even those, like the former USSR and China, that don't have economies at all, but only giant machines for eating resources (and hence the biggest opportunities for improvement).
- Most economic models are very sensitive to how fast, if at all, energy efficiency is assumed to improve by itself at present prices: one model, for instance, found that as this rate was increased from 0.5 to 1.5% per year (it actually averaged 1.54% per year during 1973–95²⁴), the calculated cost of cutting carbon emissions to 20% below 1990 levels fell from \$1 trillion nearly to zero [Manne & Richels 1990s; see WRI p 19].
- Very few of the models take any explicit account of efficiency technologies, and those that do (like the government studies that show ways to save 20–25% of the carbon at negative cost, with much further potential at low cost [IPCC 1996b, NAS 1991, OTA 1991, Levine & Brown 1997,...]) are ultraconservative: they use outmoded, costly, incremental, component-based technologies rather than reflecting the modern whole-system approach.

A lucid guide to 162 predictions by the 16 top climate/economy models [WRI] found that seven underlying assumptions explained 80% of the differences in their results. Does a model assume there's any "backstop" energy source, such as renewables or nuclear, that can be widely adopted if fossil-fuel prices get high enough? Does it assume the economy responds efficiently to price signals and can make significant substitutions between fuels and between products? Can different countries trade their savings opportunities? Are revenues recycled efficiently? Does the model count the value of avoiding climate change (perhaps a relatively minor term, but enough, with efficient revenue recycling, to improve economic welfare [Nordhaus & Young 1996, Jorgensen et al 1995, Nordhaus 1994, 1993])? Does it count the benefit of abating associated forms of conventional air pollution as a free byproduct of burning less fossil fuel—benefits large enough to offset 30–100% [IPCC 1996b] or more [Ekins 1995, Jorgenson et al 1995, Boyd Krutilla & Viscusi 1995] of the assumed cost of carbon abatement?²⁵ For (say) a 60% carbon reduction in 2020, *these seven assumptions can predetermine whether the model shows by then a 7% reduction or a 5% increase in GDP* [WRI 1997].²⁶ That noted economists should find such wildly divergent results underscores not only their lack of unanimity on whether climate protection is disastrous or beneficial for the economy, but also that the difference arises from divergent model structures and assumptions.

In sum, most economic models—especially the extreme ones publicized by fossil-fuel companies' \$30-million ad campaign—calculate large costs because they assume rigid, constrained, and unintelligent responses to economic signals. The few models that show economic *benefit* from protecting climate, even if they assume outmoded energy-

efficiency techniques and impute no value to reducing carbon or other pollution, merely assume that people and firms behave with the ordinary sagacity and flexibility that market mechanisms offer.

Even cheap energy can be saved quickly

Energy efficiency can be implemented very rapidly, by either or both of two quite different methods. One method, demonstrated in the 1970s and '80s, is to have high or rising energy prices and a sense of urgency:

- During roughly 1975–85, most new U.S. energy-using devices—cars, buildings, refrigerators, lighting systems, etc.—*doubled* their efficiency, improving at an annual rate averaging around 7%.
- If all Americans saved electricity as quickly and cheaply as ten million people served by Southern California Edison Company did during 1983–85, then each year they'd decrease the forecast need for power supplies a decade hence by about 7%, at a cost to the utility around one-tenth that of today's cheapest new power stations [Lovins 1985 pp 180–83, Fickett et al. 1990].
- In the 1980s, skillful utilities captured ~70–90+% of particular efficiency micromarkets, mainly difficult ones like retrofitting house shells, in just one or two years.
- Speed can extend to renewables as well as efficiency. Maine used auctions and other competitive processes to raise its private share of power generation from 2% in 1984 to 20% in 1989 to 36% in 1995—and more than two-thirds of that new production was renewable.

Of course, a lot has changed since the '80s. At first, U.S. primary energy consumption “froze at about 74 quads” (quadrillion BTU per year) during 1973–86 “while the GNP grew by 35%” [Levine & Brown 1997 p x]. Those huge energy savings largely caused the mid-1980s crash in energy prices. This in turn retarded further savings: “Starting in 1986, [real] energy prices began their descent...that has continued to the present. As a result, energy demand grew from 74 quads in 1986 to 91 quads in 1995”—a 22% increase, while GDP grew 23%. With more fuel being burned, “carbon emissions have been increasing at a similar pace” [Levine & Brown 1997 p x].

This history makes it natural for economists to suppose that resuming rapid energy savings will require a return to the costlier energy that propelled rapid savings before. But lower and still-declining fuel prices don't bar us from regaining that decade-old momentum. Today's better technologies and smarter delivery methods can far outweigh the lower energy prices and the used-up initial opportunities, achieving quick savings even *without* the spur of high prices:

- During 1990–96, utility facilitation enabled electric customers in Seattle—with the cheapest electricity of any major U.S. city—to save electric load nearly 12 times as fast as those in Chicago, and electric energy more than 3,600 times as fast, even though Seattle electricity prices are about half of Chicago's.²⁷ This conclusively shows that making an informed, effective, and efficient market in energy-saving devices and practices—as Seattle City Light's efforts helped to do—can fully substitute for a bare price signal, and indeed can influence energy-saving choices even more than can price alone. That is, *people can save energy faster if they have extensive ability to respond to a weak price signal than if they have little ability to respond to a strong one.*²⁸
- Investor-owned utilities, when rewarded for cutting bills, sold efficiency ever faster and more skillfully despite falling electricity prices. In 1990, New England Electric System captured 90% of a small-commercial pilot retrofit market in two months. Pacific Gas and Electric Company captured 25% of its entire new-commercial-construction market—150% of the year's target—in three months, so it raised its 1991 target...and captured all of it in the first nine days of January.

Higher energy prices do not automatically yield substantial energy savings, as can be seen simply by comparing the virtually identical electricity-using devices found in U.S. cities that pay severalfold different electric rates. Nor, as the Seattle/Chicago comparison shows, do low energy prices preclude rapid energy savings where policy encourages and support them. Thus higher energy prices do help spur savings and reflect true social costs. But high energy prices are neither a necessary nor a sufficient condition for economically and technically efficient use of energy: not necessary because vast savings are already worthwhile at present prices but blocked by the barriers described earlier, and not sufficient because the same obstacles, if not deliberately removed, would persist even at higher prices.

Honest energy prices do increase economic efficiency: if we don't know what energy really costs, we won't know how much is enough. Combining desubsidized and internalized energy prices with policy “trimtabs” that reduce the barriers would yield the fastest possible savings. The most balanced approach to price, however, is not to focus spe-

cifically on *energy* prices, but to shift taxation from jobs and income to *all* forms of resource depletion and pollution—just as the British, Danes, Dutch, Finns, and Swedes are starting to use revenues from environmental taxes to cut taxes on labor. Today's outmoded U.S. tax system penalizes work and employment while often subsidizing depletion and pollution. The present system rewards, and therefore gets, just the opposite of what we want. In a 21st-century world of more abundant people and scarcer natural capital, it makes good theoretical and practical business sense to rebalance factor inputs by correctly signaling their relative scarcities.²⁹

Energy prices and national competitiveness

If for whatever reason the price of emitting CO₂ into the atmosphere were raised above its current value of zero, Americans need not fear damage to national competitiveness. After all, the nations that have traditionally been the toughest competitors, like Japan and Germany, have long had energy prices two to three times those of the U.S. This simply made them use the energy about twice as efficiently. Learning how to do this drove their industrial innovation on a broad front, further widening the competitive gap against a cheap-fuel America. Similar flexibility, and more, exists in our own economy—as Americans have already proved by invisibly cutting the nation's annual energy bill by some \$150–200 billion compared with 1973 levels of inefficiency. And there's a hidden bonus: just as energy efficiency created the conditions that crashed world oil prices in 1986 and have made them decline ever since, triggering a durable boom [Schwartz 1997], so repeating and accelerating that success can continue to suppress OPEC's cartel power and dampen oil prices. This would cut America's oil trade deficit (\$61 billion in 1996 alone) while not causing material adverse trade shifts of other kinds [WRI p 9].

Nor need we fear that costlier energy in industrial countries would make American jobs (and carbon emissions) flee to an untaxed South—akin to the “pollution haven” notion which analysts have searched for in the data but not yet found [DeCanio new MS cite]. Electricity prices would be the most sensitive to any carbon tax or emissions trading; yet 1994 electricity bills averaged only 1.3% of the value shipped by average U.S. manufacturing firms, 3.4% for the most electricity-intensive sector (pulp and paper) [EEI Stat Yrbk 1995, p. 82].³⁰ If electricity is too small a factor cost to worry about saving, it's hardly big enough to justify moving one's factory overseas. Conversely, if its price rises enough to motivate moving abroad, it's certainly a strong enough reason to save most of that electricity, at a profit, and stay at home.

After all, a small saving in such a tiny factor cost is far less important to industrial competitiveness than the many-fold saving that's *already* available in the biggest factor cost—labor. Yet most American jobs have remained here: firms that haven't already exported jobs in search of cheap labor have generally concluded that other countries don't have the infrastructure, skills, local markets, laws, tax rules, or other conditions they need. Differences in energy price would be a much weaker incentive to migrate—as we can infer from American firms' failure to move to the few countries, like Venezuela and Saudi Arabia, that have long had even cheaper energy than we do. Another thought-experiment reveals the absurdity of this notion that energy prices are the sole or main determinant of industrial location. If this were true, then Japan and Europe would long ago have transplanted all their factories to America to take advantage of our severalfold lower energy prices. They didn't.

Those who prefer pricing to obstacle-busting policy instruments for climatic protection contemplate price increases far smaller than the differences that already exist: for example, a 1–2¢/kWh rise in electricity price—less than the differences that already exist between different parts of the United States, or even between some adjacent utilities, without triggering industrial mass migrations. Japanese industry pays about 10¢/kWh more than its American counterparts, but as Japan long ago discovered, even such a threefold difference in energy price can be offset by more productive energy use. That's the durable source of competitive advantage; and it's far easier to sustain amidst the rich infrastructure and skill base of the North than of the South, so migrating Southwards would generally lose advantage, not gain it.

Almost everyone wins

Using energy far more efficiently does mean that less fossil fuel would be sold than if we continued to waste it so profligately. Lower physical volumes may not mean lower profits, but vendors fear that they would make less profit than expected if demand grew more slowly, or stabilized, or even declined—as it would have done eventually from depletion. (For example, a standard model of stabilizing emissions at 1990 levels through a carbon tax [Jorgenson et al. 1992] shows U.S. coal output 25% below the rapid growth in its baseline projection—but output would still grow.) Where is it written, however, that coal companies or OPEC countries have an inalienable right to sell ever

more of their product—or, as their mouthpieces³¹ now urge, to be compensated for lost profits if their hoped-for demand growth slackens or reverses?

This nation has never been good at helping workers or industries in transition, and now would be a good time to get better at it. Much of the Rust Belt is now recovering, but little thanks to outside help. In today's climate-induced shifts, a similar failure to help coal miners, depressed communities, and even disappointed shareholders will encourage them to oppose measures that benefit society. But those measures are also profitable enough that society can afford to ease their difficulties. The total payroll of all U.S. coal-miners is about \$5 billion, or 1% of the nation's energy bills—less than spontaneous gains in energy efficiency save in any typical year. Climate policies threaten miners' jobs much less than do the coal companies, which since 1980 have eliminated more than half of the miners' jobs for which they profess such concern.

As for the shareholders, hard-nosed free-marketeers might say they should have foreseen that climate would become an issue, so they should have invested in natural gas, efficiency, or renewables instead of coal, or in gas pipelines instead of coal-hauling railways. If efficient energy use costs less than coal, then coal will lose in fair competition, and no friend of a thriving economy should wish otherwise. But the best outcome, especially for the workers, would be to structure the incentives so that the companies at risk in the transition will start selling a more profitable mixture of less fuel *and* more efficiency in using it—as a few oil companies and hundreds of electric and gas utilities are already successfully doing to improve both customer service and their own profits. That's the same logic that has already led the likes of BP, DuPont, Ford, Tokyo Electric, Norsk Hydro, and ABB to fund both internal and consortium research to protect the climate while advancing their own business interests [ChrSciMon editorial "21st Century Weather," 6Aug97p20].

Time to dump the myths

With this understanding of how modern technologies and creatively used markets can profitably protect the climate *and* the economy, we can see the aridity and irrelevance of the myths underlying the conventional climate debate:

- *It's about climate science.* No; it doesn't matter what the climate science says, or even whether it's right, because we ought to be purchasing energy efficiency anyway just to save money.
- *It's about decision-making under uncertainty.* The uncertainty doesn't matter, because the robust economic benefits depend only on private internal costs and benefits, not on any imputed environmental values or risks.
- *It's about carbon taxes.* No; they may be helpful and appropriate, especially as part of a general tax shift from people to resource depletion and from production to consumption, but present prices are ample to elicit all the energy savings we need—if we just get serious about vaulting the barriers that inhibit people from buying energy efficiency.
- *It's about command-and-control.* Wrong; it's about helping markets to work properly—and then letting them do their job.
- *It's about who should bear the costs.* What costs? The interesting question is who should get the *profits*. That's a good thing to compete about in the marketplace, but it shouldn't require difficult negotiations.³² The "polluter pays principle"—OECD doctrine since 1974—remains valid, but this time the polluter can profit.
- *It's about sharing sacrifices for the common good.* On the contrary, it's about helping individuals, firms, and nations behave in their economic self-interest.
- *It's about changing to a lifestyle of privation and discomfort*—as the Chairman of Chrysler Corporation recently put it, "dimming the lights, turning off the air conditioning, sacrificing some of our industrial competitiveness and curtailing economic growth" [WPost 7/17/97 p A19]. No; it's about living even better with less, by using smarter technologies that yield the same or better service. The showers will be as hot and tingly as now, the beer as cold, the rooms as well-lit, the homes as cozy in winter and as cool in summer, the cars as peppy, safe, and comfortable; but we'll have substituted brains for therms and design for dollars.
- *It's about keeping the poor down.* Quite the opposite; if equitably provided as the cornerstone of the development process [Asian paper], energy efficiency could be a boost for those most burdened with the least efficient buildings and equipment, and least able to afford such waste. Even if the price of fossil fuels did rise, that's not very regressive, because poor people spend more of their income directly on energy but less indirectly (embodied in goods and services). Any disproportionate harm to the poor could be corrected by straightforward adjustments elsewhere in the tax or welfare systems [WRI, p 8, pp 32–33]. Equity issues merit careful attention, but are no reason to keep on subsidizing energy for the rich.

- *It's about consuming too much in the North and not enough in the South.* That's a real issue, and we in the North have to start thinking hard about what we want, how much is enough, how to meet nonmaterial needs by nonmaterial means, what will make us better human beings, and the difference between a good life and what scripture calls "vanity." But the resource-efficiency revolution described in two new books³³ can buy much time by simultaneously sustaining or enhancing Northern *and* greatly improving Southern living standards while dramatically reducing the use of energy and materials.

Protecting the climate for fun and profit

A proper grasp of the practical engineering economics of energy efficiency (and of other climate-stabilizing opportunities) can thus give nearly all the parties to the climate debate what they want. Those who worry about climate can see it stabilized. Those who don't will still make more money. Those who worry about costs and burdens will see them replaced by profits. Those who want improved jobs, productivity, competitiveness, quality of life, public and environmental health, and individual choice and liberty will get those things too. Two emphases—energy efficiency, and climate-protecting farming and forestry practices that treat nature as model and mentor—can deal profitably not only with climate but with about 90% of EPA's pollution concerns. These actions are therefore are not inimical but vital to a vigorous economy, a healthful environment, sustainable development, social justice, and a livable world. As an eminent group of economists supported by more than 2,000 of their colleagues recently concluded, in short, "policy options exist that would slow climate change without harming American living standards, and these measures may in fact improve U.S. productivity in the longer run" [Arrow et al. 1997].

The true pragmatists in this debate are those who suggest that we have at hand—and should elevate to the central role in climate policy—the tools we need to turn climate into a business opportunity, at home and worldwide. This can, but need not, involve changing energy prices. Innovative, market-oriented public policies, especially at a state and local level, can focus chiefly on barrier-busting to help markets work properly and reward the economically efficient use of fuel and money. This requires much *less* intervention in the market than we now have with regulatory rules and standards: it properly assumes that the role of government is to steer, not row, and that market actors guided by clear and simple rules can best figure out what will make sense and make money. But we need to steer in the right direction—the line of least resistance and least cost—guided by a detailed and exact understanding of the barriers that now block energy efficiency, and thereby damage global development and national security [Nitze W Post A22 2 July 1997].

A bizarre irony lurks beneath the climate debate. Why do the same people who favor competitive markets in other contexts seem to have the least faith in their efficacy for saving fossil fuels? Let's recall what happened the last time this gloom-and-doom attitude overcame these people's better instincts. Just before Congress approved in 1990 the cap-and-trade system for reducing sulfur dioxide emissions, environmentalists predicted that reductions would cost about \$350 a ton, or ultimately (said the optimists) perhaps \$250. Government economic models predicted \$500–750; the higher figure was the most widely cited. Industry models upped the ante to about \$1,000–1,500. In fact, the sulfur-allowance market opened in 1992 at about \$250 a ton; in 1995, it cleared at \$130 a ton; in 1996, at \$66.³⁴ Moreover, national sulfur emissions have fallen 37% in just the past decade—and 38% faster than the Clean Air Act envisaged, because of simple incentives to reward early achievers. Much the same thing is happening with CFCs.

The genius of private enterprise and advanced technologies found a way billions of dollars cheaper than command-and-control regulation. It would do so again if we competed to save the most carbon in the cheapest ways. In fact, a double bonus would emerge: we'd automatically and profitably meet most of the stringent new ozone and fine-particle standards too, via the same reduced combustion that helps the climate and cuts our energy bills; and we could easily use similar incentives for doing so early.

In the past half-century, global carbon emissions have quadrupled. But in the next half-century, the climate problem could become as faded a memory as the energy crises of the '70s are now³⁵—because it's not an inevitable result of normal economic activity, but an artifact of energizing that activity in extraordinarily inefficient ways.

Let's vault the barriers, use energy in a way that saves money, and put enterprise where it belongs: in the vanguard of sound solutions. Climatic change is a problem we can't afford, don't need—and can avoid at a resounding profit.

* * *

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Notes [references to be added]

¹ That switch saves \$8 billion in the pulp and paper industry alone [*Agenda 2020*, Am. Forest & Paper Assn., 11/94, ref'd by Romm present'n]; similar findings of a DOE/industry process include 20% energy savings in glass, 50% in aluminum, and 15% in chemicals.

² These case-studies are from the USDOE ClimateWise Case Study Compendium, Report 1, DOE/GO-10096-217.

³ For detailed documentation on each of these matters, omitting only the newest developments such as hypercars, please see our survey paper “Least-Cost Climatic Stabilization,” *Ann. Rev. En. Env't.* 16:433–531 (1991).

⁴ The exact percentages don't matter because such big and profitable savings are available in each gas, source, and sector [*id.*].

⁵ Average U.S. industrial electricity in 1996 cost the heat-equivalent of oil at about \$79 per barrel, over three times the world crude-oil price. Commercial and residential electricity prices averaged respectively 75% and 83% higher yet. Electricity is therefore the most lucrative form of energy to save. It is also the form whose savings yield the greatest climatic leverage: each unit saved saves 3–4 units—in developing and socialist economies, more like 5–6 units—of power-plant fuel, and that fuel is mainly the most carbon-intensive kind—coal. (U.S. electricity is 52% coal-fired, and 88% of U.S. coal makes electricity.) For these reasons, our case-studies focus on new ways to save electricity, although similarly large savings are profitable for most directly used fuels too [AREE].

⁶ The negative figure means the building would have saved a capital investment equivalent to five months' worth of operating cost before you even turn it on.

⁷ The engines are especially inefficient when running air conditioners in cars stuck in traffic (*i.e.*, most cars most of the time), and all of the 5–6 GW of electricity brought into the city ends up as heat. Dr. Suntoorn [ref] notes that together, these heat sources add nearly as much artificial heat per square meter as is delivered by all the sunlight striking the city. In the nearby countryside, ingenious ventilative and radiative passive designs still work fine.

⁸ Just the temperature optimization typically saves 50% in new plants, and pays back in six months in retrofits [Levine & Brown 97 4.20].

⁹ Hypercar-like heavy road vehicles look attractive too, and new uses of information technology to smooth or displace the flow of goods can make much freight traffic unnecessary. Major savings are also available in other transport modes. Ships and passenger aircraft doubled their efficiency in the 1970s and '80s and can do it again: the National Research Council has called for 40% less fuel per seat by 2010–15 [Levine & Brown 97 5.31]. As one hint of what's possible, a 1996 Lockheed-Martin Skunkworks fighter-plane design, made of 95% carbon-fiber and the like, cut weight 35% and cost 65%. Other new vehicles are starting to enter the market, from tenfold lighter and cheaper trains to convertible road-rail vehicles (like GM's Roadrailer) and Lufthansa's freight dirigible to hybrid-electric bikes.

¹⁰ A sophisticated model perhaps a decade or two from now could combine Lexus comfort and refinement, Mercedes solidity and stiffness, Volvo safety, Porsche acceleration, roughly Taurus price, 100–200 miles per gallon-equivalent (the upper range using hydrogen fuel cells), and zero or equivalent-zero emissions. All the technologies needed to do this exist today.

¹¹ Costing only one reactor's worth (\$3 billion) spread over 20 years. Federal renewable-energy R&D was slashed 89% in real terms during 1979–89, and remains under continual attack. In consequence, American industry must already import many renewable energy technologies that were invented here, then left to wither on the vine. Effi-

ciency R&D has a similar history, with drastic cuts, slow rebuilding interrupted by continual sniping, and little attention to the \$28 billion energy saving achieved through 1996 from just five of the numerous technologies developed or demonstrated with DOE's \$28-billion efficiency RD&D budget during 1975–95 [Levine & Brown 97 p 2.5].

¹² This potential is economically consistent with the National Academy of Sciences' 1992 findings (*Policy Implications of Greenhouse Warming*) but about one-fourth to one-third as large, because the Academy examined long-term potential without regard to timing, while the five-Labs study explicitly counted retrofit and replacement dynamics.

¹³ This is possible because efficiency is abysmal to start with—so low that when an Indian village switched from kerosene to fluorescent lamps, illumination rose 19-fold, energy input decreased ninefold, and household lighting expenditure fell by half [Reddy 1994 cited at UNDP 1997 p 70].

¹⁴ This range [Levine & Brown 1997, p x] depends on what fraction of the 1973–96 reduction in primary-energy/GDP ratio is due to improved technical efficiency; with most authorities, we estimate upwards of two-thirds, the DOE estimate for 1973–86 [*id.*, p. 2.1]. The rest is due to shifts in composition of economic output and to minor behavioral changes.

¹⁵ Bill Howe, "Distribution Transformers: A Growing Energy Savings Opportunity," E SOURCE TU-93-10, 12/93; dominant models are ~96–98.5% efficient, the best amorphous-iron model 99.33%, but it costs \$680 instead of \$320, so its market share is only 10%. Compared with the best standard model, it yields a 14%/y aftertax ROI, a 20-year saving more than twice its marginal cost, a longer life, and far greater service flexibility. This analysis assumes 25-kVA oil-filled units, 0.50 load factor, 0.95 power factor, 6¢/kWh, 5%/y real discount rate, 36% marginal tax rate. The misallocation is assessed as the present value, over a 20-y minimum life, of avoided generation at 2¢/kWh and generation-plus-transmission at \$700/kW (busbar) with 3% transmission loss; each 10,000 transformers sold at 98.44% instead of 99.33% waste 2.5 peak MW and ~22 GWh/y (*id.*). One-third are bought by nonutilities; 35 million units are U.S. service; and virtually all electricity flows through similar transformers.

¹⁶ Implicit real discount rates for buying efficiency typically range upwards from 60% a year [refs], while big energy supply firms have traditionally been content with 5–6%.

¹⁷ Some theorists argue that "transaction costs"—the supposedly prohibitive cost and hassle of searching out every little source of energy inefficiency and negotiating with its owner to correct it—will eat up any profits and make further energy savings impractical. Nonsense. Transaction costs in some poorly designed early utility programs were up to tens of percent of total costs—which were still severalfold smaller than the savings they achieved. But more mature programs cut those transaction costs by tenfold, to just a few percent overhead, making the net profits even juicier [AREE p 3n/SCE pri ref].

¹⁸ Most of the misallocation is driven also by the enormous personal profits for dealmakers. Those transactional rewards drive many investments with unsound fundamentals (like most recent Asian project-financed power plants), just as they propelled the '80s real-estate bubble and S&L fiasco. Those tens of billions of dollars per year get tied up for a decade or more and can't be invested instead in cheaper efficiency. But efficiency doesn't offer fat commissions.

¹⁹ Firms are not individuals and are not of a single mind—hence often experience [DeCanio Epol p 907...] the "divergence between goals and actions" familiar in all bureaucracies. Indeed, economic theory correctly states that in general, "rational, self-interested individuals will not act to achieve their common or group interests." Corporate inefficiency may be invisible if profits are positive and competitors use similarly inefficient practices. As Nobel economist Herbert Simon convincingly describes, firms do not in fact fully maximize profits but rather resort to "satisficing" because of the inherent complexities of their environment and the limits of their processes for making and executing decisions. Shareholders hold diversified asset portfolios, but managers whose careers ride on the success of specific projects are far more risk-averse, so they go only for extremely high-return investments—and so on down the hierarchical chain of control, where subordinates bear the personal risks of failure while superiors see the results and know which projects were chosen but not why. This leads to systematic suboptimization—to second-best solutions perceived as less risky individually, but less profitable overall than they should be. In summary, the reasons for corporate (or for that matter government) underinvestment in energy efficiency are described by economists as bounded rationality, principal-agent problems, and "moral hazard" (an old insurance term for situations where behavior can take advantage of and thereby change actuarial odds or prices, as where people are more likely to abuse a rental car than one they own, forcing the rental firm to raise its price). Overlaid on these is widespread myopia—hurdle rates for capital budgeting generally (not just to save energy) well above investors' required returns. The complex reasons for this relate mainly to takeover and investment-analyst pressures.

²⁰ When regulators convert revenue requirements for a fair return on and of capital into a schedule of tariffs (cents charged per kWh used by various customers), they must assume how much energy will be sold. If the utility then sells more energy than assumed, its profits go up; if less, its profits go down. The solution is to decouple profits

from sales volumes via a simple balancing account, so the utility is no longer rewarded for selling more energy nor penalized for selling less. This also eliminates the incentive to game the forecast (lowball forecast sells so you can sell more), and does not make utilities' profits depend on things they cannot control such as weather [EPOL].

²¹ Developing countries subsidize their energy by an estimated \$111 billion per year, but America subsidizes just its car drivers by more than that (the gap between their public direct costs and their fee and tax payments) [Worldwatch ref: Vital Signs '97?]. We pay to create the problem and we pay to deal with it. It would be cheaper and smarter to pay no subsidy and thus avoid the problem.

²² The military costs of forces whose primary mission is intervention in the Persian Gulf totaled at least \$73 billion in 1994—plausibly 3+ times that [Cavallo 1996]. Allocating that cost generously to all, not just Gulf, oil use is equivalent to a hidden shift of about \$2–7 per million BTU, or \$13–37 per barrel, from energy bills to tax bills.

²³ The U.S. wouldn't have needed a drop of oil from the Gulf if it had kept on saving oil as fast after 1986 as it did for the previous nine years. During 1975–87, the U.S. had boosted its oil productivity four-fifths faster than it had to in order to match both economic growth and declining domestic oil output. By 1986, the annual energy savings, chiefly in oil and gas, were providing two-fifths more energy than the entire domestic oil industry, which had taken a century to build; by 1995 the savings had surpassed *all* oil use. But after doubling, new-car efficiency stagnated for a decade and is now declining again under the weight of inefficient light trucks, vans, and sport-utilities.

²⁴ But with localized spurts, like New England's 6%/y gains during 1978–80 (the period of the second oil shock). To be sure, national improvements were much faster before the 1986 price crash than since, but if a lower-than-historic rate is to be assumed because greater energy efficiency will continue to lower energy prices, then the stimulative effect of that cheaper energy must also be considered.

²⁵ EPA's 1994 *Emission Trends Report* states that conventional energy use causes 95% of U.S. CO₂ and NO_x emissions, 73% of volatile organic compounds, and 70% of CO, so as *The Economist* remarked in June 1990, "Using energy in today's ways leads to more environmental damage than any other peaceful human activity."

²⁶ Such a long-term change is quite small in annual terms: a review of nearly 100 modeling studies showed that holding long-term CO₂ emissions at about current levels (much more stringent than current proposals for stabilizing emissions) "may if carried out in an efficient manner be expected to reduce...average GNP growth rates over the period [to the mid-21st century] by less than 0.02–0.03% per year" [M. Grubb *et al.*, "The Costs of Limiting Fossil Fuel CO₂ Emissions: A Survey and Analysis," *Ann. Rev. En. Env't.* 18:397–478 (1993) at 472].

²⁷ Seattle City Light's measured savings achieved through 1990–96 investments in demand-side management, emphasizing energy rather than peak-load savings, were 313 GWh/y or 38 average MW—3.2% of 1996 energy sales and average load (J. Todd, personal communication, 7 August 1997, documented in annual *EMSD Accomplishment Reports*). By 1996, but nearly all during 1995–96, the nearly tenfold larger Chicago utility Commonwealth Edison saved 51 peak MW (0.27% of its 19-GW peak load), or an 11.8-fold smaller fraction of load. ComEd made essentially no effort to save electrical energy, yielding savings of only 800 MWh/y, or 0.00088% of its sales [M. Brandt, personal communications, 13 and 21 August 1997]—a 3,640-fold smaller fraction than in Seattle. The ComEd figures are not corrected for any offsetting sales increases resulting from promotional tariffs and practices. Big customers in Seattle in 1996 paid 1.9 times less and small customers paid 2.3–2.4 times less per kilowatt-hour than in Chicago.

²⁸ This is not surprising, since "nonprice measures have an important role in improving economic efficiency....All markets in open societies and in all sectors of economic activity...function within a framework of laws,...standards and public and private information services designed to improve the clarity and integrity of economic transactions and in so doing improve economic efficiency....[P]ure market transactions, in which prices, along with other economic variables such as income and wealth are the sole variables, are rare" [D. Anderson, World Bank, AREE '95, pp 563–4].

²⁹ Environmental taxes certainly work: as *The Economist* [28 June 1997] summarizes, "the OECD says that in Sweden, where dirtier automotive diesel has been taxed relatively heavily since 1991, almost all diesel is now of the cleanest type and sulfur emissions from diesel vehicles have fallen by 75%. In Norway, the carbon-dioxide tax has prompted a switch away from fossil fuels, cutting emissions from power stations and factories by one-fifth since 1991." Making "labor taxes less damaging...is worthwhile anyway." Tax-shifting simply combines both benefits. Phased-in, revenue-neutral tax shifts [Jeff Hammond, Peggy Duxbury, Alan Sanstad, & Stephen DeCanio, *Tax Waste, Not Work*, Redefining Progress, SFO, 1997] offer rich potential for strengthening the public and private economy and for avoiding many social costs whose remediation now increases the total burden of taxation. Tax-shifting would signal managers to fire the unproductive tons, gallons, and kilowatt-hours, and thereby help them to keep the people, who'd then have more and better work to do. There is an intimate link between the waste of people, resources, and money—and the solutions to all three problems are also intertwined [NatCap/MJ].

³⁰ Moreover, less than half the price of electricity is fuel, and under a mere \$20–40/ton carbon tax, coal-fired electricity would be quickly displaced by modern gas-fired plants that emit only one-fourth as much CO₂ per kWh and are hence only one-fourth as sensitive to the tax—or even by competitive renewable sources.

³¹ Including some leading non-oil-exporting Southern diplomats whom OPEC has coöpted for this purpose.

³² As chief U.S. negotiator Tim Wirth put it [Intl Envtl Reporter 2 Oct 1996], “probably the most complicated scientific, environmental, economic and political challenge in history.”

³³ *Factor Four: Doubling Wealth, Halving Resource Use* [cite] and the forthcoming book *Natural Capitalism: The Worthy Employment of People and Resources* [cite]. The European Union, German, and Dutch Environment Ministers have endorsed the Factor Four approach as a new basis for sustainable development—the only dissent coming from Sweden which, farsighted as ever, prefers a Factor Ten goal, as do the OECD Environment Ministers. Fair enough: the latest technical findings described in *Natural Capitalism* do make that a realistic goal. But four is on the way to ten and is much better than zero.

³⁴ See Bohi & Burtraw, *EI J* Aug/Sept 97 pp 67–75. The price subsequently spiked up to \$115 in spring 1997 as Enron and other traders bought the cheap allowances. By mid-1997 it had fallen back to \$90. One could well conclude [Ackerman & Moomaw, *EI J* Aug/Sept 97 pp 61–66] that “If pollution reduction is so cheap, perhaps society should buy more of it.”

³⁵ In the 1970s, experts were nearly unanimous that energy use and GDP must forever march in lockstep. The Chairman of Chrysler Corporation still holds this view and more: although his 17 July 1997 *Washington Post* op-ed “Global Warming: Industry’s Reponse” [p A19] acknowledges that “new technology will allow us to continue to grow our economy while managing the level of CO₂ output,” he also states that curtailing fossil-fuel use “in the next dozen years by more than 20 percent” by obliging ourselves to “heavily tax or somehow rigidly ration our own energy use” would have the “certain consequence” of “a decline in the country’s economic growth by a similar amount,” so without sustaining historically high levels of energy use, the U.S. is “not likely to remain” a developed country. Of course, GDP and energy have long since parted ways—we now produce 44% more GDP per unit of energy than we did in 1970—and that’s only the beginning. Even those who wonder how much further such progress can persist should be happy to try the experiment; both economically and politically, they have nothing to lose but their waste.

OFFICE MEMORANDUM

(Dictated)

DATE: October 2, 1997

TO: Mr. James D. Wolfensohn, EXC

FROM: Robert T. Watson, ENV

EXTENSION: 36965

SUBJECT: **Information and Talking Points
White House Conference Meeting on Climate Change**

1. This memorandum contains information which will be useful for your participation in ***Panel III: Kyoto Conference and U. S. National Interests*** at the White House Conference on Climate Change. The one hour panel will be chaired by Vice President Gore. The opening five minute statement will be by Secretary of State, Ms. Madeleine Albright. The other panelists are: Jessica Matthews (Carnegie Endowment for International Peace); E. Linn Draper (American Electric Power); Fred Krupp (Environmental Defense Fund); Daniel Yergin (Cambridge Energy Research Associates); Mae Jemison (Dartmouth University); and Richard Schmalensee (MIT).

2. This briefing note includes as attachments:

- a) the complete agenda, including the panelists' affiliations;
- b) draft talking points, largely taken from the Tim Wirth lunch talking points;
- c) a summary of the international reaction of the U. S. positions on greenhouse gas targets and timetables, emissions trading/joint implementation and developing country commitments; and
- d) the Byrd resolution.

I understand you already received a significant amount of other relevant material from Ismail Serageldin.

3. If you want me to further develop any of the points, I can do so before Monday.

**White House Conference on Climate Change:
*The Challenge of Global Warming***

October 6, 1997

Draft Agenda

Vice President Gore: *Welcome attendees; Introduces President Clinton*

President Clinton: *Opening Remarks: Importance of Global Warming and Climate Change for the American People.*

Panel I: The Science of Global Warming and Climate Change

Presentation: John Holdren, Professor, Department of Earth and Planetary Sciences and the John F. Kennedy School of Government, Harvard University. Head of President's Council of Advisors on Science and Technology (PCAST).

Panelists: Robert Watson, Incoming Chair of the Intergovernmental Panel on Climate Change (IPCC); Director for Environment, World Bank.
Tom Karl, Senior Scientist, NOAA, National Climatic Data Center.
Diana Liverman, Chair, National Academy of Sciences
Committee on Human Dimensions of Global Change; Director, Latin American Studies Program, University of Arizona.
Don Wilhite, Director, National Drought Mitigation Center, University of Nebraska.

Vice President Gore: *Where we've come from; Where we're going.*

Panel II: The Role of Technology in Reducing Greenhouse Gas Emissions

Presentation: Federico Peña, Secretary of Energy.

Panelists: Maxine Savitz, General Manager, AlliedSignal Aerospace Company's Ceramic Components Unit. Member of the President's Council of Advisors on Science and Technology (PCAST).
Tom Casten, President & CEO, Trigen Energy Corporation.
Michael Bonsignore, President and CEO, Honeywell Corporation.
Mason Willrich, CEO, EnergyWorks, a renewable energy joint venture between Bechtel and Pacificorp.
Kurt Yaeger, President, Electric Power Research Institute, a non-profit collaborative research enterprise of the electric power industry.

Lunch: Breakout Discussions with the Cabinet.

Remarks by First Lady Hillary Rodham Clinton

Panel III: Kyoto Conference and U.S. National Interests

Presentation: Madeleine Albright, Secretary of State.

Panelists: Jessica Tuchman Mathews, President, Carnegie Endowment for International Peace.

James D. Wolfensohn, President, World Bank.

E. Linn Draper, Chairman, President, and Chief Executive Officer, American Electric Power.

Fred Krupp, Executive Director, Environmental Defense Fund.

Daniel Yergin, President, Cambridge Energy Research Associates; author of "The Prize: The Epic Quest for Oil, Money and Power," winner of the Pulitzer Prize.

Mae Jemison, President, Jemison Group, Inc. and Jemison Institute for Advancing Technology in Developing Countries at Dartmouth University. Former NASA astronaut.

Richard Schmalensee, Professor of Economics and Management, Massachusetts Institute of Technology; Director of MIT Center for Energy and Environmental Policy Research; member of Council of Economic Advisers, 1989-91.

Panel IV: Climate Change Policy and the U.S. Economy

Presentation: Larry Summers, Deputy Secretary of the Treasury.

Panelists: Robert Repetto, Vice President and Senior Economist, World Resources Institute. Co-author, "The Costs of Climate Protection: A Guide for the Perplexed."

William Nordhaus, Whitney Griswold Professor of Economics, Yale University. Author of "Efficient Use of Energy Resources," "Managing the Global Commons."

Robert Stavins, Professor of Public Policy and Chair of Environment and Natural Resources Program, the John F. Kennedy School of Government, Harvard University.

Richard Sandor, Chairman & Chief Executive, Centra Financial Products Limited; Vice-Chair of Chicago Board of Trade.

John Sweeney, President, AFL-CIO.

Talking Points for Mr. James D. Wolfensohn
White House Conference on Climate Change:
The Challenge of Global Warming

October 6, 1997

Panel III has been asked to address the importance of the climate change issue from a national interest perspective, including: national security, flexibility (emissions trading/joint implementation), and developing country commitments. The White House would like you to focus your opening statement of five minutes on the issue of climate change and developing countries. This is a particularly important issue because of the Senate Byrd Resolution, which passed 93-0 and stated that the U. S. should not sign any protocol that does not require developing countries commitments in the same time frame as Annex I countries (developed countries and countries with economies in transition). The basic argument of the Byrd resolution is that the climate system cannot be protected without a global commitment, and that American jobs will go abroad to developing countries because they will not be saddled with expensive controls on the use of fossil fuels.

It is quite likely that at least one panel member will take the Byrd resolution position and urge the American public not to support any protocol that does not include developing countries. Hence, I believe you may want to make the following five points:

- (i) The scientific evidence that human activities are causing climate to change is convincing, and developing countries are the most vulnerable i.e. developed countries and countries with economies in transition are causing the problem (emissions in developing countries are still much lower than in developed countries, both in absolute and per capita terms), but developing countries will suffer most.
- (ii) While it is clear that in the long-term all countries will need to limit their greenhouse gas emissions, in the near-term, Annex I countries will need to take the lead in reducing their emissions. This is appropriate given the current and historical sources of emissions of greenhouse gases, and because developed countries have the economic, technical, and institutional capabilities to start to address the issue in a cost-effective manner.
- (iii) Increased energy services in developing countries are critical to alleviate poverty and underdevelopment. A few statistics might be useful: 1.3 billion people live on less than \$1 per day; 3 billion people live on less than \$2 per day; 2 billion people without electricity (hence, they cook using traditional fuels that lead to a high incidence of respiratory infections, diseases and death); and 1.3 billion people live without clean water.
- (iv) Developed countries need to assist developing countries expand their production and consumption of energy in the most efficient and environmentally benign manner.

- (v) The World Bank Group stands ready to assist developing countries limit their greenhouse gas emissions, but it will not ask them to be burdened with the extra costs of being climate friendly—at least not in the short-term.

Therefore, I suggest you focus your remarks around the following points as you did at the Tim Wirth lunch, but with an increased emphasis on the equity issue and the need for developing countries to increase their production and consumption of energy to alleviate poverty and underdevelopment. I have only made minor modifications to the Tim Wirth talking points as it was that lunch-time speech that impressed the U. S. Administration, and contributed to their request for your participation in the October 6 panel. I have asked Maureen Cropper, who works with Joe Stiglitz, to provide me with some more information, before the meeting on Monday, on the potential job losses in the U.S. if Annex I countries agree to greenhouse limitations without obligations on developing countries. If Maureen comes with interesting information, I will brief you on Monday before your speech.

Some of the points you might want to make follow in bold—while the rest of the text is primarily background information, you may want to use some of it in your talking points.

A. The IPCC makes a convincing case that human activities are already changing the Earth's Climate System, and that unless there is a concerted effort to reduce the projected emissions in greenhouse gases the Earth's climate will warm significantly, sea level will rise and precipitation patterns will change.

- The atmospheric concentrations of greenhouse gases (especially carbon dioxide and methane) are increasing because of human activities—primarily due to energy and land-use practices.
- The Earth's atmosphere has warmed by about 0.5 degrees Centigrade (one degree Fahrenheit) over the last 100 years; sea level has increased by 10-25 cms; glaciers have retreated globally; and in some regions there is evidence of an increase in heavy precipitation events.
- The observed changes in temperature cannot be explained by natural phenomena, but are consistent with the theoretical models that take the observed changes in greenhouse gases and aerosols into account—hence the IPCC concluded the scientific evidence suggests there is a discernible human influence on the Earth's climate system.
- Without climate-specific policies, IPCC projects an increase in global mean temperatures of 1.0 to 3.5 degrees Centigrade (1.5 to 6.5 degrees Fahrenheit) by the year 2100.
- These projected increases in temperature would be accompanied by an increase in sea level of 15-95 cms by 2100;
- These increases in temperature would be accompanied by changes in precipitation—in particular increases in heavy precipitation events and a decrease in gentle rain—this will lead to more floods and droughts.

B. These projected changes in climate will, in many regions of the world, have adverse effects on :

- ◆ **human health (increase in vector-borne diseases such as malaria and dengue);**
 - ◆ **ecological systems (especially coral reefs);**
 - ◆ **agriculture (decreased production in the tropics), forestry, and fisheries;**
 - ◆ **human settlements—tens of millions of people will be displaced by sea level rise and whole cultures may disappear—small Island States.**
- Significant increase in vector-borne diseases (especially malaria and dengue), especially in the tropics and sub-tropics, areas with a high burden of disease today;
 - While global food production may not be adversely affected by climate change, agricultural production is projected to decrease in the tropics and sub-tropics, areas with famine and hunger today.
 - A one-meter sea level rise would threaten the viability of many small Island States (e.g. Maldives) and would displace tens of millions of people in low-lying deltaic regions (Bangladesh, Egypt, and China).
 - Complex ecological systems are likely to be adversely affected, particularly forests and coral reefs—many forest species will not be able to migrate as fast as needed to keep pace with the projected rates of change in temperature—many coral reefs may die because of increases in sea temperatures.
 - There will be significant shifts in precipitation and evaporation leading to changes in water supply and run-off—unfortunately our ability to predict where and when changes will occur is not possible with the accuracy required for water management decisions.

C. Developing countries will be more vulnerable than developed countries, especially the poor in these countries.

- Bank client countries in the tropics and sub-tropics are most vulnerable to climate change—increases in vector-borne diseases, reductions in agricultural production, loss of land because of sea level rise and more uncertain water supplies.
- The economic costs of climate change in a doubled carbon dioxide world (late next century) could be 5-9% of GDP in developing countries—this estimate is very uncertain.

D. Progress in reducing greenhouse gas emissions since Rio has been very disappointing, hence Kyoto needs to be a success if the climate system is to be protected

- Only three OECD countries will have limited their greenhouse gas emissions in the year 2000 to the 1990 levels as agreed in Rio.
- Greenhouse gas emissions in countries with economies in transition have decreased, but because of poor economic performance not because of climate change policies.
- Greenhouse gas emissions have risen sharply in a number of developing countries because of economic growth.

E. While there is no debate that protection of the climate system will eventually need all countries to limit their greenhouse gas emissions, it is imperative that developed countries (in particular the U. S.) and countries with economies in transition take the lead and agree to limit their greenhouse gas emissions—this should be quite feasible given that many cost-effective strategies (technologies, policies and practices) exist to start limiting greenhouse gas emissions.

- While the integrity of the climate system can only be ensured with all countries eventually assuming obligations to limit their greenhouse gas concentrations, it is clear that Annex I countries should demonstrate their willingness to reduce their emissions first:
 - ◊ Annex I countries should decrease their emissions because of the current and historic patterns of emissions (historically most emissions have come from Annex I countries—Annex I per capita emissions are significantly greater than developing country per capita emissions), coupled with the financial and technical capabilities of Annex I countries—in spite of the demands of the U. S. Congress that developing countries assume obligations in the near-timeframe—U. S. failure to advocate specific targets and timetables is undermining the possibility of a successful outcome in Kyoto.
- Energy supply options to reduce greenhouse gas emissions:
 - ◊ more efficient production of energy from fossil fuels;
 - ◊ fuel switching (coal to gas);
 - ◊ carbon dioxide sequestration;
 - ◊ renewable energies (wind, solar, modern biomass, etc.)
 - ◊ nuclear (assuming safety/waste disposition/fissile material containment considerations and public acceptability);
- Energy use options to reduce greenhouse gas emissions
 - ◊ transportation (e.g., efficient vehicles);
 - ◊ buildings (e.g., efficient building structures, appliances, etc.);
 - ◊ industry (e.g. waste and energy minimization, recycling, etc.).

F. In the near-term, developing countries need to increase their production and consumption of energy to alleviate poverty and underdevelopment. At a later date they too will need to limit their greenhouse gas emissions, recognizing they would have differentiated responsibilities.

- Increased energy services in developing countries are critical to alleviate poverty and underdevelopment;
 - ◊ 1.3 billion people live on less than \$1 per day;
 - ◊ 3 billion people live on less than \$2 per day;
 - ◊ 2 billion people without electricity (hence, they cook using traditional fuels that lead to a high incidence of respiratory infections, diseases and death);
 - ◊ 1.3 billion people live without clean water.

G. The Bank believes that the Convention would be facilitated, and so would all Parties to the Convention, if joint implementation with crediting were allowed:

- **the Bank is willing to develop a Global Carbon Fund (an approach to trading carbon whereby developing countries and countries with economies in transition get new technologies and a share of the OECD cost savings).**

H. The challenge is to assist developing countries produce and consume energy in the most climate-friendly manner even if they have no specific obligations to reduce greenhouse gas emissions. In addition to the Global Carbon Fund, the World Bank is ready to assist by:

- **Working with them to develop appropriate sector and macro-economic frameworks that encourage the efficient production and consumption of energy and stimulate private sector investment**
- **Mobilizing grant resources through the Global Environment Facility to pay for the incremental costs of more climate-friendly technologies**
- A three-fold energy-environment strategy is being developed that will allow Bank clients to meet their energy service needs while minimizing local, regional, and global environmental damage. The strategy will include promoting:
 - ◇ *economic efficiency* by continuing to promote macro- and sectoral reform (e.g. subsidy elimination); international gas trade; hydroelectric power that is environmentally and socially sustainable;
 - ◇ Bank clients to internalize local and regional environmental degradation (particles, ozone, and acid deposition);
 - ◇ climate friendly alternatives (see next entry).
- All Bank-funded energy sector work will consider climate change, including assessing greenhouse gas emissions, and identifying and costing climate friendly alternatives—known as the “Global Overlays Program”;
- Bank is aggressively supporting the replenishment of the GEF—the US failure to pay its agreed contribution is threatening the long-term viability of the GEF;
- Bank and GEF staff are evaluating how to develop a more strategic Bank-GEF partnership to increase the competitiveness of new and renewable non-greenhouse gas emitting technologies—could possibly develop into a \$1 billion per year program;

The Bank is developing a number of Market Transformation Initiatives (e.g., Forest, photovoltaic)—these will result in a reduction in net emissions of carbon dioxide.

THE INTERNATIONAL REACTION

The U.S. has proposed a three-part framework for a climate change agreement in Kyoto:

I. Binding emissions targets for developed nations.

Almost all developed countries, including the United States, will fall short of the non-binding aim in the current Climate Convention, which calls on nations to reduce emissions to 1990 levels by 2000. Shifting to a binding, realistic, and achievable target should spur greater commitment and action by countries to limit greenhouse gas emissions. The United States has not yet proposed a specific target and timetable.

International Reaction. The concept of binding targets for industrialized nations was widely embraced at the Second Conference of the Parties to the Climate Convention in Geneva in July 1996. Since then, several countries, or blocks of countries, have made more specific proposals. The European Union has called for a 15% reduction in emissions below 1990 levels by 2010. The Association of Small Island States has proposed a 20% reduction below 1990 levels in 2005. The U.S. has rejected both of these targets as unrealistic and overly stringent. Japan, Norway, and Australia have all proposed some form of differentiated regime, whereby developed nations would take on different levels of commitments. The U.S. has largely opposed this approach, arguing that it would be unworkable to negotiate a sensible differentiation scheme in time for Kyoto. By and large, developing nations have urged a stringent target be adopted for the industrialized world.

II. Flexibility to achieve cost-effective reductions.

The U.S. supports provisions designed to ensure that the greatest reductions are gained at the least cost. These include the ability to trade emissions rights internationally and to conduct projects with developing countries to cut emissions (joint implementation).

International Reaction. The U.S. has had a difficult time building support for emissions trading and joint implementation (JI). The EU has largely opposed trading, even though their own 15% target in fact represents a sort of trading scheme in itself. (Under the EU "bubble" approach, certain countries would be allowed to increase their emissions while others would decrease, as long as the net effect was a 15% reduction below 1990 levels by 2010). The EU has also been largely negative on JI. The lack of a specific U.S. proposal for targets and timetables has probably made it more difficult for much progress to be made here. With regard to the developing

world, JI remains quite contentious. Countries seem to have some combination of concerns that (a) JI amounts to the U.S. shirking its own responsibilities to cut emissions, (b) JI would be filled with too many loopholes and would not be credible, and (c) JI would use up all of the cheapest developing country emissions reductions so that when developing countries accept targets at a future point, they will be left with only the most expensive reductions. The exception is Latin America, where several countries have expressed some degree of support for a JI regime.

III. Participation of developing countries.

The U.S. currently has the most extensive proposal for developing country participation in a new climate agreement. The key parts of the proposal include strengthening language on existing developing country commitments under the 1992 Climate Convention, encouraging certain developing nations (i.e. those joining the OECD) to voluntarily accept binding emissions limits, and obtaining an agreement that all developing nations will take on binding targets over time. Partially in light of the Byrd Resolution (adopted 95-0 by the Senate this summer), the U.S. is considering strengthening this proposal further. The Byrd Resolution essentially calls on developing nations to accept binding limits in the same compliance period as industrialized nations, though it does not specify what the specific nature of those commitments should be.

International Reaction. The U.S. does not currently have much public support internationally for its developing country proposals, particularly those dealing with emissions targets. Developing nations have argued that the proposals are inconsistent with the negotiating mandate agreed to in Berlin in 1995, that they do not reflect the fact that most every developed nation will miss the original Climate Convention goal of reducing emissions to 1990 levels by 2000, and that they are fundamentally inequitable. The EU has been largely silent on the issue of developing countries. Given their "bubble" approach (which, for example, would allow Portuguese emissions to grow some 40% over the next decade), they are not in a strong position to take a tough stance. Those closest to the U.S. position include Australia, Canada, and New Zealand.

The Byrd Resolution

Bill 32 of 43

There are 2 other versions of this bill.

GPO's PDF version of this bill	References to this bill in the Congressional Record	Link to the Bill Digest file.	Download this bill. (7,832 bytes).
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Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations... (Reported in the Senate)

SRES 98 RS

Calendar No. 120

105th CONGRESS

1st Session

S. RES. 98

[Report No. 105-54]

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations framework Convention on Climate Change.

IN THE SENATE OF THE UNITED STATES

June 12, 1997

Mr. **BYRD** (for himself, Mr. HAGEL, Mr. HOLLINGS, Mr. CRAIG, Mr. INOUE, Mr. WARNER, Mr. FORD, Mr. THOMAS, Mr. DORGAN, Mr. HELMS, Mr. LEVIN, Mr. ROBERTS, Mr. ABRAHAM, Mr. MCCONNELL, Mr. ASHCROFT, Mr. BROWNBACK, Mr. KEMPTHORNE, Mr. THURMOND, Mr. BURNS, Mr. CONRAD, Mr. GLENN, Mr. ENZI, Mr. INHOFE, Mr. BOND, Mr. COVERDELL, Mr. DEWINE, Mrs. HUTCHISON, Mr. GORTON, Mr. HATCH, Mr. BREAU, Mr. CLELAND, Mr. DURBIN, Mr. HUTCHINSON, Mr. JOHNSON, Ms. LANDRIEU, Ms. MIKULSKI, Mr. NICKLES, Mr. SANTORUM, Mr. SHELBY, Mr. SMITH of Oregon, Mr. BENNETT, Mr. FAIRCLOTH, Mr. FRIST, Mr. GRASSLEY, Mr. ALLARD, Mr. MURKOWSKI, Mr. AKAKA, Mr. COATS, Mr. COCHRAN, Mr. DOMENICI, Mr. GRAMM, Mr. GRAMS, Mr. LOTT, Ms. MOSELEY-BRAUN, Mr. ROBB, Mr. ROCKEFELLER, Mr. SESSIONS, Mr. SMITH of New Hampshire, Mr. SPECTER, and Mr. STEVENS) submitted the following resolution; which was referred to the Committee on Foreign Relations

July 21, 1997

Reported by Mr. HELMS, without amendment

RESOLUTION

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations Framework Convention on Climate Change.

Whereas the United Nations Framework Convention on Climate Change (in this resolution referred to as the 'Convention'), adopted in May 1992, entered into force in 1994 and is not yet fully implemented;

Whereas the Convention, intended to address climate change on a global basis, identifies the former Soviet Union and the countries of Eastern Europe and the Organization For Economic Co-operation and Development (OECD), including the United States, as 'Annex I Parties', and the remaining 129 countries, including China, Mexico, India, Brazil, and South Korea, as 'Developing Country Parties';

Whereas in April 1995, the Convention's 'Conference of the Parties' adopted the so-called 'Berlin Mandate';

Whereas the 'Berlin Mandate' calls for the adoption, as soon as December 1997, in Kyoto, Japan, of a protocol or another legal instrument that strengthens commitments to limit greenhouse gas emissions by Annex I Parties for the post-2000 period and establishes a negotiation process called the 'Ad Hoc Group on the Berlin Mandate';

Whereas the 'Berlin Mandate' specifically exempts all Developing Country Parties from any new commitments in such negotiation process for the post-2000 period;

Whereas although the Convention, approved by the United States Senate, called on all signatory parties to adopt policies and programs aimed at limiting their greenhouse gas (GHG) emissions, in July 1996 the Undersecretary of State for Global Affairs called for the first time for 'legally binding' emission limitation targets and timetables for Annex I Parties, a position reiterated by the Secretary of State in testimony before the Committee on Foreign Relations of the Senate on January 8, 1997;

Whereas greenhouse gas emissions of Developing Country Parties are rapidly increasing and are expected to surpass emissions of the United States and other OECD countries as early as 2015;

Whereas the Department of State has declared that it is critical for the Parties to the Convention to include Developing Country Parties in the next steps for global action and, therefore, has proposed that consideration of additional steps to include limitations on Developing Country Parties' greenhouse gas emissions would not begin until after a protocol or other legal instrument is adopted in Kyoto, Japan in December 1997;

Whereas the exemption for Developing Country Parties is inconsistent with the need for global action on climate change and is environmentally flawed;

Whereas the Senate strongly believes that the proposals under negotiation, because of the disparity of treatment between Annex I Parties and Developing Countries and the level of required emission reductions, could result in serious harm to the United States economy, including significant job loss, trade disadvantages, increased energy and consumer costs, or any combination thereof; and

Whereas it is desirable that a bipartisan group of Senators be appointed by the Majority and Minority Leaders of the Senate for the purpose of monitoring the status of negotiations on Global Climate Change and reporting periodically to the Senate on those negotiations: Now, therefore, be it

Resolved, That it is the sense of the Senate that--

(1) the United States should not be a signatory to any protocol to, or other agreement regarding, the United Nations Framework Convention on Climate Change of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would--

(A) mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period, or

(B) would result in serious harm to the economy of the United States; and

(2) any such protocol or other agreement which would require the advice and consent of the Senate to ratification should be accompanied by a detailed explanation of any legislation or regulatory actions that may be required to implement the protocol or other agreement and should also be accompanied by an analysis of the detailed financial costs and other impacts on the economy of the United States which would be incurred by the implementation of the protocol or other agreement.

SFC. 2. The Secretary of the Senate shall transmit a copy of this resolution to the President.

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[Report No. 105-54]

RESOLUTION

Expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to any international agreement on greenhouse gas emissions under the United Nations Framework Convention on Climate Change.

July 21, 1997

Reported without amendment

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The World Bank
Washington, D.C. 20433
U.S.A.

ISMAIL SERAGELDIN
Vice President
Environmentally Sustainable Development

Mr. James D. Wolfensohn

September 29, 1997

Dear Jim,

In Hong Kong, you asked me to send you some materials concerning climate change which you could read in preparation for your White House meeting. I have been somewhat hampered by arriving on the weekend and by having some of the key people traveling. Nevertheless, I hope that the attached will be of interest and of some use. Herewith:

- A summary description of the convention, reflecting mainstream scientific opinion on climate change (Annex 1);
- The latest we know about the position of the US and the international reaction to it (Annex 2);
- Notes on the latest information on the status of negotiations as of August, 1997, and the events in September and upcoming events in October (Annex 3);
- A brief statement on integrating climate change issues in the World Bank's work (Annex 4); and
- A note on the carbon backcasting study, that you may find of interest (Annex 5).

You are of course fully familiar with the Global Carbon Initiative. We are presently meeting with the participants in this endeavor here at the Bank. It is progressing well, but a few issues remain, including with the GEF. These last have been the topic of discussions between Mohamed El-Ashry and myself, but we still have some work to do on that. We will brief you on developments when you are back.

I hope that this reaches you in time and that you have had a few days of well-earned rest in Australia.

In closing, let me take this occasion to congratulate you once more on a truly moving, memorable and profound speech. It was a privilege to be there, listening to you deliver it. I can promise you that it will inspire me to redouble my efforts on behalf of the excluded of this world.

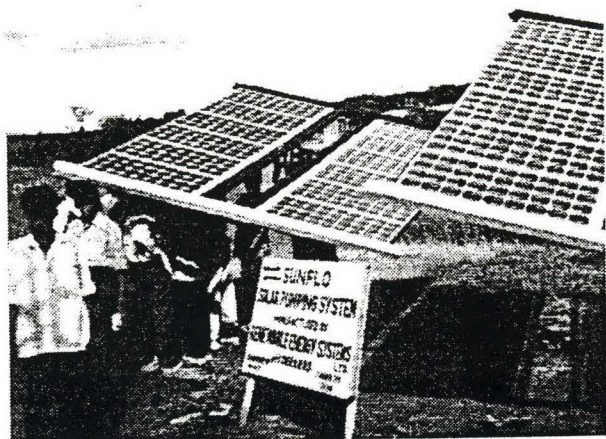
All the best,

Sincerely,



Ismail Serageldin

Attachments



Since the 1970s, when scientists began to express concern that greenhouse gases produced by human activity would cause climate change, knowledge of this subject has grown significantly. Scientists still disagree about the extent of change, and all predictions are contingent on assumptions about future events, but a broad consensus has been established that the Earth will be affected by climate change in the coming decades and beyond. Moreover, it is recognized that without remedial measures, the economic and social consequences of these changes could be severe.

Among the projected consequences of climate change are increases in certain diseases, notably malaria, in areas that become warmer and more humid, a rise in sea levels that could displace millions of people, and large shifts in ecosystems. A near-term dieback in forests is possible as climate boundaries move towards the poles (a shift estimated to be between 150 and 650 kilometers), while rising sea temperatures could damage or kill many coral reefs. From an economic perspective, the costs associated with climate change have been estimated between 1.5 and 2 percent in developed countries, and as high as 9 percent in developing nations.

The principal greenhouse gases that trap heat and therefore affect global temperature are carbon dioxide, methane, chlorofluorocarbons (CFCs), nitrous oxide, ozone, and water vapor. With the exception of CFCs, all of these gases occur naturally in the atmosphere. For this reason, "anthropogenic" is used to identify emissions that disturb the atmosphere's natural equilibrium.

By producing carbon dioxide as well as nitrous oxide, fossil fuel combustion is the most important factor in the increase in greenhouse gases. Deforestation

CLIMATE CHANGE

adds to the level of greenhouse gases, because forests serve as an important "sink" for carbon, transforming it from gaseous carbon dioxide into biomass. Cattle also create greenhouse gases by expelling methane as a result of digestion. Rice paddies are another source of methane as are coal mines and leakages from natural gas lines. The release of CFCs adds another greenhouse gas to the atmosphere, but the overall impact on global warming is attenuated by the fact that CFCs destroy ozone, which itself is a greenhouse gas.

INTERNATIONAL LEGAL REGIME

The international effort to respond to climate change is governed by the United Nations Framework Convention on Climate Change (FCCC), which was opened for signature at the Rio Earth Summit in June 1992 and entered into force in March 1994. There are 166 Signatories and 167 Parties to the Convention.

In comparison with other international agreements on the environment, the Climate Convention has certain distinctive characteristics. While many of these agreements have been negotiated in response to obvious evidence of environmental damage, such as species extinction, the Climate Convention was negotiated largely in response to anticipated environmental damage, based on extrapolations from observed changes and predictions about future emission patterns. The willingness of so many countries to acknowledge the need for international action indicates a heightened sensitivity to the environment. At the same time, however, the Convention has fewer binding commitments than some other agreements, and thus remains a work-in-progress.

Climate Change

DIFFERENCES AMONG COUNTRIES

While stating that "change in the Earth's climate and its adverse effects are a common concern of human-kind," the opening text of the Climate Convention also acknowledges that countries have different interests in the effort to mitigate climate change. In this regard, the Convention states that countries should participate in "an effective and appropriate international response in accordance with their common but differentiated and respective capabilities and their social and economic conditions."

The opening text of the Convention also acknowledges that the impact of climate change will not affect all countries equally. It states that "low-lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change." It also refers to "the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions."

Lastly, the opening text contains several formulations to ensure that developing countries will not be prevented from increasing their use of energy resources. It affirms, for example, the "principle of sovereignty of States in international cooperation to address climate change." Explicitly, it states that "the share of global emissions originating in developing countries will grow to meet their social and development needs" and that "for developing countries to progress towards [the goal of sustainable development] their energy consumption will need to grow."

COMMITMENTS AND GOALS

In the context of differentiated responsibilities, the Convention distinguishes among developing countries, former Eastern Bloc countries, and members of the Organisation for Economic Co-operation and Development (OECD). It calls on those in the latter two groups, designated as Annex I countries, to take "the lead in modifying longer-term trends in anthropogenic emissions." Specifically, these more developed countries committed themselves to the "aim" of holding anthropogenic emissions in the year 2000 (other than CFCs controlled by the Montreal Protocol) at the same levels as in 1990. At this juncture, the evidence is that these goals will not be met, except in unusual circumstances, as in former Eastern bloc countries, where reductions in emissions are more closely tied to economic difficulties than to technological change.

To assist developing countries in their effort to catalog and control greenhouse gas emissions, the Convention also commits the OECD countries, designated as Annex II countries, to "provide new and additional resources" and calls for technology transfer and "enhancement of endogenous capacities." The Global Environment Facility (GEF) serves as the financing mechanism for the Convention.

SCIENCE

Having made the case that climate change requires concerted international action, science must now refine its models to better predict both the timing and magnitude of global warming as well as determine more precisely how particular regions will be affected. Little is known at this stage, for example, about where floods and storms are most likely to occur. For nations concerned about investments in irrigation projects or dams, this kind of information is more important than generalized predictions about temperature changes.

Further progress must also be made in the area of renewable energy, which holds significant promise of directing energy use and production onto more sustainable pathways, especially in developing countries. The Convention establishes a Subsidiary Body for Scientific and Technological Advice to "identify innovative, efficient, and state-of-the-art technologies and know-how and advise on the ways and means of promoting development and/or transferring such technologies." Solar cells, wind power, and biomass are all promising sources of energy in regions in which access to electric grids is not economically feasible. Along with renewable energy, developing countries will also need access to higher efficiency conventional technologies, in particular those that shift energy use and production to fuels that burn more cleanly.

ECONOMICS

The most promising means of achieving the goals of the Convention involve the use of economic tools, including macroeconomic policy changes. Significant progress has been made in recent years in the reduction in subsidies of fossil fuels. In many developing and former socialist countries, these subsidies were substantial; reducing them, therefore, is a classic win-win situation for the economy and for the environment. Such reductions stimulate energy efficiency, and they also create a level playing field for newer, climate friendly technologies. Macro-economic policies that encourage the evolution to higher value-added industries, whether in the developed or developing world, are another means of reducing greenhouse gas emissions.

Climate Change

Other economic tools that can help achieve the goals of the Convention are studies that measure the costs of inaction versus the costs of action. In this way, comparisons can be established that create the necessary impetus to redesign incentive systems. Environmental taxes also can help reduce greenhouse gas emissions. Some countries have experimented with carbon taxes, but until now, various impediments have limited their broader application. These include general opposition to taxes, a tendency for such taxes to be regressive, and concern that national industries would suffer.

The process of Joint Implementation (JI) is an additional means of encouraging more efficient energy use and consumption. Under JI, which was approved on a pilot basis at the Berlin Conference of the Parties (COP) in 1995, reductions in carbon emissions are calculated for specific projects. Ultimately, when Parties commit to binding emission targets as they have pledged to do, these reductions could be used as credits to offset against the agreed targets. A system based on carbon offsets could take different forms. Under a conservative scenario, offsets could be granted for investments within Annex I countries. A more ambitious approach could grant offsets for investments in a larger group of countries, including developing countries. Because the marginal cost of carbon abatement is lower in economies in transition and developing countries, a system of carbon offsets

would maximize the efficiency gains of new investments, while encouraging resource flows into these countries. The effectiveness of the system could be enhanced by establishing a carbon investment fund that pools different projects, thus reducing risk and lowering transaction costs. Ultimately, such a fund could lead to a full-fledged system of tradable emission permits.

LAW

Because the issue of climate change involves all nations in the world, but in many different ways, it poses special difficulties in the area of international law. Traditionally, atmospheric pollution has been viewed through the lens of sovereignty. As stated in the influential 1941 *Trail Smelter* case between the United States and Canada, "no State has the right to use or permit the use of territory in such a manner as to cause injury by fumes in or to the territory of another." In the case of climate change, however, where action is based on precaution and the issues of proof are still problematic, the use of traditional international law may not be helpful. The obvious solution is treaty law, but as the text of the Convention makes clear, different nations have different interests. For this reason, the negotiations at the COP in Kyoto in December 1997 are expected to be particularly strenuous, as countries focus on the need for compliance measures to achieve reduction targets.

FOR FURTHER INFORMATION

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Martin Luther King Strasse 8
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Bonn, Germany, D-53153
Tel: 49-228/ 815-1000
Fax: 49-228/815-1999
Website: <http://www.unfccc.de>

Climate Change

SIGNATORIES AND PARTIES TO THE CONVENTION (AS OF JULY 1997)

Afghanistan (np)	Dominican Rep. (np)	Libya (np)	St. Vincent and the Grenadines
Albania	Ecuador	Liechtenstein	Samoa
Algeria	Egypt, Arab Rep. of	Lithuania	San Marino
Angola (np)	El Salvador	Luxembourg	São Tomé and Príncipe (np)
Antigua and Barbuda	Eritrea	Madagascar (np)	Saudi Arabia
Argentina	Estonia	Malawi	Senegal
Armenia	Ethiopia	Malaysia	Seychelles
Australia	European Community (w)	Maldives	Sierra Leone
Austria	Fiji (w)	Mali	Singapore
Azerbaijan	Finland	Malta	Slovak Rep.
Bahamas	France	Marshall Islands	Slovenia
Bahrain	Gabon (np)	Mauritania	Solomon Islands (w)
Bangladesh	Gambia	Mauritius	South Africa (np)
Barbados	Georgia	Mexico	Spain
Belarus (np)	Germany	Micronesia	Sri Lanka
Belgium	Ghana	Moldova	Sudan
Belize	Greece	Monaco (w)	Suriname (np)
Benin	Grenada	Mongolia	Swaziland
Bhutan	Guatemala	Morocco	Sweden
Bolivia	Guinea	Mozambique	Switzerland
Botswana	Guinea-Bissau	Myanmar	Syrian Arab Rep.
Brazil	Guyana	Namibia	Tanzania
Bulgaria (w)	Haiti	Nauru (w)	Thailand
Burkina Faso	Honduras	Nepal	Togo
Burundi	Hungary (w)	Netherlands	Trinidad and Tobago
Cambodia	Iceland	New Zealand	Tunisia
Cameroon	India	Nicaragua	Turkmenistan
Canada	Indonesia	Niger	Tuvalu (w)
Cape Verde	Iran, Islamic Rep. of	Nigeria	Uganda
Cent. Afr. Rep.	Ireland	Niue	Ukraine
Chad	Israel	Norway	United Arab Emirates
Chile	Italy	Oman	United Kingdom
China	Jamaica	Pakistan	United States
Colombia	Japan	Panama	Uruguay
Comoros	Jordan	Papua New Guinea (w)	Uzbekistan
Congo, Dem. Rep. of	Kazakhstan	Paraguay	Vanuatu
Congo, Rep. of	Kenya	Peru	Venezuela
Cook Islands	Kiribati (w)	Philippines	Vietnam
Costa Rica	Korea, Dem. People's Rep. of	Poland	Yemen, Rep. of
Côte d'Ivoire	Korea, Rep. of	Portugal	Yugoslavia, Fed. Rep. of (Serbia/Montenegro) (np)
Croatia (w)	Kuwait	Qatar	Zambia
Cuba (w)	Lao People's Dem. Rep.	Romania	Zimbabwe
Cyprus (np)	Latvia	Russian Federation	
Czech	Lebanon	Rwanda (np)	
Denmark	Lesotho	St. Kitts and Nevis	
Djibouti	Liberia (np)	St. Lucia	
Dominica			

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.

THE US POSITION AND THE INTERNATIONAL REACTION TO IT

The U.S. has proposed a three-part framework for a climate change agreement in Kyoto:

I. Binding emissions targets for developed nations.

Almost all developed countries, including the United States, will fall short of the non-binding aim in the current Climate Convention, which calls on nations to reduce emissions to 1990 levels by 2000. Shifting to a binding, realistic, and achievable target should spur greater commitment and action by countries to limit greenhouse gas emissions. The United States has not yet proposed a specific target and timetable.

International Reaction. The concept of binding targets for industrialized nations was widely embraced at the Second Conference of the Parties to the Climate Convention in Geneva in July 1996. Since then, several countries, or blocks of countries, have made more specific proposals. The European Union has called for a 15% reduction in emissions below 1990 levels by 2010. The Association of Small Island States has proposed a 20% reduction below 1990 levels in 2005. The U.S. has rejected both of these targets as unrealistic and overly stringent. Japan, Norway, and Australia have all proposed some form of differentiated regime, whereby developed nations would take on different levels of commitments. The U.S. has largely opposed this approach, arguing that it would be unworkable to negotiate a sensible differentiation scheme in time for Kyoto. By and large, developing nations have urged a stringent target be adopted for the industrialized world.

II. Flexibility to achieve cost-effective reductions.

The U.S. supports provisions designed to ensure that the greatest reductions are gained at the least cost. These include the ability to trade emissions rights internationally and to conduct projects with developing countries to cut emissions (joint implementation).

International Reaction. The U.S. has had a difficult time building support for emissions trading and joint implementation (JI). The EU has largely opposed trading, even though their own 15% target in fact represents a sort of trading scheme in itself. (Under the EU "bubble" approach, certain countries would be allowed to increase their emissions while others would decrease, as long as the net effect was a 15% reduction below 1990 levels by 2010). The EU has also been largely negative on JI. The lack of a specific U.S.

proposal for targets and timetables has probably made it more difficult for much progress to be made here. With regard to the developing world, JI remains quite contentious. Countries seem to have some combination of concerns that (a) JI amounts to the U.S. shirking its own responsibilities to cut emissions, (b) JI would be filled with too many loopholes and would not be credible, and (c) JI would use up all of the cheapest developing country emissions reductions so that when developing countries accept targets at a future point, they will be left with only the most expensive reductions. The exception is Latin America, where several countries have expressed some degree of support for a JI regime.

III. Participation of developing countries.

The U.S. currently has the most extensive proposal for developing country participation in a new climate agreement. The key parts of the proposal include strengthening language on existing developing country commitments under the 1992 Climate Convention, encouraging certain developing nations (i.e. those joining the OECD) to voluntarily accept binding emissions limits, and obtaining an agreement that all developing nations will take on binding targets over time. Partially in light of the Byrd Resolution (adopted 95-0 by the Senate this summer), the U.S. is considering strengthening this proposal further. The Byrd Resolution essentially calls on developing nations to accept binding limits in the same compliance period as industrialized nations, though it does not specify what the specific nature of those commitments should be.

International Reaction. The U.S. does not currently have much public support internationally for its developing country proposals, particularly those dealing with emissions targets. Developing nations have argued that the proposals are inconsistent with the negotiating mandate agreed to in Berlin in 1995, that they do not reflect the fact that most every developed nation will miss the original Climate Convention goal of reducing emissions to 1990 levels by 2000, and that they are fundamentally inequitable. The EU has been largely silent on the issue of developing countries. Given their "bubble" approach (which, for example, would allow Portuguese emissions to grow some 40% over the next decade), they are not in a strong position to take a tough stance. Those closest to the U.S. position include Australia, Canada, and New Zealand.

NOTES AND OTHER INITIATIVES
ON
CLIMATE CHANGE

NOTES

It appears that the US "went some way" towards accepting, in principle the European "bubble" concept, i.e. internally differentiating targets for emission reductions. (This is the old US "bubble" concept introduced in the Carter Administration for each company, or on a state level.)

The US Senate passed a recent resolution on climate change stating that the US should not sign any protocol unless developing countries are also pulled within a binding limitations framework. This position, although not binding, has hardened the G-77/China positions. More recently the US position on contributions to the UN is further angering many of the same delegates dealing with climate change.

US industry is working to exploit North/South tensions, and advancing a campaign to create fear in the US about job losses, noting that US unilateral actions will lead to labor exploitation by others.

The negotiating text does have a draft escape clause "Parties will continue to retain maximum flexibility in deciding how best, based on their national circumstances, they can reach emission limitation/reduction objectives." A distinction has been made whereby commitments will be met individually, to which the Bank's carbon initiatives responds.

The EU will accept trading if the levels of targets agreed under the Berlin Mandate "are adequate".

Japan's public is more supportive than US in support of action on climate change, but the the government of Japan has not yet reach a common negotiating position.

SEPTEMBER

The U.S. conducted regional climate change workshops to examine the vulnerabilities of various regions to climate variability and climate change and to support national-scale scientific assessment.

Senegal, Benin hosted a training workshop on preparing and/or presenting national implementation strategies; (Benin, Chad, and Bolivia will follow suit in October and November.)

Hungary held a workshop on clean energy technologies, project development and finance,

Leipzig, Germany held a conference relating to the preservation of the climate.

OECD Environmental Directorate is addressing "International Greenhouse Gas Emission"

OCTOBER

In addition to the White House meeting and our conference;

Cyprus will host an international conference on "Energy and the Environment, Efficient Utilization of Energy and Water Resources, in conjunction with the Department of Mechanical Engineering, Middlesex.

There will be the Asia-Pacific Initiative for Renewable Energy and Energy Efficiency and

Climate Network Europe will host "Targeting Kyoto and Beyond, " with the Global Legislators Organization for a Balanced Environment, involving parliamentarian, business and a ministerial panel.

Framework Convention on Climate Change Subsidiary Bodies will be meeting.

I. Serageldin
September 29, 1997

Mainstreaming Climate Change in the World Bank

A growing number of countries are seeking the Bank's assistance for integrating global environmental concerns into policymaking and investment planning. Complementary efforts are underway to apply greenhouse gas accounting techniques at the individual investment level, where global externality impacts serve as an input to the environmental scoping process affecting project choice. The recognition of climate change externalities is formalized in *Operational Policy (OP) 10.04, Economic Evaluation of Investment Operations* (September 1994).

In an effort to ensure that global climate change externalities are integrated into Bank Economic and Sector Work (ESW), strategic planning of environmental management (e.g., National Environmental Action Plans), and the CAS, the Bank launched the "Global Overlays Program" in 1995. The program's aim is to test and refine the analytical foundation, tools and methods for integrating global environmental externalities in planning and executing sectoral development. It involves an iterative process, combining conceptualization studies, reviews of the state of the art of measuring and mitigating global externalities, and the testing of these concepts and tools through country level studies as a means of identifying "good practice". The results will provide guidance for actions at the national level to reduce greenhouse gas emissions. Results will also be incorporated into the development of the CAS.

The Climate Change Global Overlays Program addresses primarily the mitigation and abatement aspects of climate change (reduction of greenhouse gas emissions), but is also concerned with adaptation to the impacts of climate change. The objective is to assist developing countries in implementing commitments to the UNFCCC, and to build in the global environmental dimension into national programs for sustainable development.

Carbon Backcasting Study

The World Bank is considering strategies that encourage investment in low and no-carbon energy alternatives such as including a carbon shadow price in its analyses of project benefits and costs. To inform the debate over suitable strategies for the Bank, the Federation of American Scientists (FAS) recommended that the Bank examine how the economic analyses of recently approved energy projects might have been affected by including a carbon shadow price.

The Carbon Backcasting Study was commissioned by the Bank in response to the FAS recommendation. It aimed to analyze the effect of placing a shadow price on carbon emissions for a sample of recently approved energy loans to determine whether the shadow price could adversely affect their economic analyses. (A smaller scale study using similar methods is also being conducted on transport sector loans. The results of that study will be presented in a supplemental report that will be completed in late CY1997.) The study also analyzed whether a shadow price would encourage investment in low-carbon alternatives. A carbon shadow price can increase the relative economic attractiveness of alternative energy investments: e.g., a wind-generation project that is more costly than a diesel-generation project will become more competitive when a carbon shadow price is applied to the diesel's carbon emissions.

The Carbon Backcasting Study achieved three objectives: (1) It documented the carbon intensity of the Bank's energy portfolio; (2) demonstrated the effects of a range of carbon shadow prices -- \$5-\$40 per ton of carbon -- on the energy portfolio; (3) analyzed how the inclusion of a shadow price could encourage investment in low-carbon alternatives.

The main results of the Study can be summarized as follows:

- From 1990 to 1996, the World Bank approved a \$20 billion portfolio of energy sector loans, supporting activities from power sector development to improved access to modern fuels in rural areas. Together, these activities emit approximately 80 million tonnes of carbon (C) per year, or about 2% of all current non-OECD emissions.
- If the Bank were to value these emissions at a shadow price of \$20/tonne C, a mid-range estimate of damage resulting from climate change, nearly 50% of the energy loans made in 1990-93 would be uneconomic. This percentage declined to 11% for the 1994-96 sub-sample (i.e. following implementation of new energy policies).
- At this shadow price, a number of lower-carbon alternative investments from wind power to efficiency improvements would be economically competitive with the original investments.
- Shifting investment choices toward lower carbon fuels and technologies could nonetheless require significant incremental cost support. If the Bank were to reduce or offset sufficient carbon emissions to make all of its energy loans economic ($NPV > 0$) at \$20/tonne C, incremental funding on the order of \$1.5 to \$2 billion per year would be needed (based on the average of 1990-96 lending practices).