ACTIONS BY DEVELOPING COUNTRIES TO CONTROL GREENHOUSE GAS EMISSIONS

Annotated Outline

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I. INTRODUCTION

Although developing countries have taken and are taking significant actions to control their greenhouse gas (GHG) emissions, information about many such actions has not been assembled, much less analyzed and widely disseminated. In the absence of reliable information about GHG-controlling actions by developing countries, some observers have concluded that developing countries are doing little to mitigate the risk of climate change, both in absolute terms and relative to actions taken by the United States. Based on readily available information, this report will present evidence of a substantial range of activity by developing countries. Many of the actions being taken by developing countries are consistent with those referenced in the Kyoto Protocol for Annex I Parties (See Box).

A. Objective

The purpose of this report is to document the extent to which developing countries have taken actions that are resulting in a reduced rate of GHG emissions growth. These actions include those that limit emissions from GHG sources, protect carbon sinks, and those specifically identified as GHG reduction measures. In addition, national economic reforms may result in GHG benefits. Many of the actions being taken (such as reducing energy subsidies) are politically painful because they create short term hardships even though they are thought to confer long term economic benefits. This report will address the need for better information about developing country actions that mitigate GHG emissions.

B. Approach

The approach for preparing this report will include refining the taxonomy of developing country actions that affect GHG emissions to ensure that it is comprehensive, reviewing published and unpublished information sources on the topic, and determining which among the various actions taken are likely to have had significant positive effects on GHG emissions. To the extent allowed by available information, these actions will be presented in a manner that allows countries to be compared with respect to their level of activity. (Quantitative estimates and comparisons of GHG impacts, however, are generally beyond the scope of this report.) To facilitate certain comparisons, units will be standardized where necessary.[1]

Data will be collected from a wide range of sources that includes World Bank studies and databases, UNDP, the Support for National Action Plans (SNAP) program, U.S. Countries

[1]For example, in making international comparisons involving energy consumption or GHG emissions per unit of economic activity, this report will use "purchasing power parity" (PPP) which adjusts a country's currency based on how much of a common market basket of goods and services the currency can purchase locally.

Studies Program, U.S. International Joint Implementation (IJI) program, U.S. government agencies, NGOs, ministries in case study countries, proprietary databases, and academic institutions. Likely data sources for specific actions are listed in the corresponding sections of this outline.

C. Structure of report

The report will be organized as follows. Section II will examine the implications of broad economic policies on GHG emissions Section III will discuss actions that developing countries have taken that affect major GHG sources and sinks.. Section IV will present developing country actions to explicitly reduce GHG emissions or otherwise support implementation of the FCCC. Section V will present an overall comparison among the countries and actions in terms of GHG emissions. The body of the report will be followed by a series of appendices consisting of country case studies.

Box: Policies and Measures

Policies and measures that can be taken to mitigate climate change through reduction in GHG emission and enhancement of GHG sinks were originally mentioned in the FCCC and then elaborated upon in the Kyoto Protocol. These policies and measures refer to actions that Annex I Parties can implement in their national action programs. Examples of such elements include:

- enhancement of energy efficiency in relevant sectors of the national economy;
- protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol through promotion of sustainable forest management practices, afforestation and reforestation;
- promotion of sustainable forms of agriculture;
- research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;
- progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and application of market instruments;
- encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;
- measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;
- limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy.

II. BROAD ECONOMIC REFORMS THAT AFFECT GHG SOURCES AND SINKS

Many developing countries instituted broad economic reforms during the 1990s in response to debt, currency or other economic crises. Reform packages may include energy price deregulation, inflation controls, currency devaluation, trade liberalization, and privatization of formerly state industries. Many of these reforms were politically painful because they resulted in job losses and higher prices for basic commodities and services.

National economic policies potentially affect GHG sources and sinks in several ways, for example, through changing:

* price signals to consumers,
* the relative returns to alternative investments, such as holding natural resource assets, industrial production, or natural resource extraction,
* the mix of inputs used in production within a given sector,
* the share of resources allocated among different sectors, and
* returns to investing in development and commercialization of climate-friendly technologies.

The GHG effects of economic reforms can be profound. Quantifying these effects, however, or even understanding the direction of GHG change may require economic modeling.

A. Reducing Energy Subsidies

Energy consumption is affected by prices. All sectors of an economy potentially respond to changes in price signals. Although energy prices are affected by world markets, national government policy also plays a role. Governments may set prices for energy goods and services directly, through public enterprises, or by controlling them through regulation. In many developing countries, all or parts of the energy supply chain is government-owned and managed. Prices are most likely to be controlled for residential, rural, and low-income customers.

In countries where energy demand exceeds supply, the government may give priority to certain classes of customers. Doing so affects prices to other customers who must compete for smaller quantities of energy than would be available to them without the rationing. For example, some states in India give priority to farmers for electricity, forcing industrial customers to generate their own power.

Overall, developing countries reduced their energy subsidies substantially during the 1990s. Several countries experiencing economic crises during the 1990s -- Mexico, Indonesia, Thailand, Korea -- and implemented fiscal reforms as part of financial assistance packages from the IMF. These reforms typically included the politically difficult measure of relaxing government controls on energy prices.

Country Examples

Fossil fuel subsidies in 14 developing countries declined 45% between 1990 and 1996.

In China, total fossil fuel subsidies in 1996 were less than half of those in place in 1990. The average retail energy price is now at or above the cost of supply. Coal and oil prices are determined by market forces.

On average, consumers in developing countries now pay over $2.00/gallon for gasoline.

Graphics

Time series and cross-country comparisons of energy prices. For example:

Mean Consumer Price at the Pump Per Liter

	Gasoline	Diesel
United States	$ 0.37	$ 0.31
Developing Country Average	$ 0.56	$ 0.38
Poorest Country Average	$ 0.57	$ 0.40

Data Sources

Price trends for gasoline, fuel oil, natural gas, electricity, and coal: World Bank, IEA.

B. Restructuring Energy Sectors

Energy sector restructuring and reform offers a window of opportunity to encourage climate-freindly investments. In developing countries, power sectors in 1990 were dominated by publicly owned and managed utilities that were characterized by not being able to meet rapidly growing demand for power, poor reliability, and, for some classes, subsidized tariffs. The systems were frequently strapped for capital to invest in new capacity and maintain what they already had.

Changes in the ownership, management, and structure of the energy industry have potentially

profound effects on GHG emissions. These reforms affect market actors' incentives for which types of fuel and technologies for power generation to use, for reducing energy losses in transmitting and distributing power, and for managing customers' end use demand.

Commercialization and private power development in developing countries have resulted in an infusion of capital to upgrade existing facilities and construct new ones that are more efficient than those in the system. Energy losses in transmission and distribution systems have been reduced. At the same time, electricity tariffs have been reformed to more closely reflect true costs.

In the 1990s, some developing countries also privatized fuel production and industrial sectors as part of more general economic liberalization. Privatization of fuel production similarly stimulated new investment in extraction and transport facilities. One effect has been to expand the range of fuels available for power generation and other purposes. In some countries, natural gas increased its market share over this period, relative to coal and oil.

Privatization of state-owned industries also occurred. Prior to being privatized, many such industries did not pay their energy bills, making them insensitive to how much energy they used. After privatization, these industries became subject to the same rules to which other industries were subject.

As they have privatized their energy sectors, many developing countries also strengthened regulatory oversight over them. More stringent regulation of conventional air pollutants and associated compliance costs increases the competitiveness of climate-friendly generation options.

Country Examples

As part of its privatization of the power sector, Brazil is also leveling the playing field among renewable and nonrenewable generation, such as by phasing out subsidies for diesel powered generation in remote locations.

Proposed national legislation in India to establish regulatory authority over the power sector includes a provision that at least 50% of the cost of electricity production must be recovered through tariffs.

Distribution energy losses were reduced in Argentina in the wake of privatization from 21% in 1992 to 12% in 1995.

The Government of Argentina is providing incentives for privatized electricity distribution companies to use renewable energy for serving rural areas.

Graphics

Time trends in electricity tariffs

Share of IPP capacity with CO_2 emission factors < X tons/GWh relative to average national emission factors

Data Sources

Power sector and reforms in developing countries: Hagler Bailly reports, World Bank

Electricity tariff trends: EEP reports, EEI and EPRI, World Bank

C. Reforming Tax Policy

Tax policy can affect investment and consumption decisions that have GHG implications. For example, countries vary widely in their energy tax policy. Energy taxes may be imposed at the point of fuel extraction (royalty payments), imports of fuel or energy technologies, fuel transport, wholesale power generation, or retail fuel or electricity sales. Taxes on upstream production and transport of fuels show up as higher prices at the retail level.

Other tax policies can also affect energy consumption indirectly. For example, the home mortgage interest deduction in the U.S. has been shown to increase the square footage of homes that can be afforded for families at a given income level.

In general, interest in market-based instruments for environmental protection is growing among developing countries. If data are available for analysis, the report will examine how GHG emissions may be affected by the overall tax structure in selected developing countries. For example, many developing countries derive a relatively large share of their tax revenues from various value-added taxes, including those imposed on energy use. Taxing consumption of energy is particularly difficult politically in developing countries because energy taxes tend to be regressive. A few developing and emerging economies have implemented environmental taxes.

Some countries have used tax policy to encourage investment in developing GHG-friendly energy options. Measures include tax exemptions or credits for specific technologies or types of investments, and accelerated depreciation.

Country Examples

Brazil reduced value-added and import taxes on renewable energy equipment during the 1990s by X%. In late 1997, several types of renewable energy equipment were exempted

from an 18% state value-added tax.

Although individual countries vary widely, the relative share of total government revenues derived from taxes on consumption is often greater in developing countries than in major industrialized countries.

Graphics

Cross-country comparison of energy taxes

Data Sources

Tax policy: IMF, KPMG international tax database

D. Liberalizing Trade Policy

Trade policy can discourage or facilitate the importation of climate-friendly goods and equipment. Some countries differentiate between domestic and imported goods to protect domestic industries. A country may impose domestic content requirements, quotas, or other nontariff trade barriers. Restrictions on imported fuels may also be imposed.

Many developing countries have been liberalizing their trade policies, in the context of both global and regional trading regimes. As part of trade liberalization, countries are looking to international standards for energy efficiency in traded goods and industrial processes.

Country Examples

APEC members have agreed to use common test procedures for measuring the energy efficiency of equipment and appliances traded among APEC economies.

Graphics

Data Sources

National trade policies: WTO

Regional trading initiatives: APEC, ASEAN, NAFTA, Mercosur

III. SECTOR-SPECIFIC ACTIONS THAT AFFECT MAJOR GHG SOURCES AND SINKS

The net contribution a country makes to GHG emissions is a combination of emissions from various sectors and carbon sequestered. Developing countries have taken actions to improve the efficiency in which energy is supplied and consumed, increase reliance on renewable energy sources, and protect land areas that serve as carbon sinks. As with macro policy reforms documented in Section II., the actions summarized below have been taken for reasons other than GHG control -- reducing reliance on imported fuels, improving local environmental quality, saving money, protecting biodiversity, etc. Nonetheless, they constitute further evidence that developing countries are limiting their net GHG emissions.

A. Reducing Fossil Fuel Energy Use in Buildings and Industry

During the 1990s, developing countries have initiated a wide range of actions to improve energy efficiency in different sectors. Each country is pursuing approaches to reducing energy use in buildings according to its own economic, political, and social characteristics. Some are taking voluntary approaches including information campaigns, others are offering financial incentives, and yet others have adopted codes and standards.

Adoption of codes and standards - Several developing countries have adopted national building codes that include energy efficiency provisions and efficiency standards for major appliances such as air conditioners, motors, and refrigerators.

Market Incentives - Market incentives for improving energy efficiency include rebates for energy efficient products and tax credits for energy efficient retrofits.

Other Initiatives that Conserve Energy - Other initiatives include public education campaigns for household energy conservation and the establishment of financing mechanisms for energy efficiency improvements.

Country Examples

On January 1, 1998, China passed an Energy Conservation Law that makes energy conservation a long term development strategy, requires the government to formulate an energy conservation policy, develop national efficiency standards, invest in clean and renewable energy sources, and retire inefficient plants and equipment.

The Chinese government established a "green lights" program in 1996 whose goal is to add 300 million high efficiency lights by 2000, saving 7.4 million tons of carbon annually.

In 1996, energy savings from lighting efficiency programs in Brazil saved an estimated 2.8 Twh, about 1.1% of total electricity use.

Programs implemented by the energy conservation organization of Brazil's power sector (PROCEL) resulted in about 3.6 Twh/yr. as of 1996, about 1.4% of electricity consumption in Brazil in 1996.

The Philippines, Thailand, and Mexico have adopted energy efficiency comparison labeling programs for air conditioners. Korea has adopted energy labeling for refrigerators, air conditioners, water heaters, space heaters, lamps, ballasts, motors, and boilers.

ASEAN commercial building codes have been established in Singapore, Indonesia, Malaysia, The Philippines, and Thailand.

Thailand's lighting efficiency program has saved 17 MW.

Lighting efficiency programs in Mexico have resulted in...to be added

India's Petroleum Conservation Petroleum Research Association, which is funded through a tax on oil consumption, has saved an estimated 1.2 million tons of petroleum products since 1985.

To ensure that energy efficiency continues to be promoted in a privatized electricity industry, the Government of Brazil has created a fund from taxes on electricity sales with $30-$40 million annually to leverage energy efficiency investments.

In 1995, Philippines DOE issued a mandate for all utilities to create DSM plans. The Energy Regulatory Board, which oversees electric utilities and regulates national energy prices, is drafting regulations that will allow utilities to recover DSM program costs. MERALCO, the country's largest distribution utility, has established a DSM office and is designing pilot programs.

As part of its regulation of the power sector, the Philippines has allowed utilities to recover the costs of DSM programs.

As part of the restructuring of the power sector in the Indian State of Orissa, an $80 million DSM program has been approved.

Graphics

A matrix of major energy efficiency actions by country

Time trends in utility DSM expenditures and as a share of total revenues

Time trends in fossil fuel use/capita

Time trends in fossil fuel/GNP

Average annual kWh consumption of major appliances (such as refrigerators) sold

Domestic national expenditures on end use energy efficiency per unit GNP

Data sources

Trends in energy consumption: UNDP, WRI

Government energy efficiency initiatives: Hagler Bailly reports, IIEC, ACEEE, WEEA

National institutions promoting energy conservation: PROCEL, IREDA, EPA, DOE

China: LBL, PNL, ACEEE

India: TERI, energy efficiency center, IREDA

Thailand: DSMO, DEDP, NEPO

Brazil: PROCEL

Trends in DSM expenditures: EEI, EPRI, US EIA, ACEEE, ASE, IIEC, ORNL

B. Reducing Fossil Fuel Energy Use in Transportation

Transportation strategies to reduce GHG emissions work through one of the following mechanisms -- reduce/shift travel demand, improve fuel economy, or switch to alternative fuels with lower lifecycle carbon content (such as compressed natural gas and electricity). Although often done to relieve traffic congestion, many developing countries have made substantial investments in public transit.

Country Examples

As a result of land use policies, public transit accounts for 70% of the average daily commuter trips in the City of Curitiba, Brazil.

The City of Sao Paulo is in the process of replacing all diesel-powered buses with buses fueled by natural gas.

Korea and Brazil have adopted fuel efficiency labeling for motor vehicles.

Singapore has instituted congestion pricing to discourage auto use.

Graphics

Trends in average MPG of motor vehicles sold

Trends in average VMT total and by major modes

Average fuel economy of vehicle fleet

Data Sources

C. Reducing Fossil Fuel Use in Energy Production

Deployment of Low and No Carbon Electric Generation Technologies

Renewable power sources, both connected to the grid and for off-grid applications, are helping to meet the need for expanded electric generation without adding to GHG emissions. Greater use of natural gas for power generation, especially when burned in highly efficient turbines, also reduces GHG emissions over both coal and oil-fired generation.

Improving the Efficiency of Power Generation, Transmission and Distribution

New investment in generating capacity, transmission and distribution systems has improved "supply side" efficiency and reduced energy losses in getting power to customers.

Country Examples

Over 700 MW of wind capacity have been installed in India and over 200 MW of sugar cogeneration capacity are under construction.

By the end of 1995, the use of renewable energy in China approached 300 million tons of coal equivalent annually.

China has installed 30 MW of wind capacity and plans to install 1,000 MW by 2000 and 3,000 by 2010.

Installed mini-hydro capacity in China has reached 16,200 MW.

Biomass-based methane is used by 5.7 million Chinese households.

Power from geothermal sources has reached 14% of the Philippines total generating capacity.

The Philippines Government has approved the Malampaya-Camago gas-to-power pipeline, which will increase the market share of natural gas in power generation to 15% by 2004.

More rural households have received electricity services from PV systems in Kenya than from grid extension.

The Government of India's role in renewable energy development was raised to the Cabinet ministry level in 199X and was instrumental in favorable policies including tax incentives for renewable energy, banking and wheeling privileges, etc.

India's National Thermal Power Corporation (NTPC) has reduced carbon emissions in its coal-fired capacity through plant efficiency improvements and coal beneficiation.

The Government of the Philippines has established special provisions for approving renewable energy projects below 50 MW in size.

In Kunming, China, 20,000 coal burners in the commercial and government sector have been replaced by LPG, coal gas, and electricity.

Graphics

Time trends in generation mix: coal, oil, natural gas, hydro, renewables, nuclear

Time trends in T&D energy losses

Average heat rates of new thermal capacity

Data Sources

Trends in renewable energy capacity: NREL, trade associations

Average national T&D energy losses in 1990 and later: World Bank, EEI, EPRI, US EIA

Average plant heat rates: Hagler Bailly international power database

D. Protecting Carbon Sinks

In addition to actions that control GHG emissions, a country's net GHG contribution is affected by the status of its carbon sinks. Policies that preserve or expand forest areas, for example, have the effect of sequestering carbon, thus offsetting some of the country's carbon emissions. Conversely, forest fires, either set purposely to clear land or that occur naturally, reduce a country's ability to sequester carbon.

Public investment in infrastructure affects GHG sources and sinks. Investments in urban infrastructure (roads, mass transit, water and sewer, etc.) can have long term effects on GHG emissions because they determine spatial patterns of population centers and economic development which, in turn, affect energy used for transportation and in buildings. Patterns of spatial development also affect the extent to which land cover that serves as a carbon sink is converted to urban uses.

High rates of urbanization lead to increases in GHG emissions from transportation, buildings, industry and landfills. Urbanization also contributes to the destruction of land-based carbon sinks. The link is both direct, when forests and agricultural lands are cleared and wetlands drained for urban settlements, and indirect, when markets are created for timber and other products. Furthermore, pollution from urban energy uses stresses trees, thereby reducing rates of carbon sequestration.

Policy Initiatives and Reforms

Several developing country policy reforms in different sectors have helped preserve or improve the status of their carbon sinks, notably through reforestation and the transition to sustainable agriculture. For example, the ability of forests to sequester carbon has been helped through improved land tenure regimes, reduced impact harvesting, creation of parks, and community-based resource management.

Agricultural policy affects GHG emissions by affecting incentives regarding land cover, what to grow, and how to grow it. Agricultural policy can affect whether perennial pasture or annual crops are grown, methane emissions from paddy rice and livestock production, and soil carbon losses due to erosion.

In the 1990s, many countries have strengthened property rights regimes, clarifying which activities could be conducted. Agrarian reforms have re-allocated land holdings from large

landowners to landless people. Moreover, countries established national parks and preserves, giving these areas at least legal protection even it has not always been strongly enforced.

At the same time, there have been policy actions taken that have the effect of protecting carbon sinks. These include incentives for wood lot development, sustainable agriculture, reduction in subsidies for conversion of forest land to agriculture and livestock production, green revolution, and debt for nature swaps.

Country Examples

Standing forest biomass in China has increased in recent years, to almost 14%, with a national goal of 15.5% by 2000.

In India, 20,000 villages have formed forest protection groups, which effectively control access to 3%-5% of India's total forest area.

Projects that give local communities explicit rights over forest management have been initiated in India, the Philippines, Thailand, Indonesia, and Nepal.

Graphics

Time trends of carbon sequestered by standing biomass

Time trends of soil loss

Area of forest lands under legal protection from harvesting

Data sources

Area in forest cover: The Nature Conservancy, US Forest Service

Debt for nature swaps: The Nature Conservancy

Area in agricultural land cover: USDA, World Bank/CGIAR,

Forest Policy: The Wilderness Society, The Nature Conservancy

IV. ACTIONS TO EXPLICITLY SUPPORT THE UNFCCC OR CONTROL GHG EMISSIONS

The UN Framework Convention on Climate Change (FCCC) established commitments for the Parties to the Convention, and the Kyoto Protocol has elaborated on those commitments. Several fundamental differences between the commitments for developed and transitional economy country (i.e., Annex I) Parties and the developing country Parties were established to account for their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances. (See Box.)

Box: Differentiated Responsibilities Under the Kyoto Protocol

Article 3 of the Kyoto Protocol establishes specific targets for quantified emission limitation and reduction commitments for Annex I Parties, and establishes the concepts of joint implementation and emission reduction unit trading between Annex I Parties. Article 2 of the Protocol requires that Annex I Parties implement and elaborate policies and measures to achieve the reduction targets specified under Article 3. Article 11 of the Protocol requires that Annex I Parties provide new and additional financial assistance to developing countries for the transfer of GHG reducing technologies. The definition of a clean development mechanism (CDM) in Article 12 extends the concept of joint implementation to include non-Annex I Parties. *All* Parties to the Convention must also meet requirements pertaining to the development of GHG inventories, action plans and programs, and national communications as elaborated in Article 10 of the Kyoto Protocol.

Following is a brief synopsis of programs and actions which developing countries have implemented to fulfill their commitments under the FCCC and that directly address climate change issues. The human and financial resources committed to these actions demonstrates the seriousness with which developing countries are addressing the climate change issue.

A. National Action Plans

All of the key countries under consideration in this report are developing national action plans (NAP) as required under the terms of the FCCC. The NAPs, and in particular identification of specific policies and programs designed to address climate change issues, form the basis for their national communications package which are also under development. The NAPs, which are being prepared under the guidance of key governmental agency officials, are intended to provide national guidance through the intervention of national policies and measures. The planning committees generally recognize that introduction of new environmentally friendly technologies will benefit their countries both environmentally and economically, and are taking this opportunity to promote the use of new technologies.

The major GHG emitting developing countries have all committed significant resources to the national action planning process. In particular, they have developed inventories of their GHG sources and sinks, and have committed knowledgeable agency staff members to the evaluation of

sector data to identify GHG reduction opportunities and to the development of national programs to implement new policies and technologies. They have also welcomed the guidance provided by Annex I countries and international organizations such as the UNEP, UNDP and GEF, and are taking advantage of provisions of the FCCC that afford assistance in the transfer of technology from the developed countries

B. National Communications

Under terms of the FCCC, each Party to the Convention is obligated to develop a national communication containing the following information elements as a minimum: (1) a national inventory of anthropogenic sources and sinks of all GHGs not controlled by the Montreal Protocol; and (2) a general description of the steps taken or planned to implement their actions and programs.

Of the six countries initially selected for inclusion in this report's case studies (Brazil, China India, Indonesia, Korea, and Mexico) all have either prepared or are completing their national communications packages. Many other developing countries are following similar timetables. The present schedules are in keeping with the FCCC guidelines which state that the Parties must submit within three years of entry into force for that Party or from the identification of sufficient funding to complete the tasks.

The FCCC did not specify a particular format for the national communications documentation. To assist the overall reporting process, non-Annex I Parties (G77 and China) developed a position paper with formatting guidelines prepared during the seminar held in Geneva, Switzerland on February 1996. This format is consistent with that being used by the developed countries with the exception of an assessment of the impact that each policy or measure will have on GHG emissions.

The format for the Brazilian draft National Communication, for example, follows these guidelines. Their national communication contains the inventory of sources and sinks (which was prepared in accordance with the guidelines established by the International Panel on Climate Change), and a description of the steps that Brazil has already taken or envisions to implement the Convention.

Anticipated Impact

The development of national communications packages is a vital first step in the process of getting countries to evaluate their current status regarding GHG emissions, to develop policies and plans to implement effective GHG emission mitigation actions, and to assess their vulnerability and generate adaptive policies to climate change. In addition, the process will

provide a starting point, or baselines, against which to measure the impact of future mitigation actions. This baseline information will be required for the development of potential joint implementation projects, and will be necessary before the developing countries will be positioned to participate in a carbon trading regime.

Country Examples

Mexico has completed its national inventory of GHG emissions and has developed a mitigation strategy that includes a $10 billion program to replace oil with natural gas for power generation, lighting efficiency, improved efficiency of motors and boilers, and cogeneration.

C. Global Environment Facility (GEF)

The GEF was established to serve as the financial mechanism for the FCCC. The GEF has been operational for five years, under both a pilot phase and an operational phase.

The fund has provided assistance for xxxs (tbd) projects including yyyy (tbd) projects for the countries to be considered in this report. The relative contributions of the selected host countries has been substantial, and will be tabulated to show the significant investment that developing countries have already made to combat climate change and to address the impacts of potential change.

D. Joint Implementation

Joint Implementation (JI), also know as Activities Implemented Jointly (AIJ), is a concept that has gone through a limited pilot phase. Over 50 (update required) projects, both energy-related GHG emission reduction projects and biodiversity-based carbon sink enhancement activities, have been conducted under several JI pilot programs to demonstrate the feasibility of the JI concept, and many more are under consideration. The fact that many countries, both developing and developed, have voluntarily participated in JI projects with no specific benefit regarding carbon offsets accruing to their national GHG budgets indicates the widespread interest in addressing climate change issues through cooperative efforts. Each pilot program implementation is unique, and interpretations regarding concepts such as additionality, baselines and offsets, and leakage have been treated differently. The practical experience being gathered under these JI pilot projects will provide the foundation for a more formal JI project that can be conducted on a larger scale.

The JI concept will most likely be an integral component of an international carbon trading scheme. The Clean Development Mechanism (CDM) that was established by the Kyoto Protocol

embodies the principals of JI along with the concept of credit through the use of certified emission reductions.

V. CONCLUSIONS

This final section of the main body of the report will integrate and compare the preceding sections. In interpreting actions taken by developing countries over the period of analysis, it is important to remember some broad baseline characteristics. Relative to the U.S., many developing countries have experienced substantially higher rates of economic growth; energy demand often outstripped supply; and developing country GHG emissions per capita had much lower starting points. These characteristics have implications for comparing the level of emissions without the actions taken and with the actions taken. To be significant, actions taken by developing countries should reduce their rate of GHG emissions growth relative to the base case. (In contrast, according to the Kyoto Protocol, the U.S. is supposed to reduce its actual emissions by 7% from 1990 levels by 2010.)

Several key questions will be addressed in this section:

* What actions are developing countries taking that have made significant contribution to reduce their rate of net emissions growth?

* What is the overall direction of the various time trends among countries that were evaluated?

* How do these actions affect overall energy intensity trends or other indicators of a country's contribution to climate risks?

* Which developing countries are leaders in initiating actions that reduce their growth in GHG emissions?

Country Examples:

Between 1991 and 1995, China maintained the lowest ratio between energy consumption and GDP growth in the world.

Graphics

Cross-country time trends of energy intensity and other indicators of GHG contributions

Matrix summarizing major categories of actions taken by key developing countries

VI. COUNTRY CASE STUDY APPENDICES

The appendices that follow the body of the report will provide detailed information about ten countries. The case studies will include China. India, Brazil, Indonesia, Korea, and Mexico. In addition, 3-5 countries will be chosen from among the following: Egypt, Philippines, South Africa, Thailand, Argentina, Nigeria, Pakistan, Chile, and Costa Rica. The set of case study countries will be chosen on the basis of their baseline GHG emissions and geographic distribution.

To facilitate comparison, each case study will follow a format similar to that used to present developing country actions in the body of the report. For each country and each action, data will also be collected to address following questions:

* What are the baseline GHG emission scenarios, to the extent they exist?

* Where are the major sources of and sinks for GHG emissions?

* What steps have been taken on this action from 1990 to 1998?

* What political, macroeconomic, social, etc. factors account for the status of these actions?

* What have been the results of taking these actions?

The narrative will be accompanied by appropriate tables and graphs and will include a complete list of data sources.

6 July 1998 (Revision 3)

Framework Convention on Climate Change -- Follow-Up to Kyoto
Calendar of Events

Note: The following is a list of scheduled meetings, along with some suggestions, marked with the letter "T" which might be useful for pursuing U.S. climate strategy.

July 1998

TBD -- Miami (?): Dates for Brazil follow-up meeting on their proposal

Tues, July 7 to Tues, July 14, Africa: Visit by Transportation Secretary Slater to Senegal, Cape Verde, Ethiopia, Zimbabwe, and Cameroun

Sun, July 12 to Sun, July 19, Africa: Visit by Treasury Secretary Rubin to Ivory Coast, South Africa, Mozambique, and Kenya

Wed, July 22, Washington: Clinton-Hashimoto State Visit

Wed, July 22 to Thurs, July 23, Kiev: Gore-Kuchma; U.S.-Ukraine Binational Commission

(T)Mon, July 27 to Fri, July 31, Buenos Aires/Santiago: Climate Consultations and EPA Modelling Exercise (Hambley, EPA, DOE, USAID?); Possibly add on Mexico.

Tues, July 21 to Sat July 25, Manila: ASEAN Ministerial

(T) Late July, Beijing: High Level Follow-up to President's Trip (Kimble, Gordon and senior interagency group)

August 1998

TBD -- Mexico City: Possible follow-on to Jane Leggett's modeling workshop and follow-on to earlier visit

Mon, Aug 3 to Tues, Aug 4, Kuala Lumpur: Non-Annex I Reporting Workshop (Reifsnyder)

(T) Thurs, Aug 6 to Fri, Aug 7: Seoul, Climate Discussions with Korea (Hambley, Reifsnyder)

Tues, Aug 25 to Wed, Aug 26: Copenhagen: U.S.-Nordic Trading Workshop (EB Bass?)

Mon, Aug 24 to Thur, Aug 27: Warsaw: Meeting of Central European Power Generation Officials (USAID-funded, sponsored by U.S. Energy Association) (EB Bass?)

(T) Thurs, Aug 27 to Saturday, Aug 28, Ankara: Visit to Turkey (Hambley/Reifsnyder)

Sun, Aug 30 to Wed, Sept 2, Interlaken, Switzerland: Fourth International Conference on Greenhouse Gas Control Technologies

September 1998

Tues, Sept 1 to Wed, Sept 9, Kuantau: APEC Senior Officials Meeting

Mon, Sept 7 to Tues, Sept 8: Wellington, Umbrella Meeting (Hambley, Reifsnyder, Biniaz)

(T) Wed, Sept 9 to Mon, Sept 21, Somewhere TBD: Commerce Secretary Daley intends to travel abroad during this timeframe

Thurs, Sept 10 to Fri, Sept 11, Paris: Annex I Experts Group (Hambley, Merida, Bloom?)

(T) Sat, Sept 12 to Tues, Sept 15, Ankara: Climate Discussions with Turkey (Hambley, Merida, Wickwire plus EPA/DOE)

Thur, Sept 15 to Fri, Sept 16, Washington: Visit by Central American Environment Ministers (90-minute exchange of views on climate-related issues requested);

Thurs, Sept 17 to Fri, Sept 18, Tokyo: FCCC pre-COP-4 Ministerial (Stu/Frank? Kimble or Pomerance, Hambley, Reifsnyder)

(T) Mon, Sept 20 to Tues, Sept 21, Seoul: Follow-on visit on climate (possibly also to Beijing. (Kimble/Pomerance and/or Hambley/Reifsnyder)

September 21 Rosh Hashanah Begins

(T) Week of Mon, Sept 21, Ottawa: Possible CDM/Trading Ministerial

Week of Mon, Sept 21, Vienna: IPCC/SBSTA Sinks Workshop

Tues, Sept 22 to Wed, Sept 23, Baltimore: USAID Conference on Urbanization and Climate Change

Mon, Sept 28 to Wed, Oct 7, Vienna: IPCC Plenary (Pomerance, Reifsnyder)

(T) Mon, Sept 21, New York: President Clinton's address before the UN General Assembly

Tues, Sept 29 to Thurs, Oct 1: Toronto: Annual Canadian Climate Conference (AREA); (Hambley)

September 29/30 is Yom Kippur

October 1998

TBD -- Mexico City, An additional follow-up visit might be envisioned.

Thurs, Oct 1 to Fri, Oct 2, Paris: IEA/UNDP CDM Wrap-up Workshop (Bradley?)

(T) Fri, Oct 9 to Sat, Oct 10: Buenos Aires: FCCC Extended Bureau Meeting (Hambley, Reifsnyder)

Mon, Oct 12 to Thur, Oct 15, Dakar: Workshop for African Negotiators and U.S./African Business (Reifsnyder/Wickwire)

(T) Week of Mon, Oct 19, Brussels, Bonn, Vienna: U.S.-EU High Level Consultations and other bilaterals (Kimble and TBD)

(T) Fri, Oct 23 to Sun Oct 25, Ankara/Istanbul: Follow-up to Turkish talks (Kimble/Hambley)

November 1998

Mon, Nov 2 to Fri, Nov 13, Buenos Aires: Fourth Conference of the Parties to the FCCC; (Eizenstat/Loy(?),Kimble/Pomerance et. al.)

Thurs, Nov 12 to Wed, Nov 18, Kuala Lumpur: APEC Ministerial and Heads of State/Government Meeting (Kimble)

facsimile TRANSMITTAL

To: Joe Aldy

Of: CEA

Fax: 202-395-6870

Phone: 202-395-1455

Pages: 2, including this cover sheet.

Date: June 12, 1998

Here is a one-page summary of the Economics Workshop on Models Related to Climate Change, held in Mexico City on June 8-9, 1998. Please contact me at 202-260-5276 if you would like more information.

From the desk of...

Francisco Dóñez
Policy Analyst
U.S. Environmental Protection Agency
202-260-5276
Fax: 202-260-2685

Economics Workshop on Models Related to Climate Change, June 8-9, 1998
Ministry of Environment, Natural Resources and Fisheries (SEMARNAP), Mexico City

The workshop was a success, with each presentation followed by lively discussion. Attendees included representatives from EPA, DOE and the University of Ohio in the USA; and SEMARNAP, the Energy Ministry, and UNAM in Mexico. Luis Guardarrama moderated the workshop, and emphasized that the proceedings were meant to be informal, and not a forum to express individual institutional perspectives. The following persons made presentations.

- Phillip Tseng (US DOE) spoke generally about the criteria used in the USA for selecting models, and continued to describe his experience with the Markal-Macro model.
- Peter Nagelhout (US EPA) discussed the Interagency Analytical Team process and its use of the SGM model. He also touched upon the possibility of ancillary benefits from climate protection as an area to be explored by Mexican and US modelers, perhaps through a localized study. Hugo Contreras will arrange to get Peter in contact with Mexico City's Air Quality Commission.
- Claudia Sheinbaum (UNAM, Engineering Institute) discussed the Institute's bottom-up engineering model, the GHG Mitigation Model for Mexico (MMM). In the future, Sheinbaum would like to (1) include fuel costs in the model, (2) interact the forestry and energy sectors, and (3) relate her modeling results to a macroeconomic model.
- Juan Quintanilla (UNAM, University Energy Program) described MODEMA, the Energy Demand Model for Mexico. This model is currently in the intermediate stage of development, but has been put aside while the Energy Program prepares to devote more effort to Markal beginning in September. Data from MODEMA will initially be used as an input to Markal, and Quintanilla hopes to use MODEMA later as a replacement or complement for the Markal-Macro combination.
- Roy Boyd (Ohio University) described a CGE model for Mexico, and Sara Avila (SEMARNAP) presented some preliminary results. One disadvantage of this model is that it provides a very broad-brushed analysis, taking as its main units Mexico and "the rest of the world". On the other hand, the fact that it was designed as a specifically Mexican model is also a great advantage. Also, the data and modeling system are transparent and shareable, another distinct strength. In the future, Boyd hopes to better incorporate international interactions and technical change in the energy sector.

The strongest consensus that emerged from the workshop was that communication and information sharing should be continued in the future. In particular, data sharing and the use of common assumptions were proposed as ways for modelers to work toward mutually comparable results. Possible communications mechanisms included the following.

- Holding Mexico-US modeling workshops periodically, perhaps twice a year (once in each country).
- Maintaining a networking mechanism such as a listserv or website, or a combination of the two.

Francisco Dóñez and Hugo Contreras informally agreed to explore these ideas, and perhaps propose them more formally in the near future. In addition, broad consultations with Mexican and US modelers will be needed for agenda setting when future workshops are held. Over time, these meetings and other networking projects could evolve into an established binational working group for climate change economic modeling.

At the end of the meeting, Claudia Sheinbaum reminded the group that the main questions to be answered by climate change modeling are (1) whether Mexico is capable of achieving emissions limits over the next 15-20 years, and (2) what those limits might be. Her comment put the previous discussions in perspective and provided a good closure for the workshop.

Developing Country Participation in International Emissions Trading

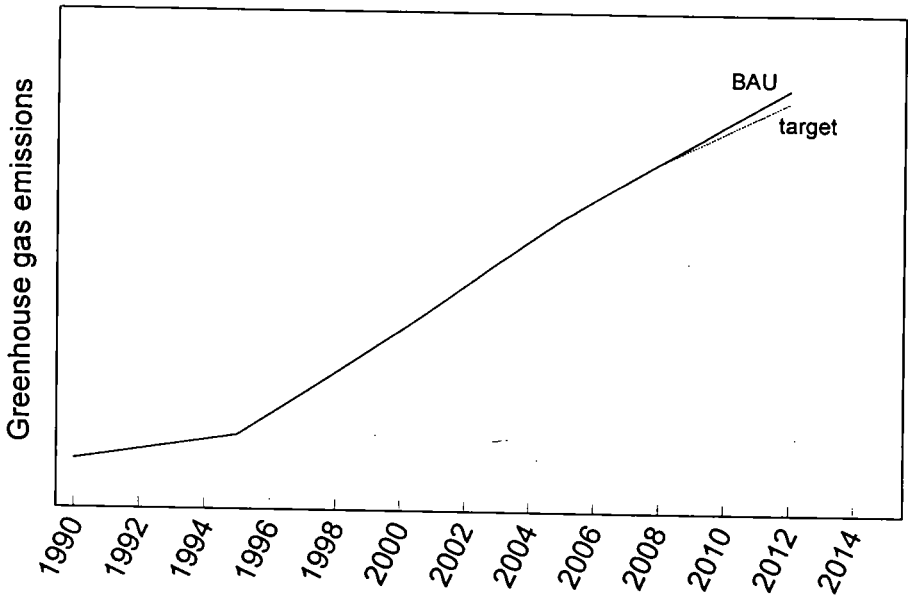
If a developing country (a) chooses to adopt a growth target slightly below its business as usual (BAU) emissions, and (b) trades its emissions allowances internationally, it could enjoy substantial economic and environmental gains.

- **Economic Benefits.** As potential sellers, developing countries with targets slightly below BAU projections could enjoy net gains from participation in international emissions trading, because they can achieve emissions reductions relatively "cost-effectively" (i.e., at a cost per metric ton of carbon equivalent that is less than the world trading price). Even with this participation, a country's emissions could continue to grow above current levels (see figures below).

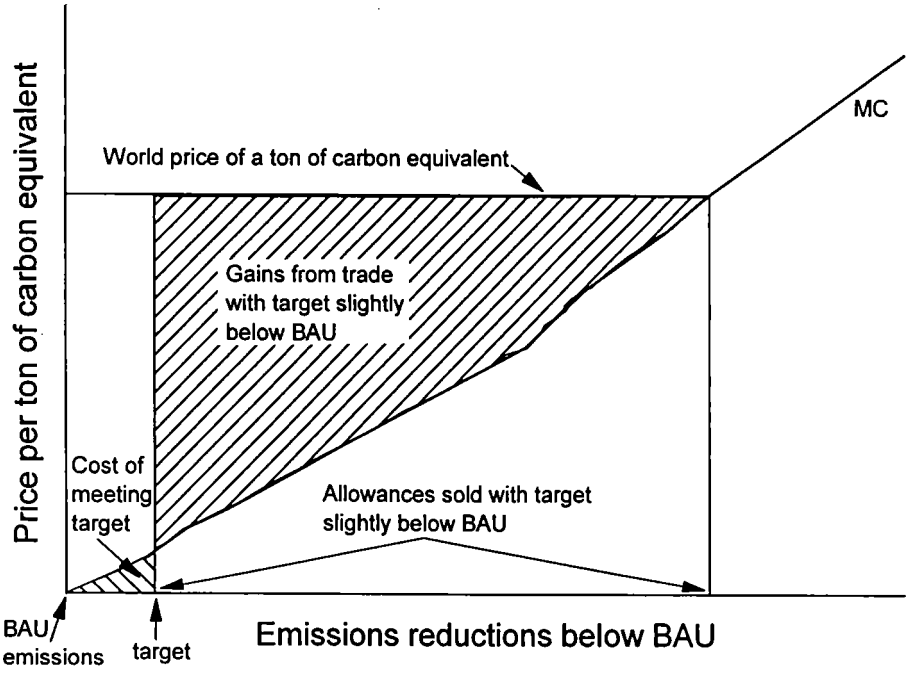
- **Environmental Benefits.** A world with broad-based participation in international emissions trading, including participation by countries with growth targets slightly below their BAU projections, could result in lower global greenhouse gas emissions relative to a world with narrow participation. Moreover, reductions in greenhouse gas emissions would generate ancillary air quality benefits through reductions in sulfur dioxide, nitrogen oxides, and particulate matter emissions.

Benefits of Trade: The following example illustrates (i) a potential growth target, set slightly below a developing country's BAU projection, and (ii) the economic benefits available to this developing country through international emissions trading.

(i) Illustration of a Developing Country Growth Target



(ii) Marginal Abatement Cost Curve and Gains from Trade in 2010



These gains from trade represent revenue from sales of emissions allowances less the cost to the developing country of reducing emissions.

Preliminary, close hold

JF, 6/11//98+

QUESTIONS REGARDING TARGETS FOR DEVELOPING COUNTRIES

This note lists six questions that must be answered in considering alternative possible specific versions of the CEA proposal that LDCs be asked to accept emissions targets "at or near" their forecasted BAU paths.

To begin, it is important to acknowledge that :

- there is always a tradeoff between the environmental benefits of bigger cuts vs. the economic costs. More specifically,
- aggressive cuts relative to the expected pre-Kyoto BAU path will be even more firmly opposed by the LDCs than the BAU path itself; while
- increases relative to the pre-Kyoto BAU path (e.g., ratifying forecasted leakage from the Kyoto agreement) will be firmly opposed by environmentalists.

(1) Should the explicit goal (in the first commitment period) be:

- post-Kyoto BAU (including estimate of leakage)
- pre-Kyoto BAU, or
- pre-Kyoto BAU minus some percentage ?

(2) Should the goal be implemented in the form of:

- numbers negotiated internationally by diplomats over the next few years
- numbers produced by a body of "objective experts" over the next few years
- a formula agreed now, contingent on future data
- submissions from countries as to how they propose to determine their own BAU (including the possibility of a formula), subject to a process of expert review / international approval ?

(3) If it is to be a formula, should it be:

- with specific numbers determined in 2007 contingent on data available then
- with numbers determined contemporaneously in 2008-2012 ?

(4) If it is to be a formula, which of the following variables should be included?

- GDP
- population
- pre-Kyoto emission levels
- time trend
- all of the above ?

(5) If it is to be a formula, how should the weights on the variables be determined?

- chosen by international body of "objective experts"
- pure cross-section statistical estimates using past data
- time-series or panel-data statistical estimates using past data
- negotiated common formula
- negotiation of different formulas for different countries ?

(6) Should there be any general presumption that the approach (e.g., the choice of variables to enter the formula) might be applied not only to LDCs in 2007-2012, but also to

- LDCs in subsequent commitment periods (presumably with further cuts) ?
- Annex I countries in the future as well, with a goal in the (very) long run of a common formula to apply to all countries ?

6/9/98

TO: Under Secretary Stuart Eizenstat
From: Nazir Bhagat Mobile:(703)-625-8169 Res (703) 354-9080.
Re: Follow-up to our conversation on "Target and Trade"/Meaningful Participation

As promised, here are some problems I see with CEA's "Target and Trade"proposal, particularly how it may be misapplied. I have also included an excerpt from my India paper on how we should handle "meaningful participation" by developing countries. I appreciate your interest in my views. Since Jeffrey Hunker's departure, I have not had the opportunity to express them.

The CEA proposal would permit developing countries (LDCs) to trade and profit from selling excess emission rights if, in exchange, they agree to growth targets that are essentially "business as usual" (BAU). While such a proposal points out one of the economic inducements for a developing country to agree to a target, it should not be used as the center point of State's negotiating strategy with developing countries. [Other economic benefits of a ratified treaty such as possible carbon leakage, decline in world oil prices, premature retirement, in developed countries of less efficient capital equipment stock that would be available at distress prices, etc. would be more effective in persuading LDC to ante up to help us ratify the Treaty in Congress.]

Moreover, it may be imprudent, as some DOS drafts do, to publicize our estimates of specific dollar value of gains (e.g. $1.6 billion in the case of India) that a particular LDC may realize from a BAU target and trade agreement. Such estimates are very imprecise and they depend upon a number of tenuous assumptions. Moreover, the gains to an LDC declines rapidly as other major LDCs sign up. Also, focus on such estimates could encourage unacceptable demands by LDCs for larger and guaranteed payoffs and make such target and trade agreements unlikely to be acceptable to the Treaty's Congressional critics (due to implied cash transfers from developed countries to LDCs) as well as to its to environmental critics (due to the potentially unbounded increases in hot air such a policy may create).

From an LDC perspective, the costs (of measurement, reporting, accountability) and the benefits (dollar value of selling surplus emission credits) from "target and trade" must be compared with those it can obtain from CDM. The CEA estimates of gains from a target and trade agreement do not subtract out the gains that could be obtained without such agreement, from CDM. Granted CDM is project based and may have a higher transaction cost per project (e.g. those for getting the project funded and approved), but CDM does not impose on the LDC any national requirements that participation in a trading system would. CDM, however, requires each project to have "additionality" while the target and trade system does not. Additionality disqualifies windfall gains from activities that would have taken place anyways. Additionality requirements need to also be built into the BAU targets of LDCs in order to prevent creation of "hot air" from such agreements. Such additionality requirements could take the form of BAU target modifiers based on specific events. However, such modifiers are difficult to design and more difficult to negotiate. Instead, it may be more appropriate to get LDCs to commit to efficiency targets, such as emissions per unit of GDP, which I had discussed in my India paper.

If a careful definition of BAU to include all factors that may affect a country's emissions is not done, then a country with a BAU target may be able to reap windfall surplus of emission rights (and consequently profits) from a number of events such as:

- an unexpected slowdown in its rate of growth
- unplanned construction of an irrigation dam leading to a planting of orchards
- unanticipated depletion of its coal resources and switch to other fuels (as in UK)
- a newly discovered gas field leading to switch away from coal
- Energy efficient technology that is embodied in new plant installations and equipment, and that becomes routinely available at no extra cost from all vendors.

Note that unless such future events are predicted with a fair degree of certainty and reflected in the negotiated BAU target, a developing country could reap some windfall gains in terms of emission rights surpluses. Recognition of this possibility could lead to "adverse selection," i.e., LDCs expecting an unpublicized decline in their emissions (compared to a BAU growth target based on recent past) may agree to the BAU targets and each may thereby profit unduly from the resulting "hot air." This hot air would be sold to Annex-I countries to help decrease their obligations and, as a result, total world emissions could increase as a result of offering this target and trade option to LDCs, compared to not offering it.

Nor is adverse selection the only mechanism for creating this "hot air" in the target and trade system. The same result would obtain if there was a repeated bias towards overestimating emissions in setting BAU targets. Alternatively, an LDC may argue that it cannot predict its emissions with certainty and, because the LDC may consider itself risk averse, it may insist that its target be set above its BAU in order to reflect a premium for the risk that its emission growth may, due to unforseen events, accelerate and exceed its target.

Thus, we need to be cautious in how we negotiate the definition of meaningful participation and the details of specific targets for LDCs. Alternative definitions of meaningful participation need to be analyzed in order to sort out those that seem promising and likely to lead to acceptable outcomes in the international negotiation process. In the earlier paper on India, I have made the case for using efficiency (i.e. emissions per unit of GDP) as an LDC target. Other alternatives for meaningful participation are: a delayed budget period for LDCs, a commitment triggered by a threshold level of per capita income and, policies and measures such as energy efficiency standards for new power plants. Alternatively, developed countries should be permitted to adopt border tariffs on imports from non Annex-I countries (subject to an injury determination as in countervailing duty cases) in order to undo the competitive disadvantage energy intensive industries in Annex-I may suffer due to a cap on their CO2 emissions.

Which of the definitions of meaningful participation we should promote depends on iterative negotiations between what the Congress will accept and what can be achieved in the international negotiations. If Congressional demands for LDCs commitments stems primarily from competitiveness concerns, then LDC commitments in the form of specific "policies and measures" in energy intensive industries, particularly from LDCs that are our trade competitors may be an acceptable compromise. If fairness is the prime Congressional motivation for LDC commitments,

then base year emission targets (comparable to Annex-I) triggered by a per capita income threshold may be more acceptable.

Meaningful Participation" from my earlier paper on India:

For the Indian businessmen, a simple commitment to undertake some **modified binding limits after a threshold per capita GDP level has been attained** will be most easy to accept. This approach will avoid the pitfalls of a complicated formula approach that Indians will use as an excuse to claim that the appropriate metric should be per capita emissions. Most businessmen are short term oriented and the easiest commitments to make are those that are conditioned on their becoming rich, particularly if they believe the commitment may help them get rich faster (due to expectations of carbon leakage and increased USG assistance in promoting joint ventures and technology licensing between U.S. and Indian firms). Coupled with the limits, there should be a commitment on undertaking no regrets measures (particularly energy efficiency), promoting forestry management and structural uses of wood products, improving bovine health to reduce methane gas (cows are sacred and India has the largest population of cows in the world), renewable energy R&D, weather research, reducing methane from rice cultivation, etc.

In arguing before government bureaucrats and economists, we need to be careful and avoid discussions that lead to comparisons of per capita emissions. Some leading Indian environmentalists have been using the per capita emissions argument to either excuse India from any commitments or to demand that developed countries have an obligation to transfer technology and funds to India to help it adapt to climate change. The U.S. has done well so far in avoiding per capita emission comparisons by framing the discussion in terms of reductions for each country measured as:

percentage reductions from the country's emissions in a base year, i.e., 1990.

For discussions with LDC officials on meaningful participation and arriving at LDC targets in terms of a formula, emissions may be thought of as the product of :

Population x emissions/GDP x GDP/population

Developing countries have a stake in reducing their population growth in order to improve their per capita income and we /USAID/ World Bank can help with population control assistance (hopefully in a manner that does not alienate domestic religious constituencies in America.)

Emissions/GDP are a function of historical trend and income level. We want developing countries to agree to lower their emissions/GDP below their 1990 levels by an amount that is a function of their per capita GDP level. (Reference to 1990 is to create a perception of parallelism in commitments.) At a certain threshold level of per capita GDP, we expect them to graduate to Annex-I. Lowering their emissions per GDP may be done through: policies and measures on new plant and investment (as recommended in the interagency papers on International Financial Initiatives and the power plant initiative) AND renovation/retrofits to

improve the energy efficiency of existing capacity, which may be the basis of CDM projects. For CDM projects, focusing on retrofit energy efficiency opportunities (or reforestation and afforestation opportunities) has the added benefit of reducing (though not eliminating) the problems of proving additionality.

If developing countries agree to limit the first two terms above, they will experience an acceleration in their GDP/capita because we will help promote trade and investment opportunities for them (as per the interagency paper on International Financing Institutions, assistance with tech licensing, USAID projects, and rights to trade in permits, which, according to analysis by CEA, could develop substantial revenues for India). Currently, China enjoys more than 10 times the foreign direct investment inflows than India, indicating a potential for substantially increasing inflows into India through adequate policy reforms and trade promotion.

If Indians argue for per using capita emissions, then one may point out some drawbacks of using an emissions per capita numeric, such as :

--- it does not promote energy efficiency
--- it does not promote population control and unduly rewards countries with fast growing populations such as Nigeria, Kenya, Pakistan (which has a 3% growth rate compared to India's 2 percent) and more densely populated countries such as Bangladesh, Indonesia, and China
--- it discourages developed countries to continue liberal immigration policies

In conclusion, we are in for a long negotiation that will tax our patience and perseverance. In the meantime we should develop a more refined strategy to educate various constituencies in LDCs on the benefits of meaningful participation and, at the same time, lower expectations in the U.S. Congress about what we can get from LDCs in the short run.

P S: Incidentally, CDM has a specific requirement to ensure additionality, but its focus is limited to the project. Thus, if sinks are included as CDM projects and there are no safeguards, one could have a country burning forests in one of its regions and at the same time claim credit for CDM projects to plant trees in another.

PS 2: The President is expected to address the World Energy Congress in Houston this September. US Energy Association is contemplating inviting the Indian Prime Minister at the same conference. You may wish to contact USEA Director Barry Worthington or Bob Ichord at USAID on this issue.

DEPARTMENT OF STATE
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FAX COVER SHEET

TO:	Wes McGrew	**PHONE:**	622-2876
		FAX:	622-1273
FROM:	**Victoria A. Greenfield**	**PHONE:**	**202-647-6985**
		FAX:	**202-647-5713**
DATE:	5/26/98	**TIME:**	noon

Number of pages including cover sheet: 12

Subject: Climate Change

Messages: Per our discussion, I am sending a package of climate-related information:

1. State Dept Kyoto Fact Sheet (5 pages)
2. Background Paper - Staff level draft (1 page)
3. General Talking Pts - Staff level draft (1 page)
* 4. Proposed Climate Strategy - Staff level draft (4 pages)

I look forward to meeting with you @ 9:30 tomorrow. Joe Aldy & Jim Rubin will also attend. (Joe Aldy is @ CEA & Jim Rubin is @ WH Task Force.)

* This draft does not reflect recent changes in the "primary goal" for the BNC. The next iteration of the Proposed Climate Strategy will incorporate these revisions.

The Kyoto Protocol on Climate Change
Fact Sheet released by the Bureau of Oceans and International Environmental and Scientific Affairs
January 15, 1998

BACKGROUND

At a conference held December 1 - 11 1997, in Kyoto, Japan, the Parties to the UN Framework Convention on Climate Change agreed to an historic Protocol to reduce greenhouse gas emissions by harnessing the forces of the global marketplace to protect the environment.

The Kyoto Protocol in key respects -- including emissions targets and timetables for industrialized nations and market-based measures for meeting those targets -- reflects proposals advanced by the United States. The Protocol makes a down payment on the meaningful participation of developing countries, but more needs to be done in this area. Securing meaningful developing country participation remains a core U.S. goal.

EMISSIONS TARGETS

A central feature of the Kyoto Protocol is a set of binding emissions targets for developed nations. The specific limits vary from country to country, though those for the key industrial powers of the European Union, Japan, and the United States are similar -- 8% below 1990 emissions levels for the EU, 7% for the U.S., 6% for Japan.

The framework for these emissions targets is based largely on U.S. proposals:

- Emissions targets are to be reached over a five-year budget period as proposed by the U.S., rather than by a single year. Allowing emissions to be averaged across a budget period increases flexibility by helping to smooth out short-term fluctuations in economic performance or weather, either of which could spike emissions in a particular year.
- The first budget period will be the U.S. proposal of 2008-2012. The Parties rejected proposals favored by others, including budget periods beginning as early as 2003, that were neither realistic nor achievable. Having a full decade before the start of the binding period will allow more time for U. S. companies to make the transition to greater energy efficiency and/or lower carbon technologies.
- The emissions targets include all six major greenhouse gases. The EU and Japan initially favored counting only three gases -- carbon dioxide, methane, and nitrous oxide. Ensuring the inclusion of the additional gases (synthetic substitutes for ozone-depleting CFCs) that are highly potent and long-lasting in the atmosphere provides more comprehensive environmental protection and lends more certainty concerning the treatment of the additional gases.
- Activities that absorb carbon, such as planting trees, will be offset against emissions targets. The treatment of these so-called "sinks" was another controversial issue at Kyoto. Many countries wanted sinks to be excluded. The United States insisted that they be included in the interest of encouraging activities like afforestation and reforestation. Accounting for the role of forests is critical to a comprehensive and environmentally responsible approach to climate change. It also provides the private

sector with low-cost opportunities to reduce emissions.

No. The 7% target represents at most a 3% real reduction below the Presidentís initial proposal of reducing greenhouse gases to 1990 levels by 2008-2012. The remaining 4 percentage points result from certain changes in the way gases and sinks are calculated and do not reflect any increase in effort as compared to the Presidentís original proposal.

Changing the baseline for the three synthetic greenhouse gasses from 1990 to 1995 accounts for about 1% of the 7% reduction. Use of these three gases has grown since 1990, so that permitting a 1995 baseline allows for a higher overall baseline than the Administration assumed last October when the President announced his goal of reaching 1990 levels by 2008-2012. Making reductions to meet a higher baseline is of course easier than making reductions to meet a lower baseline. Had the United States maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift to a 1995 baseline for the three synthetic gases would, alone, have transformed the President's goal of 1990 levels into a goal equivalent to 1% below 1990 levels.

Altering the accounting method for carbon-absorbing activities, such as planting trees, accounts for about 3% of the 7% reduction. The Presidentís original goal assumed that the 1990 baseline would be lowered by carbon-absorbing activities, but under the method agreed in Kyoto, such activities do not lower the 1990 baseline. Because the 1990 level baseline is thus higher under the Kyoto agreement, the U.S. target becomes somewhat less stringent. Specifically, had the U.S. maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift in the accounting method for carbon-absorbing activities would, alone, have transformed the President's goal of 1990 levels into a goal equivalent to at least 3% below 1990 levels. (As noted above, certain carbon-absorbing activities will count against emission reduction commitments in the budget period.)

INTERNATIONAL EMISSIONS TRADING

The United States prevailed in securing acceptance of emissions trading among nations with emissions targets. This free market approach, pioneered in the U.S., will allow countries to seek out the cheapest emissions reductions, substantially lowering costs for the U.S. and others.

Under an emissions trading regime, countries or companies can purchase less expensive emissions permits from countries that have more permits than they need (because they have met their targets with room to spare). Structured effectively, emissions trading can provide a powerful economic incentive to cut emissions while also allowing important flexibility for taking cost-effective actions.

The Kyoto Protocol enshrines emissions trading. Rules and guidelines -- in particular for

verification, reporting, and accountability -- are to be discussed at the next meeting of the Parties at Buenos Aires in November 1998.

The inclusion of emissions trading in the Kyoto Protocol reflects an important decision to address climate change through the flexibility of market mechanisms. Led by the United States, the Conference rejected proposals to require all Parties with targets to impose specific mandatory measures, such as energy taxes.

The United States also reached a conceptual agreement with a number of countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to pursue an umbrella group to trade emissions permits. Such a trading group could further contribute to cost-effective solutions to this problem.

JOINT IMPLEMENTATION AMONG DEVELOPED COUNTRIES

Countries with emissions targets may get credit towards their targets through project-based emission reductions in other such countries. The private sector may participate in these activities.

Additional details may be agreed upon by the Parties at future meetings.

CLEAN DEVELOPMENT MECHANISM

Another important free market component of the Kyoto Protocol is the so-called "Clean Development Mechanism" (CDM). The CDM embraces the U.S. proposal for "joint implementation for credit" in *developing* countries.

With the Clean Development Mechanism, developed countries will be able to use certified emissions reductions from project activities in developing countries to contribute to their compliance with greenhouse gas reduction targets.

This Clean Development Mechanism will allow companies in the developed world to enter into cooperative projects to reduce emissions in the developing world -- such as the construction of high-tech, environmentally sound power plants -- for the benefit of both parties. The companies will be able to reduce emissions at lower costs than they could at home, while developing countries will be able to receive the kind of technology that can allow them to grow more sustainably. The CDM will certify and score projects. The CDM can also allow developing countries to bring projects forward in circumstances where there is no immediate developed country partner.

Under the Clean Development Mechanism, companies can choose to make investments in projects or to buy emissions reductions. In addition, Parties will ensure that a small portion of proceeds be used to help particularly vulnerable developing countries, such as island states, adapt to the environmental consequences of climate change.

Importantly, certified emissions reductions achieved starting in the year 2000 can count toward compliance with the first budget period. This means that private companies in the developed world will be able to benefit from taking early action.

DEVELOPING COUNTRIES

Various Protocol provisions, taken together, represent a down payment on developing country participation in efforts to reduce greenhouse gas emissions:

- Developing countries will be engaged through the Clean Development Mechanism, noted above.
- The Protocol advances the implementation by *all* Parties of their commitments under the 1992 Framework Convention on Climate Change. For example, the Protocol identifies various sectors (including the energy, transport, and industry sectors as well as agriculture, forestry, and waste management) in which actions should be considered in developing national programs to combat climate change and provides for more specific reporting on actions taken.

Developing countries may, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets. The Kyoto Protocol does not include a separate article for nations to voluntarily assume binding emissions targets.

Securing meaningful participation from key developing countries remains a priority for the United States. The Administration has stated that without such participation, it will not submit the Kyoto Protocol to the Senate for advice and consent to ratification.

MILITARY EMISSIONS

The Kyoto Protocol achieves the objectives identified by the Department of Defense where international agreement was necessary to protect U.S. military operations.

- Emissions from "bunker" fuels (for international maritime or aviation use) are exempted from emissions limits.
- Emissions from multilateral operations pursuant to the United Nations Charter are exempted from emissions limits. This includes not only multilateral operations expressly authorized by the UN Security Council (such as Desert Storm, Bosnia, Somalia) but also multilateral operations not expressly authorized that are nonetheless pursuant to the UN Charter, such as Grenada.
- Countries may decide, among themselves, how to account for emissions relating to multilateral operations (for example, U.S. training in another NATO country). This provision avoids the need to use emissions trading to allocate such emissions.

COMPLIANCE AND ENFORCEMENT

The Protocol contains several provisions intended to promote compliance. These include requirements related to measurement of greenhouse gases, reporting, and review of implementation.

The Protocol also contains certain consequences for failure to meet obligations. For example, as a result of a U.S.-proposed provision, a Party not in compliance with its measurement and reporting requirements cannot receive credit for joint implementation projects.

Effective procedures and a mechanism to determine and address non-compliance are to be decided at a later meeting. For both environmental and competitiveness reasons, the United States will be working on proposals to strengthen the compliance and enforcement regime

under the Protocol.

ENTRY INTO FORCE

The Kyoto Protocol will be open for signature in March 1998. To enter into force, it must be ratified by at least 55 countries, accounting for at least 55 percent of the total 1990 carbon dioxide emissions of developed countries. U.S. ratification will require the advice and consent of the Senate.

Return to: Climate Change | Environment and Development

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Stakis draft

BACKGROUND PAPER

Mexico is the only Latin American country on the list of the world's 15 largest emitter countries. As a member of the OECD and NAFTA, Mexico tends to identify more often with the industrialized countries than with the Group of 77. It also sees itself as a regional leader in the Caribbean and in Latin America. The GOM sees Mexico, Argentina, and Korea as "intermediate" countries in the climate change negotiations.

Mexico does not share the view that Kyoto was unsuccessful, and characterizes the Conference as an "excellent" first step in an ongoing process. Mexico has accepted its responsibilities with regard to global climate change and has stated its intention to proceed to reduce its rate of increase in greenhouse gas (GHG) emissions. It is initially focusing on the energy sector, the forestry industry, and heavy industry. However, economic growth is the overriding concern of the GOM, which wants to create one million new jobs each year in the formal economy. Mexico will not sacrifice its economic growth to achieve climate change goals.

The Government of Mexico (GOM) has already adopted an ambitious National Action Plan on Climate Change which, if successfully implemented, will significantly mitigate the rate of GHG emissions growth. The GOM also appears interested in the potential benefits of emissions trading, but is opposed to per capita emissions quotas. The GOM has expressed interest in the Clean Development Mechanism (CDM) as a means of accelerating foreign direct investment into high tech projects. The GOM is also positively inclined to developing country participation (with several caveats), and remains enthusiastic about joint implementation programs.

The GOM welcomes any further opportunity for technical and political dialogue on climate change. The GOM's Interagency Coordinator for Climate Change, Dr. Fernando Tudela, characterized climate change as "under-explored", and offered to create with the USG a "mechanism of interchange." Our Embassy in Mexico believes the creation of such a mechanism for policy consultation/coordination between the USG and the GOM could prove beneficial to the outcome of the COP-4 in the area of voluntary obligations for developing countries.

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Briefing draft

TALKING POINTS

1. The U.S. applauds Mexico's view of Kyoto as an "excellent first step" in the ongoing process of forging a global partnership on climate change, especially its support for including a provision on voluntary commitments by developing countries (Article 10).

2. Mexico is to be complimented for actions already taken to combat the negative effects of climate change, to wit: establishment of an Interagency Coordinator for Climate Change; preparation of a National Action Plan; emissions mitigation efforts in the energy sector, forestry industry, and heavy industry; participation in Joint Implementation projects; and natural gas-for-oil substitution projects.

3. While the U.S. understands Mexico's concerns about its economic growth, climate change policies and programs can be designed to foster such growth, not hinder it. New clean technologies can make industry more competititve while reducing air pollution.

4. As a member of NAFTA and OECD, and as a leader state in Latin America and the Caribbean, the U.S. encourages Mexico to endorse voluntary, graduated mechanisms at the forthcoming climate change meeting in Bonn and at COP-4 in Buenos Aires; to encourage with others a coordinated developing country stand on voluntary commitments; and to take on for itself binding emissions growth targets by COP-5.

5. The U.S. also notes Mexico's keen interest in the potential benefits of emissions trading, the Clean Development Mechanism (CDM), and joint implementation. A voluntary commitment on binding emissions growth targets is key to reaping the benefits of these programs under the Kyoto Protocol.

6. The U.S. looks forward to continued cooperation through existing joint programs and projects, and to establishing a regularly scheduled joint consultative process on climate change (mechanism of interchange) for policy consultation and coordination between our two governments.

Rub. Analysis

5/6 DRAFT- NOT CLEARED
PRE-DECISIONAL/DO NOT CITE

PROPOSED CLIMATE STRATEGY FOR BINATIONAL COMMITTEE MEETING

Goal: To engage Mexico in meaningful participation under the Kyoto Protocol and the FCCC. The primary goal would be to persuade Mexico to commit to a binding target that limits emissions growth ("growth target"). Other important goals would include encouraging the setting of standards for energy efficiency, the funding of new projects or modifying existing projects to increase efficiency and lower emissions; and the active implementation of a National Action Plan on Climate Change. In any event, we should work with Mexico to promote the development of the Clean Development Mechanism. Ultimately, we should urge Mexico to take a greater leadership role with the rest of Latin America by participating more meaningfully in the Protocol and FCCC.

Means: There are a number of bilateral opportunities for constructive engagement, including the June 10-11, 1998 Binational Commission (BNC) to be held in Mexico. The BNC will bring together senior U.S. and Mexican officials on a wide-spectrum of issues, and offers opportunities to engage the Mexicans simultaneously on a number of related fronts. The BNC meetings are usually pre-scripted and noncontroversial, based around deliverables where possible. Hence, significant efforts would need to be made well before the actual BNC to get climate change topics on the various agendas and deliverables negotiated. The U.S. interagency process for the BNC has been underway for some time and consists of 16 working groups headed by one or more agency representatives.

Overall Strategy: There would be four pieces to a climate change BNC strategy:

(1) identify relevant working groups;

(2) determine climate change goals, issues or deliverables;

(3) engage U.S. agency lead;

(4) engage Mexican counterparts and negotiate agendas, deliverables.

We should coordinate our efforts closely with State, particularly ARA, which oversees the BNC interagency process.

Specific Strategy:

Identifying working groups. There are two working groups that appear as obvious choices for engagement: Environmental and Natural Resources (EPA lead) and Energy (DOE lead). Other potentially relevant subgroups include Agriculture (USDA lead); Bilateral Relations (DOS lead); Fiscal, Financial and Customs (Treasury lead); Science and Technology (DOS lead); and Transportation (DOT lead). Finally, more peripherally relevant working groups include

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Education and Cultural Affairs (Education lead); Health (DHHS lead); Housing and Urban Development (HUD lead); Labor (DOL lead); and Trade and Investment (USTR lead). Although a broad spectrum approach would be useful, it would probably be most effective to concentrate on a limited number of these working groups, since climate change may be seen as quite a stretch for some.

Goals, Issues or Deliverables

A. Environment and Natural Resources - This is probably the most logical place to discuss the importance of Mexico's taking significant actions to address climate change. The Mexican environmental agency, SEMARNAP, would probably be the most agreeable to these actions, but it is not the most powerful force in the Mexican political process. EPA has also done some preliminary work in this area. We should focus discussions here on the importance of Mexico taking on a growth target to reduce emissions and achieve a leadership role within the Latin American world and other developing countries. In addition, we could stress our support for full implementation of the National Action Plan and completion of national communications. We could also focus on strategies to reduce overall air pollution and deforestation. Finally, we can discuss the environmental and natural resource threats posed by climate change and the need to develop mitigation strategies. One possible deliverable could be the establishment of a formal "mechanism of interchange," proposed by the lead Mexican climate change official, Dr. Fernando Tudela, which could serve as a mechanism for further policy consultation and coordination. Other deliverables could include further US participation in ongoing EPA-Mexico projects and support of National Action Plan projects. Finally, we could discuss potential initiatives on joint implementation (Mexico has three projects in land use and forest management).

B. Energy - Rather than push a particular target in this group, we could discuss cooperative development projects for energy efficiency and renewable energy. DOE has also done some preliminary work in this area. We could discuss strategies for development of natural gas resources and infrastructure and support efforts to shift to natural gas in electric generation. We could promote independent ownership and operation of electric power plants and enhancement of electricity trade across the border to defer construction of new power plants. We could discuss the benefits of new technologies such as efficient lighting programs and incentives, improving the efficiency of industrial boilers, cogeneration of electricity and renewable energy. In terms of deliverables, we could agree to further US participation in ongoing DOE-Mexico projects. Similarly, we could discuss further initiatives on joint implementation in the energy field (there is one project in rural renewable energy; one wind power project is under review).

C. Agriculture - As with energy, it may be more useful to focus on specific climate-related issues and initiatives in the agricultural sector than on targets. Topics may also overlap with environment and natural resources, depending on how and where forestation issues are considered. Discussions could focus on more efficient uses of power for agriculture, cattle grazing efficiencies, forest management, and other methods of reducing emissions from the agricultural sector.

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D. Bilateral Relations - To the extent this working group focuses on broad bilateral issues, it could provide another forum for discussion of a growth target and overall participation of developing countries. We could also discuss in this group establishing a mechanism for further policy coordination and consultation on climate change (see above).

E. Fiscal, Financial and Customs - This group could provide a forum for discussion of a target, with the emphasis on ensuring economic growth. We could also discuss the economic benefits from industrial modernization and development of environmental technologies. We should particularly emphasize the economic benefits from participation in emissions trading and joint implementation under the Protocol. We could also discuss the CDM in this forum.

F. Health - This group could focus on health threats from climate change. Projects might include the improvement and dissemination of vulnerability assessment capabilities. We could also focus on the health benefits of reduced emissions of pollutants through greater efficiency and use of renewable energy.

G. Science and Technology - This could be another useful forum for discussion of specific climate change matters, especially because State/OES leads the interagency process here. We could focus on scientific and technical issues concerning monitoring and measurement of emissions, and adaptation and mitigation of impacts from climate change. We could also discuss advanced technologies in emissions reductions, such as energy and fuel efficiencies. In terms of deliverables, this group has already discussed setting up a bilateral science foundation. That foundation could be tasked with undertaking one or more climate change initiatives.

H. Transportation - This group could also discuss specific issues and initiatives in the transportation sector. For example, we could discuss the role that transportation plays in emissions, and how such emissions can be reduced through increase in mass transit and development and use of more fuel efficient or alternative fuel vehicles.

I. Education and Cultural Affairs - This group could discuss cooperative efforts in educating our publics about the importance of climate change and ways to address it. There appears to be weak public support of climate change policies in Mexico.

J. Housing and Urban Development - This group could provide a forum for discussion of energy efficient construction and urban development issues that promote more efficient energy usage.

K. Labor - This group could discuss ways of minimizing adverse effects on labor that might arise from emissions reductions strategies.

L. Trade and Investment - This group could provide another forum for discussion of emissions trading and joint implementation as well as the clean development mechanism. There could also be a focus here on the development and promotion of environmentally friendly

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technologies.

Engaging U.S. Agency Leads

The immediate task would be to gain high level political direction to move forward on climate change issues on a broad front. We would probably need to coordinate the overall effort with State/ARA. We will also need to coordinate with the agency representatives heading up the working groups who are developing BNC agendas to negotiate with the Mexicans. There may be resistance to adding climate change issues to already crowded agendas, particularly where the links are not clear or direct, or where the goals and issues are controversial. Any resistance could probably be addressed by focusing on the most useful fora and receiving high level guidance. We will need to act quickly as several working groups are already proposing agendas, and there will be little time to negotiate with the Mexicans.

Engaging Mexican Counterparts

Once we have worked with agency representatives to propose agenda, goals and deliverables, we need to work with Mexican officials to agree to these approaches. This will probably prove to be the most difficult part of the process for several reasons. First, the BNC is a pre-scripted event built around fairly non-controversial discussions. Controversial issues, particularly regarding a binding target, may be not lend themselves to such a forum. Even though Mexico has acknowledged its climate change responsibilities and seems positively inclined toward further involvement in the Kyoto Protocol, its paramount concern remains its economic development. It will not likely agree to take on a target that would restrain its economic growth. Moreover, Mexico may not be willing to be the first - or only - nonAnnex 1 country to join the Kyoto Protocol. Mexico also may be somewhat constrained in its ability to implement national policies and procedures in view of its decentralized regulatory structure. Mexico's powerful state owned oil and electricity companies may also resist large scale changes in the Mexican energy policy. Lastly, Mexico will not want to feel or appear to be pressured into taking on a target or other significant obligations, especially by the United States. We would need to consider how to pitch our messages in a sufficiently nonconfrontational way and offer appropriate incentives or tradeoffs.

Draft Agenda:
Technical Support for Macroeconomic Analysis in Developing Countries:
Carbon Mitigation Policy Analysis

Introduction and Overview of Carbon Mitigation Options

Presenter: Senior Political Appointee(s)

1 Topic: Overview of Economics of Carbon Mitigation (Compare/contrast alternate approaches and their findings

Potential Presenter: Weyant, other EMF Participants

2 Topic: Common Challenges Encountered when Applying Tools of Economic Analys to non-OECD and Potential Solutions

Potential Presenter: Jayant Sathaye

3 Topic: Bottom Up Models: Overview, Strengths and Weaknesses

Potential Presenter: (DOE nomination?)

* Markal Macro (specific country application)
* (others? E.g., ETO?)

4 Topic: Top-Down Models: Overview, Strengths and Weaknesses

* SGM (Jae Edmonds)
* Presentation of SGM China, India, Mexico and/or Brazil Regional Model by in-country collaborator(s)
* Jorgenson China CGE Model(D. Jorgenson or Karen Fisher Vanden)

5 Topic: Co-Control Benefits of Carbon Mitigation

Overview of the discrete steps

* carbon mitigation policy impacts on conventional pollutant emissions
* assessing changes in air quality attributable to change in emissions
* application of dose/response functions to affected populations and ecosystems

FAX TRANSMITTAL

* valuing changes in environmental quality

Potential Presenter(s): Representative individual or tag team from Lancet article co-authors, World Bank researcher(s)

6 Topic: Economic analysis of carbon sequestration options

Presenter:

7 Topic: Economic analysis of "other gases" mitigation costs

Presenter:

Overview and Conclusion/Next Steps

U.S. Position Paper

DEVELOPING COUNTRIES

The Kyoto Protocol takes several steps toward engaging developing countries in responding meaningfully to climate change. Specifically, it: (1) Identifies sectors in which actions should be considered and requires more specificity than the Climate Convention in reporting on actions taken; (2) defines a new Clean Development Mechanism to promote project activities in developing countries that reduce greenhouse gas emissions; and (3) does not preclude developing countries for taking on binding emissions limitation commitments and participating in emissions trading (through amendment of the Protocol).

Still, these provisions do not amount to "meaningful participation" as called for by the President. They also fall well short of the Byrd/Hagel standard -- "quantified emissions limitation commitments in the same compliance period [as developed countries]." Until we achieve meaningful participation from key developing countries, the President has said that he will not send the Protocol to the Senate.

To move forward we will need a two pronged effort: (1) We must work to win support in the Senate for the President's approach by promoting a better understanding of the differences among developing countries, of the steps that many are now taking and of the need for a differentiated approach; and (2) we must intensify our diplomatic efforts by promoting unity among developed countries and acceptance of the need to act among key developing countries. We should be open to how "meaningful participation" is recorded – we should not necessarily insist that it take the form of commitments contained in the Kyoto Protocol or another legal instrument.

Indicia of Meaningful Participation

We have identified six indicia to use in assessing "meaningful participation":

1. **Compliance with the Framework Convention on Climate Change/ Kyoto Protocol** (are countries actively participating in these fora and meeting their commitments?);
2. **technology transfer/diffusion/investment** (to what extent are countries receptive to and facilitating efforts in these areas?);
3. **domestic policy reform/implementation** (what domestic actions are countries taking to address climate change?);
4. **long-term commitments, including targets** (to what extent are countries willing to consider, accept and/or adopt growth targets?);
5. **national action plan** (have countries prepared them, or are they seeking to do so?);
6. **capacity building and public education** (what efforts are countries making in these areas?).

Key Countries

One country rivets Senate attention – China. To a lesser degree, India and Brazil also attract Congressional interest. While these three countries are certainly "key", they are among the most difficult to move. It will be extremely difficult in the near term to persuade them to adopt binding targets to limit emissions growth.

Other developing countries are likely to be more receptive in the near term. For this reason, we must work with a broader cross-section of these countries to change the dynamic within the G-77. If we can generate some momentum in the near term, it will grow over time and will increasingly influence China, India and Brazil.

Consequently, we are focusing on 29 developing countries. These stand out because of their total greenhouse gas emissions, their level of per capita income, or both. They fall into three loose categories, where high and low refer to total emissions and rich and poor refer to per capita income: (1) high/rich (Mexico, Korea); (2) low/rich (Singapore, United Arab Emirates); and (3) high/poor (China, India).

However, we should recognize (and seek to impress upon the Senate) that most of the 132 current members of the G-77 fall into a fourth category – low/poor. We should use the same six indicia in evaluating the extent to which countries in this category are participating meaningfully, but expectations as to how much they can do or how far they can go should be lower than with respect to the large emitters and the wealthy.

We have begun an internal assessment of the extent to which these 29 developing countries are participating meaningfully. In each case, we are developing specific country profiles and strategies, beginning with China, India, Brazil and Mexico. Over time, this effort will extend to the full 29. These assessments will provide the basis for specific bilateral diplomatic efforts. We will soon begin to make public our assessment process in Congressional testimony to demonstrate that the Administration is moving forward seriously on this issue. In addition, Under Secretary Eizenstat recently urged the OECD to begin an analytical effort to evaluate the potential for developing country action. If undertaken by the OECD, that effort will help to solidify support among developed countries for engaging developing countries more meaningfully. If established, the new G-8 Working Group should also help in this.

Long Term Goal

Clearly, binding targets to limit emissions growth should be the ultimate goal for all developing countries. Lesser commitments (e.g. energy efficiency improvements, increased share of renewables in the national energy mix, fuel switching, energy taxes) may be valuable, we should not accept them as substitutes for binding emissions growth targets for advanced developing countries.

For the first budget period (2008-2012) we should encourage as many countries as possible to adopt growth targets. Simultaneously, we should encourage broadening this effort to additional countries for the second budget period.

Voluntary Commitments in the First Budget Period

Focus on economic benefits of T+T

Voluntary commitments (to binding growth targets) should be pursued both in the Convention process and outside of it. Within the Convention process, Argentina has called for this issue to be placed on the agenda for COP-4 in Buenos Aires. Between now and then, we must continue efforts – as we did at the Santiago Summit of the Americas – to recruit support for such commitments from key developing countries. Outside the Convention process, we should seek to begin an informal dialogue with select developed countries and sympathetic developing countries to encourage consideration of voluntary commitments to binding growth targets. In this regard, we should stress the advantages to "volunteers" of participating in emissions trading. Such an informal process can be started initially through a series of bilateral discussions; ultimately we should seek to bring a group of "like-minded" countries together.

Creating Expectations for the Second Budget Period

We should also begin now to broaden this effort for the second budget period to additional developing countries. This can be done by enlisting the support of developed country partners for this approach in various fora (e.g., the G-8 process, U.S.-E.U. High Level Consultations, the U.S.-Japan Common Agenda, the U.S.-Russia Climate Policy Group, the OECD and the IEA). It can also be done in bilateral contacts at various levels in developing countries. Creating the expectation that key developing countries are expected to sign up to binding growth targets -- at the latest, by the second budget period -- will be essential.

We can also pursue this objective in the Convention process, by supporting consideration of binding growth targets in the context of the reviews of all Parties' commitments under Article 7.2(a) of the Convention and Article 9 of the Kyoto Protocol.

Need for Further U.S. Action

Finally, we should consider a range of new U.S. initiatives to support the efforts of developing countries to engage more fully in responding to climate change, including: (1) a program to help build capacity in certain key advanced developing countries to undertake macro-economic analysis related to climate change response options and to use climate models; (2) a new (expanded) program to support developing country efforts to develop national action plans for climate change, and (3) a program to promote climate change technology needs assessments in key developing countries. The U.S. Clean Growth Initiative (which is the subject of a separate paper) will also form a part of these efforts.

MEMORANDUM

TO: Distribution

FROM: Clare Breidenich, EPA/OPPE

RE: Technical Analysis of Brazilian Protocol Proposal

DATE: April 4, 1998

Please find attached the technical analysis of the Brazilian Protocol Proposal discussed at today's Interagency Working Group on Climate Change meeting. I have also enclosed a three page memo summarizing the analysis and the results. Please note that this analysis is provided for internal discussion and review only. Comments would be greatly appreciated. I can be reached at (202) 260 – 6879. Thank You.

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EPA/OPPE Assessment of Brazilian Protocol Proposal

In the negotiations leading up to the Kyoto Protocol, the government of Brazil submitted a proposed framework for GHG emission reduction commitments for all countries. Under the proposed framework, historical and projected energy-related CO2 emissions are translated to changes in global mean surface temperature. Brazil proposes that individual developing countries take on emission targets when the impact of their cumulative emissions on global mean temperature reaches that of Annex I countries. Using this framework, the Brazilian proposal concludes that the impact of developing country GHG emissions, as indicated by contribution to changes in global mean surface temperature will equal those of Annex I countries in 2147.

EPA conducted a technical evaluation of Brazil's proposal, specifically the framework for assigning GHG emission controls to developing countries. While the framework prevents an interesting and potentially workable approach to establishing equitable burden-sharing among developing countries, Brazil's results are not consistent with those derived by EPA under similar analysis. Significant differences are identified below.

Results

- Under Brazil's analysis, which only covers emissions of CO2 from energy and cement production only, the contribution of non-Annex I Parties (as a group) to increase in global mean surface temperature is projected to equal that of Annex I countries as a group in 2147.

- In contrast, EPA's analysis, which includes CO2 from land-use change plus CH4 and N2O, projects the convergence date to occur a century earlier in 2045.

- If one considers other indicators of relative responsibility -- such as cumulative emissions and increase in radiative forcing-- convergence of Annex I and non-Annex I contribution occurs much earlier. Convergence of cumulative emissions is projected to occur in 2023; convergence of contribution to radiative forcing in 2011. A summary table of the critical differences in the modeling assumptions and results is presented below.

Discussion

- Most of the difference in the results can be attributed to three factors: coverage of GHGs included in the analysis, assumptions about 'starting conditions' in 1990 and assumptions about projected future emissions. EPA's analysis included the three major GHGs; Brazil's only covered CO2 from energy and cement production.

- As to starting conditions, EPA's analysis attributed a greater proportion of the contribution to increased temperature in 1990 to non-Annex I countries than the Brazilian analysis -- 40% and 12% respectively. EPA based this assumption on assessment of the relative annual gag emissions of non-Annex I countries in 1990, plus consideration of the fact that non-Annex I emissions have grown faster than Annex I emissions since 1990.

- Additionally, EPA's latest ASF analysis projects a higher growth rate for non-Annex I emissions and slower growth for Annex I emissions than the original IS92a scenario. This difference is primarily due to strong economic growth in non-Annex I countries, particularly Latin America and Southeast Asia, and the economic collapse of the Former Soviet Union.

- These three factors do not completely explain the discrepancies between EPA's and Brazil's results. One possible reason for the unexplained difference is the approach to calculating changes to global mean surface temperature. It is not clear from the Brazilian proposal whether their analysis is based on a cumulative integration of radiative forcing, or whether they incorporated a decay rate to account for atmospheric turnover. If the analysis relied upon the former approach, the results would tend to overestimate the historic contribution of Annex I countries.

- A final point relates to the choice of indicator for assessing the relative responsibility of Annex I and non-Annex I Parties. Several potential indicators could be used: cumulative emissions, contribution to increased atmospheric concentrations, contribution to radiative forcing, and contribution to changes in global mean temperature. While each successive step yields more technical precision in accounting for physical changes in the atmosphere, and, hence, associated impacts, each successive step is also farther removed from the actual emissions activity causing the atmospheric changes and impacts. Therefore, from a policy perspective, it may be more appropriate to consider cumulative emissions or contribution to radiative forcing as indicators of relative responsibility than contribution to change in global surface temperature.

- Regarding timing, it must be noted that there are substantial lags between the dates at which 1) contribution to radiative forcing, 2) cumulative emissions and 3) contributions to temperature increase converge. Under the EPA analysis convergence of contribution to radiative forcing occurs prior to convergence of cumulative emissions because calculation of radiative forcing accounts for GHG decay in the atmosphere. The lag between the convergence dates of cumulative emissions and temperature effects is due to the buffering effect of current levels of GHGs in the atmosphere. Because of the long atmospheric residence time of GHGs, the atmosphere takes a long time to adjust to changes in relative emission levels. Relative contributions to atmospheric concentrations, which are currently disproportionately due to Annex I countries, will thus be prolonged even though relative emission levels change dramatically.

- Options for refining the analysis in future work include:
  - Inclusion of other GHGs, precursors and sulfate aerosols,
  - Analysis of effects of Annex I action, and
  – Technical Consultations to identify additional technical differences in modeling approaches.

Summary of Modeling Inputs and Results

Variable	Brazil	EPA
Relative share of emissions in 1990	Annex I – 68% CO2 from energy and cement only Non-Annex I – 32%	Annex I – 52 % all GAG Non-Annex I – 48%
Assumption about relative regional contribution to increase in CO_2 concentration in 1990	Annex I – 79% Non-Annex I – 21%	Annex I – 79% Non-Annex I – 21%
Assumption about relative regional contribution to increase in temperature change in 1990	Annex I – 88% Non-Annex I – 12%	Annex I – 60% Non-Annex I – 40%
Year of CO_2 *annual* emissions convergence – energy and cement	2037	2011
Year of all GHGs (i.e., CO_2, CH_4, and N_2O) *annual* emissions convergence	Na	1992
Year of all GHGs (i.e., CO_2, CH_4, and N_2O) *cumulative* emissions convergence	Na	2023
Year of convergence of the relative contributions to increase in radiative forcing – all GHGs (i.e., CO_2, CH_4, and N_2O)	Na	2011
Year of convergence of the relative contributions to the temperature increase	2147 (CO_2 from energy and cement)	2045 (All GHGs: CO_2, CH_4, N_2O)

EPA TECHNICAL EVALUATION OF BRAZILIAN APPROACH FOR MEASURING RELATIVE CONTRIBUTION OF ANNEX 1 AND NON-ANNEX 1 COUNTRIES TO GLOBAL CLIMATE CHANGE USING THE ASF MODEL

I. Description of Brazilian Approach

A. Methods

Brazil suggests using the change in the global average temperature caused by anthropogenic GHG emissions to measure the relative contribution of Annex 1 and non-Annex 1 countries to the global climate change.

Emissions of carbon dioxide (CO_2) are used as a proxy for emissions of all the GHGs. These emissions are converted into changes in atmospheric concentartions, radiative forcing, and, finally, temperature using a set of simple equations calibrated to fit the output of the MAGICC box diffusion atmpsheric model.

B. Assumptions

- Emissions of all the GHGs generated by Annex 1 and non-Annex 1countries can be approximated by CO_2 emissions from fossil fuel consumption and cement production.
- CO_2 emissions from 1840 to 1950 can be approximeted by an exponential function developed by fitting the emission values for the period from 1950 to 1973.
- All GHGs have constant atmospheric lifetime.

C. Data

Historic Emissions

CO_2 emissions for the period from 1950 to 1990 from Annex 1 and non-Annex 1 countries were obtained from the Oak Ridge National Laboratory country-level database of CO_2 emissions from fossil fuel consumption and cement production. Emissions for the period from 1840 to 1950 were estimated by extrapolating backwards (using an exponential function) the emissions trend from 1950 to 1973.

Future Emissions

Emissions from 1990 to 2100 for Annex 1 and non-Annex 1 countries were derived from the IPCC IS92a scenario.

D. Results

Brazil estimated that the annual emissions of non-Annex I countries will become equal to the Annex I emissions by 2037 and the resulting change in temperature as measured by the **effective emissions** from non-Annex I countries are estimated to equal that of Annex I countries in 2147.

II. Methods of EPA Evaluation of the Brazilian Proposal

EPA evaluation of the Brazilian proposal is based on the Atmospheric Stabilization Model (ASF), a linked system of models that was originally assembled to perform a quantitative analysis of potential future GHG emissions and emission mitigation options for the EPA Report to Congress on Policy Options for Stabilizing Global Climate (EPA, 1990a) (Appendix A). The ASF was subsequently used to develop the first and the second sets of the IPCC emission scenarios (IPCC, 1990; IPCC, 1992). Both the EPA scenarios and the second set of the IPCC scenarios (IS92 scenarios) were extensively reviewed in a special report of the IPCC (IPCC, 1994).

For the purposes of the current analysis we used a most resent "business-as-usual" scenario EPA1, which is conceptually similar to the IS92a scenario. Two types of emission projections starting from 1990 were used: CO_2 emissions from energy use and cement production only, and emissions of CO_2, CH_4, and N_2O from all the sources. Details of EPA modeling approach to estimate the relative contribution of Annex 1 and non-Annex 1 countries to the global climate change are presented in Appendix B.

Five groups of values were subject to the evaluation: CO_2 emissions from energy use and cement from 1840 and 1990; years when the annual and cumulative emissions from Annex 1 and non-Annex 1 countries converge; years when the contributions of Annex 1 and non-Annex 1 countries to the CO_2 global average concentration converge, years when the contributions of Annex 1 and non-Annex 1 countries to the CO_2 global average radiative forcing converge, and years when the contributions of Annex 1 and non-Annex 1 countries to the global average temperature change converge.

Assumptions about the relative contributions of Annex 1 and non-Annex 1 countries to the global average CO_2 concentration, raditive forcing, and temperature increase in 1990 are critically important to estimating the relative contributions in the future. This analysis uses three different sets of values for 1990 relative contributions which are called the Staring Conditions.

Starting Conditions I: Relative contribution of Annex 1 countries to the 1990 CO_2 concentration is 79% and non-Annex 1 – 21% ;

Starting Conditions II: Relative contribution of Annex 1 countries to the 1990 global average temperature increase is 88% and non-Annex 1 – 12% ; and

Starting Conditions III: Relative contribution of Annex 1 countries to the 1990 global average temperature increase is 68% and non-Annex 1 – 32% .

The Starting Conditions I and II are based on Brazilian proposal (p. 15 of Part III) and presumably take into consideration only emissions from energy use and cement. The Starting Conditions III are based on all the GHG emissions from all the sources (including land use) and are derived from the prior ASF-based analyses. An importance of accounting for all the GHG emission sources is illustrated by the following example: in 1990 Annex 1 countries were responsible for about 68% of the global CO_2 emissions from energy and cement, while their contribution to the global emissions of all the GHGs was only 52%.

III. Results and Discussion

A. Historic Emissions

Brazilian estimate was based on extrapolating backwards *country-level* emissions from 1950 to 1973 taken from the Oak Ridge National Laboratory (ORNL) Database, while the EPA analysis used actual ORNL *region-level* data. In spite of this difference, the cumulative 1990 emissions estimated by Brazil and EPA are quite close (Table 1).

B. Future Emissions

Similar to the historic emissions, estimates of the year when *cumulative* CO_2 emissions from Annex 1 and non-Annex 1 countries converge produced by both the Brazilian the EPA analyses are quite close (Table 1). According to the EPA analysis, the year of convergence of all the GHGs occurs slightly earlier than the year of CO_2 emissions convergence (2042 vs. 2047). The major difference exists between the year of convergence in the *annual* CO_2 emissions from energy and cement: according to the Brazilian analysis this moment happens almost 25 years later than according to EPA estimates (2037 vs. 2011). This difference can be explained by the fact that CO_2 emissions in non-Annex 1 countries according to the scenario used in the EPA analysis (EPA1) grow substantially faster than CO_2 emissions in the IS92 scenario, which is used in the Brazilian proposal (Figure 1).

C. Future CO_2 Concentrations

The Starting Conditions I were used to evaluate how the inclusion of all the CO_2 sources (including land use) as opposed to CO_2 from energy and cement only would impact the timing of convergence of the relative contributions of Annex I and non-Annex I countries to the global average CO_2 concentration. The EPA analysis shows that when all the CO_2 sources are taken into account the convergence occurs substantially earlier (2027 vs. 2042) (Table 1).

D. Future Radiative Forcing Change

Since the changes in radiative forcing are directly proportional to the changes in atmospheric concentrations, the dates of convergence in the radiative forcing contributions are the same as the dates of convergence in the CO_2 concentration contributions (Table 1). When all the GHG sources are included in the analysis, the convergence in the forcing contributions between Annex 1 and non-Annex 1 countries happens almost 25 years faster, than in the situation when the analysis is based solely on CO_2 emissions from energy and cement.

Table 1. Climate change variables used for estimating the relative contributions of Annex 1 and non-Annex 1 countries to the global climate change: Brazilian and EPA .

Variable	Brazil	EPA
Emissions		
Cumulative CO_2 1840-1990 Annex 1 – energy and cement (Tg C)	169	182
Cumulative CO_2 emissions 1840-1990 non-Annex 1[1] energy and cement (Tg C)	34	35
Year of *cumulative* CO_2 emissions (1840-1990) convergence[2]	2044	2047
Year of all GHGs (i.e., CO_2, CH_4, and N_2O) *cumulative* emissions convergence	Na	2042
Year of all GHGs (i.e., CO_2, CH_4, and N_2O) *annual* emissions convergence	Na	1992
Year of CO_2 *annual* emissions convergence – energy and cement	2037	2011
Concentration, Forcing and Temperature Increase Starting Conditions		
Assumption about relative regional contribution to increase in CO_2 concentration in 1990	*Annex I – 79%* *Non-Annex I – 21%*	*Annex I – 79%* *Non-Annex I – 21%*
Year of convergence of the relative contributions to increase in CO_2 concentration – CO_2 from energy and cement	Na	2042
Year of convergence of the relative contributions to increase in CO_2 concentration – all CO_2 sources	Na	2027
Year of convergence of the relative contributions to increase in radiative forcing – CO_2 from energy and cement	Na	2042
Year of convergence of the relative contributions to increase in radiative forcing – all CO_2 sources	Na	2027
Year of convergence of the relative contributions to increase in radiative forcing – all GHGs (i.e., CO_2, CH_4, and N_2O)	Na	2018
Year of convergence of the relative contributions to the temperature increase – CO_2 from energy and cement	2147	Between 2100 and 2110
Relative regional contributions to	Na	Annex I – 51%

[1] For purposes of the current analysis Non-Annex 1 countries include all the transitional countries in Eastern Europe and FSU.

[2] Sources: fuel use and cement production before 1990 and all the CO_2 sources after 1990.

Variable	Brazil	EPA
temperature increase in the year 2100 – CO_2 from energy and cement		Non-Annex I – 49%
Year of convergence of the relative contributions to the temperature increase– all GHGs (i.e., CO_2, CH_4, and N_2O)	Na	2062
Temperature Increase Starting Conditions		
Assumption about relative regional contribution to increase in temperature in 1990	*Annex I – 88%* *Non-Annex I – 12%*	*Annex I – 88%* *Non-Annex I – 12%*
Year of convergence of the relative contributions to the temperature increase – CO_2 from energy and cement	2147	Between 2110 and 2115
Relative regional contributions to temperature increase in the year 2100 – CO_2 from energy and cement	Na	Annex I – 52% Non-Annex I – 48%
Year of convergence of the relative contributions to the temperature increase– all GHGs (i.e., CO_2, CH_4, N_2O)	Na	2079
Temperature Increase Stands Constant		
Assumption about relative regional contribution to increase in temperature in 1990	*Annex I – 88%* *Non-Annex I – 12%*	*Annex I – 60%* *Non-Annex I – 40%*
Relative regional contributions to temperature increase in the year 2100 – CO_2 from energy and cement	Na	Annex I – 47% Non-Annex I – 53%
Year of all GHGs (i.e., CO_2, CH_4, and N_2O) *cumulative* emissions convergence	Na	2023
Year of convergence of the relative contributions to increase in radiative forcing – all GHGs (i.e., CO_2, CH_4, and N_2O)	Na	2011
Year of convergence of the relative contributions to the temperature increase– all GHGs (i.e., CO_2, CH_4, N_2O)	Na	2045

- the exact convergence year cannot be estimated, since the EPA1 emissions scenario covers the period only up to 2100.

E. Future Temperature Change

Under the Starting Conditions I, the convergence of the relative contribution of Annex I and non-Annex I countries according to the current analysis occurs about 50 years earlier than in the Brazilian proposal. Smaller, but still notable difference in the convergence year also exists under the Starting Conditions II (Table 1). Two major factors contribute to this result: (1) higher emissions in non-Annex I countries in the EPA1 scenario as opposed to the IS92a scenario used by Brazil and (2) differences in the modeling approaches used to convert GHG emissions into changes in the global average temperature.

(1) EPA1 and IS92a scenarios have quite substantial differences in both the absolute CO_2 emissions from energy and the proportion between Annex 1 vs. non-Annex 1 countries (Figure 1, Table 2). The higher non-Annex 1 emissions in absolute and relative terms partially explain the difference in the "temperature contribution" convergence year.

Table 2. Relative contribution of Annex 1 and non-Annex 1 countries to the total CO_2 emissions from energy in the EPA1 and IS92a scenarios.

Year	*EPA1-Annex 1*	*IS92a-Annex 1*	*EPA1-non-Annex 1*	*IS92a-non-Annex 1*
2000	56.53%	70.42%	43.47%	29.58%
2025	41.92%	55.14%	58.08%	44.86%
2050	34.34%	44.70%	65.66%	55.30%
2100	25.33%	34.34%	74.67%	65.66%

(2) Based on the Appendix 1 of the Brazilian proposal, it can be concluded that the approach used by Brazil to relate changes in temperature to changes in emissions differs from the one used in the current analysis. For example, Brazil assumes that all the GHGs have the constant lifetime and uses the single formula to estimate multi-year impacts of changes in atmospheric concentrations on the global average temperature. Meanwhile, the ASF model is based on the annual accounting of all the emission sources and sinks, including the ocean and forest uptake. The Brazilian approach might overestimate the impact of historic emissions as compared to emissions that occur after 1990. This issue deserves further analysis.

The inclusion of all the GHGs from all sources starting from 1990 leads to major shifts in the year when the contributions of Annex 1 and non-Annex 1 countries converge. Under the Starting Conditions I the convergence with all the GHGs are taken into account occurs in 2062, while under the Starting Condition II this happens in 2079 (Table 1).

The earliest convergence of the relative contributions to the global temperature increase occurs under the Staring Conditions III. These conditions are based on the assumption that the inclusion of all the GHGs (i.e., CO_2, CH_4, and N_2O) as well as all the sources (e.g., deforestation, agriculture, etc.) will increase the relative 1990 "temperature" contribution of non-Annex 1 countries to about 32% (as compared to 12% according to the Staring Conditions II) (Table 1).

If this assumption is accurate and if the EPA1 emission scenario is applied, the convergence of the relative contributions to the temperature increase will occur as early as 2045 (Table 1).

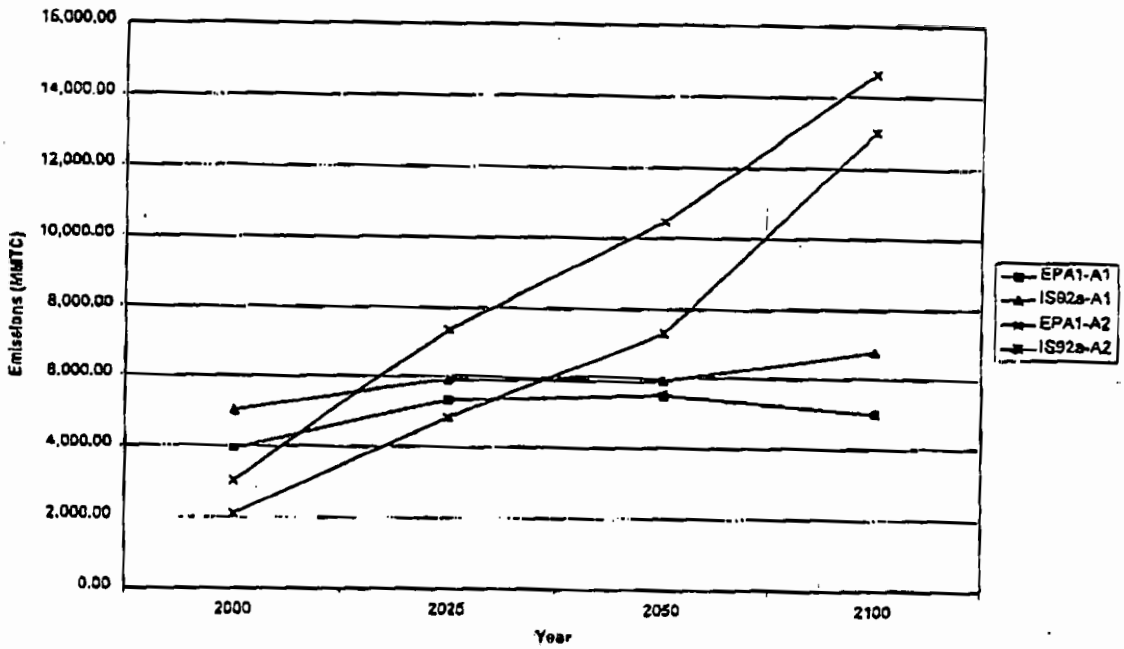
IV. Conclusions

The current analysis showed that:

- The convergence of the relative contributions of Annex 1 and non-Annex 1 countries to the global temperature change occurs approximately 40 years earlier than in the Brazilian proposal when the relative responsibilities of both groups of countries in 1990 are the same as in the Brazilian proposal and emissions from 1990 to 2100 change according to the EPA1 scenario.

- When the analysis includes all the CO_2 emissions sources (in addition to energy use and cement production) and also includes such GHGs as CH_4 and N_2O the convergence between Annex 1 and non-Annex 1 countries occurs faster, is comparison with the situation when only CO_2 emissions from energy and cement are considered.

Figure 1. Carbon Dioxide Emissions fromEnergy Use in EPA1 and IS92a Scenarios. A1 - Annex I, A2 - non-Annex 1.



APPENDIX A

The current version of the ASF includes four "sector" modules (energy, deforestation, agriculture, and halocarbon), an emissions module, and an atmosphere/ocean module. The ASF estimates annual GHG emissions for the years 1990 through 2100 for nine regions of the world (Table 1). From 1990 to 2025, emissions are estimated in five-year intervals, and from 2025 to 2100 – in 25-year intervals.

The ASF *energy module* represents energy use in three end-use sectors (residential/ commercial, industrial, and transportation) and is based on the modified Long Term Global Energy-CO_2 Model (Edmonds & Reilly, 1986). These sectors consume liquid fuels, solid fuels, gaseous fuels, and electricity. An electricity generation sector converts liquid fuels, solid fuels, gaseous fuels, nuclear energy, hydro energy, and solar/wind energy to electricity. A separate synthetic fuel sector converts coal and biomass to liquid and gaseous fuels. The ASF energy module estimates future energy demand using input assumptions about population growth, economic growth, and energy efficiency; while energy supply is estimated using input data on availability of energy resources (both fossil and non-fossil), costs of resource extraction, and costs of energy generation. The module estimates future energy prices that balance energy supply and demand.

Improvements in energy efficiency in the ASF are simulated based on assumptions concerning energy consumption by the residential/commercial, industrial, transportation, and electricity generation sectors. The initial assumptions were derived from detailed country and regional case studies estimating energy consumption through 2025. These assumptions then were adjusted based on new information regarding economic restructuring in Eastern Europe and the NIS, more recent information on regional energy use, and new data on the availability of improved energy technologies (*e.g.*, heat rate of new and future generation units).

Improvements in the efficiency of electricity generation are modeled in the ASF by identifying the efficiency of new generation plants when they are available to the market and by allowing new technologies to penetrate the market depending on the rate of growth in demand and the turnover in capital stock. All the scenarios currently generated by the ASF assume that the efficiency of new generation plants (defined as energy delivered divided by energy input) reaches 70 percent by 2050.

Direct consumption of liquid fuels, gaseous fuels, solid fuels, and electricity (secondary energy use) is represented as demand for energy services. Different energy types satisfy this demand with efficiencies and non-fuel costs that differ by energy type. Improvements in the energy efficiency on the demand side are modeled in two ways: by adjusting the efficiency of technologies used to convert the secondary energy to energy services and by adjusting the overall efficiency of the sector being modeled. The overall efficiency of energy consumption in each sector is used to calibrate the model to both energy use through 1995 and to the detailed energy studies used for the IS92 scenarios.

The ASF *agriculture module* estimates future regional consumption and production of agricultural products and the area of land used for rice production. The ASF *deforestation module* estimates the area of tropical forests cleared annually and the total amount of biomass removed. Human population is the main input variable of both the agriculture and deforestation modules.

The *halocarbon module* estimates future emissions of SF_6, CFCs, HCFCs, PFCs and other halocarbons based on assumptions about future demand for, and controls on, their production. Projections of SF_6, HFC, PFC, and other halocarbon emissions in the U.S. were derived from EPA estimates. Emissions of substitutes for ozone depleting substances are calculated in EPA's vintaging model, which tracks the use and emissions of high global warming potential compounds from refrigeration, air conditioning, foam blowing, solvent, fire extinguishing, aerosol, and sterilant end uses in the United States. Emissions of HFCs, PFCs, and SF_6 from other industrial sources are estimated by EPA based upon knowledge of the factors that affect emissions from the various sources. These sources include aluminum smelting and byproduct emissions from fluorocarbon production. Global emissions of SF_6, CFCs, PFCs, and other halocarbons are obtained by scaling up the US estimates.

The ASF *emissions module* uses outputs of the *energy, deforestation, and agriculture modules* together with population and economic growth assumptions to estimate emissions of greenhouse gases (CO_2, CH_4, and N_2O), ozone precursors (NO_x, CO, and NMVOCs), and SO_x for each of the ASF regions. These emissions are estimated by mapping emission sources to corresponding emission drivers and changing emission estimates according to changes in these drivers. For example, CO_2 emissions from coal are mapped to the amount of coal consumed, while CH_4 emissions from landfills are mapped to population.

The ASF uses several approaches for estimating SO_x emissions and controls, which are based on an observed relationship between societal wealth and implementation of emission controls (Grossman & Krueger,

1995). Emissions of SO_x from coal combustion are modeled as a function of the sulfur content of the coal, the share of sulfur released to the atmosphere, and the level of emission controls that reduce the amount released. The initial installation of sulfur emission controls occurs in the model when average per capita incomes reach $900 (1990 US dollars). When per capita incomes reach $11,500, 90 percent of SO_x emissions are assumed to be captured by emission-controlling devices. It is assumed that no sulfur emissions result from coal synfuel processes.

Emissions of sulfur from petroleum are modeled as a function of the sulfur content of the crude oil, the share of sulfur that ends up in three different types of petroleum products (light, medium, and residual), and controls on sulfur emissions. The model assumes that no controls exist in regions with per capita incomes less than $900 and that the full set of controls are applied when per capita incomes reach $11,500. No sulfur is assumed to end up in light products, while a maximum of 0.3 weight percent sulfur is assumed to end up in distillate. The ultimate cap on sulfur emissions is 0.1 percent for distillate and 1.0 percent for residual fuel oil.

Finally, the ASF *atmosphere/ocean module* uses estimates of future emissions of GHGs, ozone precursors, and SO_x to calculate the corresponding global average radiative forcing and global average temperature change (relative to 1990). The ocean component of the module determines the global average CO_2 and heat uptake by the ocean.

A more detailed description of the ASF components and underlying assumptions is provided in the technical appendices to the EPA 1990 Report to Congress (EPA, 1990b).

APPENDIX B

(A) Estimation Methodology:

The EPA's analysis involved the following three steps:

(1) For each gas (i.e., CO_2, CH_4, and N_2O), estimate regional contribution to increase in concentration, based on the level of regional emissions;

(2) For each gas, estimate regional contribution to global increase in the atmospheric radiative forcing, based on the regional contribution to increase in atmospheric concentration of each gas; and

(3) Estimate the regional contribution to increase in the global mean surface temperature, based on the regional contribution to increase in total atmospheric radiative forcing.

The formulae and the assumptions used in estimating each of these steps are described below.

(1) Estimating Regional Contribution to Increase in Atmospheric Concentration:

For the years from 1990 through 2100, for each of the nine ASF regions, the regional contribution to increase in the global concentration of each gas over its pre-industrial concentration level was calculated using the two formulae given below. Because ASF projections were developed only for selected years between 1990 and 2100, the regional emissions data were interpolated for the intermediate years assuming constant growth rate between those years. For example, the regional emissions projections for 2001 through 2004 were interpolated based on the emissions projections for 2000 and 2005, using average annual emissions' growth rates between 2000 and 2005 for each region.

$$C^i_{rt} = (C^i_{r,t-1} + E^i_{rt}) * f^i_t$$

i = CO_2, CH_4, and N_2O.
r = Africa, Centrally Planned Asia, Centrally Planned Europe, Latin America and the Caribbean, Middle East, OECD-East, OECD-West, South East Asia, and USA.
t=1990,....,2100.

where
C^i_{rt} is the contribution of region r to increase in the atmospheric concentration of gas i, over the pre-industrial levels, at time period t;
E^i_{rt} is the region r's emissions of gas i at time t; and
f^i_t is a fraction (see below).

$$f^i_t = (C^i_t - C^i_{pre\text{-}industrial}) / (C^i_{t-1} + E^i_t - C^i_{pre\text{-}industrial})$$

where
C^i_t is global atmospheric concentration of gas i, at time t;
E^i_t is the global anthropogenic emissions of gas i, at time t; and
$C^i_{pre\text{-}industrial}$ is the pre-industrial global atmospheric concentration of gas i.

(1) Estimating Regional Contribution to Increase in Radiative Forcing:

For each region, regional contribution to increase in the atmospheric concentration of each gas was translated into that region's contribution to increase in the atmospheric radiative forcing (of that gas) over its pre-

industrial levels, using the formula given below. The regional contribution to increase in the atmospheric radiative forcing was estimated for every year from 1990 through 2100.

$$R^i_{rt} = R^i_t * C^i_{rt} / \sum_r C^i_{rt}$$

Where

R^i_{rt} is the contribution of region r to global increase in the radiative forcing of gas i, over its pre-industrial level at time t;

R^i_t is the global increase in the radiative forcing of gas i, over the pre-industrial level at time t; and

C^i_{rt} is the contribution of region r to increase in the atmospheric concentration of gas i, over the pre-industrial level, at time period t;

$\sum_r C^i_{rt}$ is the sum of the regional contributions to increase in the atmospheric concentration of gas i, over its pre-industrial level, at time t. It is equal to $C^i_t - C^i_{pre\text{-}industrial}$.

(I) Estimating Regional Contribution to Increase in the Global Mean Surface Temperature:

The regional contribution to increase in the global mean surface temperature was estimated using the set of formulae given below. Because historical data were not available, the year 1990 was considered the starting period for this analysis. Therefore, for 1990, the increase in the global mean surface temperature over the pre-industrial level was allocated across all regions in proportion to the regions' contribution to global increase in the atmospheric radiative forcing (over the pre-industrial level) in 1990. For the remaining years, 1991 through 2000, for each ASF region, the increase in the global mean surface temperature over the pre-industrial level was calculated using the following two formulae.

$$T_t = T_{t-1} + [(\sum_{All} R_t * cf) - T_{t-1}] * r$$

where

T_t is increase in the global mean surface temperature at time t;

T_{t-1} is the increase in the global mean surface temperature at time t-1;

$\sum_{All} R_t$ is the global increase in the radiative forcing of all GHGs, including PFCs and HFCs, and other gases that have an impact on radiative forcing (such as stratospheric ozone, SO_2, and aerosols) at time t;

cf is the conversion factor = (2.5 degree celsius) / (4.3 w/m^2); and

$r = [T_t - T_{t-1}] / [(\sum_{All} R_t * cf) - T_{t-1}]$

$$T_{rt} = T_{rt-1} + [(\sum_{All} R_t * cf) - T_{t-1}] * r * (\sum_i R^i_{rt} / \sum_i R^i_t)$$

where

T_{rt} is the contribution of region r to increase in the global mean surface temperature at time t;

T_{rt-1} is the contribution of region r to increase in the global mean surface temperature at time t-1;

$\sum_i R^i_{rt}$ is the contribution of region r to global increase in the radiative forcing of all three gases, CO_2, CH_4 & N_2O, at time t; and

$\sum_i R^i_t$ is the global increase in the radiative forcing of the three gases, CO_2, CH_4 & N_2O at time t.

Preliminary, close hold

JF, 4/12/98

TARGETS FOR DEVELOPING COUNTRIES

This note lists six questions that must be answered in considering alternative possible specific versions of the CEA proposal that LDCs be asked to accept emissions targets "at or near" their forecasted BAU paths.

To begin, it goes without saying that :

- there is always a tradeoff between the environmental benefits of bigger cuts vs. the economic costs. More specifically,
- aggressive cuts relative to the expected pre-Kyoto BAU path will be even more firmly opposed by the LDCs than the BAU path itself; while
- increases relative to the pre-Kyoto BAU path (e.g., ratifying forecasted leakage from the Kyoto agreement) will be firmly opposed by environmentalists.

(1) Should the explicit goal (in the first commitment period) be:

- post-Kyoto BAU (including estimate of leakage)
- pre-Kyoto BAU, or
- pre-Kyoto BAU minus some percentage?

(2) Should the goal be implemented in the form of:

- numbers negotiated internationally by diplomats over the next few years
- numbers produced by a body of "objective experts" over the next few years
- a formula agreed now, contingent on future data
- submissions from countries as to how they propose to determine their own BAU (including the possibility of a formula), subject to a process of expert review / international approval

(3) If it is to be a formula, should it be:

- with specific numbers determined in 2007 contingent on data available then
- with numbers determined contemporaneously in 2008-2012 ?

(4) If it is to be a formula, which of the following variables should be included?

- GDP
- population
- pre-Kyoto emission levels
- time trend
- other

(5) If it is to be a formula, how should the weights on the variables be determined?

- chosen by international body of "objective experts"
- pure cross-section statistical estimates using past data
- time-series or panel-data statistical estimates using past data
- negotiated common formula
- negotiation of different formulas for different countries

(6) Should there be any general presumption that the approach (e.g., the choice of variables to enter the formula) might be applied not only to LDCs in 2007-2012, but also to

- LDCs in subsequent commitment periods (presumably with further cuts)?
- Annex I countries in the future as well, with a goal in the (very) long run of a common formula to apply to all countries?

Preliminary, close hold

JF, 4/9/98

TARGETS FOR DEVELOPING COUNTRIES

This note lists five questions that must be answered in considering alternative possible specific versions of the CEA proposal that LDCs be asked to accept emissions targets "at or near" their forecasted BAU paths.

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- numbers produced by a body of "objective experts" over the next few years
- a formula to be agreed now, with specific numbers determined in 2007
- a formula to be agreed now, with numbers determined contemporaneously in 2008-2012 ?

merge

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- negotiated common formula
- negotiation of different formulas for different countries
- b.d.y of experts

(5) Should there be any general presumption that the approach (e.g., the choice of variables to enter the formula) might be applied not only to LDCs in 2007-2012, but also to

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or under 2

proposals from LDCs to be negotiated (subject to expert review)

India

Macro Economic Indicators, 1997

GDP (Current dollars)	$540 billion
Estimated GDP growth through 2010, EIA	7-8 % annually
Per capita Income	$557
Population	970 million
Exports	$36 billion
Net Exports (X-M)	$ -3.5 billion
Major exports (1995)	Manufactured goods (78%), agricultural and related products (17%), ores, minerals, fuels, and lubricants. 17 % of exports were to the United States.

Energy Profile, 1995

Energy Consumption	11.1 Quad Btu	12 % of US Energy Consumption
Electricity Production	9.1 Quad Btu	
Electricity Generation	393 billion kwh	
Electricity Generation by Type:		*Percent of Total:*
Thermal	315.7 billion kwh	80 %, most of this is coal generated elect.
Hydro	70.9 billion kwh	18
Nuclear	6.5 billion kwh	1.6
Geothermal and other	.1 billion kwh	>1
Energy Consumption by Fuel Source:		*Percent of Total:*
Petroleum	3.27	29
Natural Gas	.72	6
Coal	6.28	56
Hydro	.74	6

Nuclear	.08	.69
Geothermal, Solar, Wind	.0006	little
Excise Taxes	Steam and Coking Coal (Ind, HH, Elct Gen), per ton basis, Light and heavy fuel oil	
Subsidies	Govt. program of subsidies for refined oil product prices	
Tariffs	On crude oil/refined products prices, non-coking coal import tariffs.	
Price Controls	Coal, Natural Gas	

Preliminary, close hold

JF, 4/12/98

TARGETS FOR DEVELOPING COUNTRIES

This note lists six questions that must be answered in considering alternative possible specific versions of the CEA proposal that LDCs be asked to accept emissions targets "at or near" their forecasted BAU paths.

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More specifically,

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- increases relative to the pre-Kyoto BAU path (e.g., ratifying forecasted leakage from the Kyoto agreement) will be firmly opposed by environmentalists.

(1) Should the explicit goal (in the first commitment period) be:

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- pre-Kyoto BAU minus some percentage?

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- numbers produced by a body of "objective experts" over the next few years
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- LDCs in subsequent commitment periods (presumably with further cuts)?
- Annex I countries in the future as well, with a goal in the (very) long run of a common formula to apply to all countries?

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
POLICY, PLANNING AND EVALUATION

April 10, 1998

MEMORANDUM

SUBJECT: Planning meeting for Developing Country Technical Workshop on Economic Analysis of Greenhouse Gas Mitigation Options

FROM: Al McGartland, Director
Office of Economy and Environment

TO:		
	Joe Aldy	395-6870
	Randy Lutter	395-6870
	Eric Petersen	586-2176
	Phil Tseng	586-5391
	Maurice LeFranc	260-6405
	Leslie Cordes Black	216-3227
	Jack Fitzgerald	586-3485

The Country Studies Program is interested in developing an initiative to improve economic modeling capacity in key developing countries. As follow up to an "Advisors'" meeting on future directions of the Country Studies Program, I was asked to organize a cross-agency group to discuss and recommend the technical content of such an initiative. The Advisors' group decided to design a workshop to overview (for key country representatives) the key types of economic models that are available, as well as their relative strengths and weaknesses.

Accordingly, we would like to invite you to a meeting to start this work, which I have scheduled for Thursday, April 16, from 1:00 - 3:00 in room M3205. By the end of this meeting I hope to have developed an agenda for a Country Studies Program technical workshop on economic modeling. This workshop will provide technical training for developing countries on economic analysis of greenhouse gas mitigation options. This meeting will follow up on discussions on the Country Studies Program held last week at the State Department.

Please contact Peter Nagelhout (202 260-7015) if you have any questions, and to get cleared through EPA security on the 16th. West Tower

A Proposal for Developing Countries: Participation in a "Target and Trade" System

I. This analysis demonstrates that the gains will be substantial if developing countries (a) accept binding targets at or slightly below their business as usual (BAU) emissions levels, and (b) trade from their respective targets. We believe that participation in a "target and trade" system should be the cornerstone of our international negotiations.

The economic and environmental rationale for such participation includes

- **Greater economic benefits to developing countries:** With targets at or only slightly below BAU, developing countries would enjoy net gains of many billions of dollars through the international sale of emission reductions achieved at lower cost than the world price.

- **Greater cost savings to the U.S.:** Participation by developing countries in international permit markets would greatly lower the costs to the U.S. of meeting its Kyoto target (as CEA testimony showed). In particular, costs would be lower than with trading among only Annex I countries.

- **Greater environmental benefits:** Targets slightly below business as usual would lower global emissions relative to a world with only Annex I targets. Further, reducing carbon dioxide emissions generates ancillary air quality benefits through lower particulate matter, sulfur dioxide, and nitrogen oxides emissions.

- **Target and trade yields greater benefits than CDM:** While the Clean Development Mechanism will likely result in cost savings to the U.S. relative to a world with only Annex I trading, a system including effective target and trade of developing countries' emissions would yield much greater cost savings to the U.S. and greater gains to developing countries than CDM. Further, target and trade could achieve environmental benefits not achievable by pursuing CDM, which only redistributes emissions geographically.

- **The principle of full participation:** Other rationale include the long-run benefits of including developing countries into global negotiations, for example, as recognized by the Byrd-Hagel resolution. By establishing participation now, further commitments might be feasible in future periods.

II. Problem: To persuade a developing country *voluntarily* to adopt a target and then to trade permits internationally, international agreements must be structured to reduce the risk of inadvertent stringency and in particular to reduce the possibility of a target so stringent as to cause large economic losses to the developing country.

Proposed Solution: Negotiations should focus on the estimated business as usual emissions level, where this level is expressed in a way that depends on the *future* values of economic variables, such as GDP.

Rationale: Such targets would avoid the risk of inadvertent stringency associated with higher than projected economic growth between now and the beginning of the commitment period in 2008. Developing countries would face only the much smaller risk that emissions would be higher than expected, *given* the economic conditions realized in 2007.

Basic principles for implementing such an approach are:

- **Reasonable Forecasts**: The relationship between the target (putting aside any real reductions in emissions) and the values of economic variables, when applied to emissions and such variables during recent years, should predict emissions reasonably well and be without demonstrable statistical bias. Relationships that give reasonably reliable predictions reduce the risk of either inadvertent stringency or paper tons which could increase global emissions.

- **No Perverse Incentives:** The target should depend on values of economic variables only indirectly related to emissions, to avoid creating perverse incentives for developing countries to increase emissions so as to have higher targets in the commitment periods. For example, the target should not depend on energy consumption in 2007, but could reflect pre-Kyoto emissions levels.

- **Predetermined Targets:** To avoid uncertainty during the commitment period about the country's target the target should not depend on contemporaneous values of economic variables. For example, the target generally should not vary with 2008 or 2010 GDP levels, but rather with 2007 GDP.

III. Illustration: One way of implementing the solution is described below. Other ways of implementing the solution may work as well or better. The conclusions are stated below; the details of our work follow in appendix 3.

- Defining the business as usual level for a developing country as a function of its GDP and population in earlier years and setting the emissions target at that level yields a negligible risk of leaving the developing country worse off under target and trade because of inadvertent stringency. Even a target slightly below BAU would also yield negligible risk of leaving the developing country worse off.

- Emissions targets for developing countries set below their business as usual emission level would of course result in gains from trade smaller than with a BAU target, while providing environmental benefits. The higher costs of a target set below BAU are borne by both the developing countries and the Annex I countries.

There are significant gains from trade for developing countries and large cost-savings to the U.S. if even one large developing country accepts an emissions target at BAU and participates in emissions trading. Table 1 and Charts 1 through 3 illustrate these gains from trade from a baseline of full Annex I trading.

Table 1. Illustrative Gains from Trade with Developing Countries that Target and Trade

Trading Scenario	Permit Price[1] (1997$/ton)	Country Gaining	Gains from Trade with Developing Countries
Annex I only	$54	United States	not applicable
Annex I + China	$26	China	$3.6 billion/year
		United States	$11.6 billion/year[2]
Annex I + India	$47	India	$1.6 billion/year
		United States	$2.5 billion/year[2]
Annex I + Mexico	$51	Mexico	$0.9 billion/year
		United States	$1.2 billion/year[2]

[1] These scenarios do not account for the cost savings available through the Clean Development Mechanism and carbon sinks.

[2] Gains from trade for the U.S. are estimated as the change in the U.S. total cost of complying with the Kyoto Protocol relative to an Annex I only trading regime.

Chart 1. China's 2010 Marginal Abatement Cost Curve and Gains from Trade

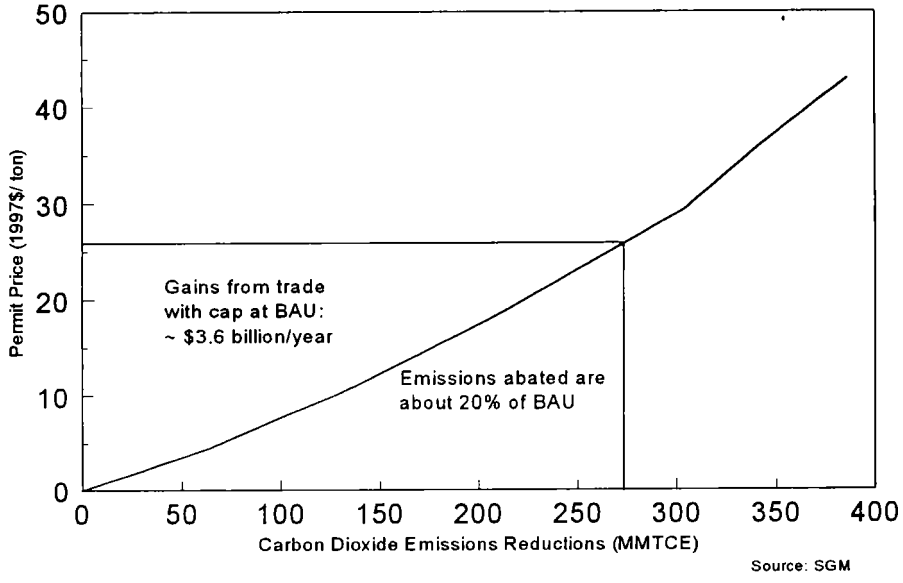


Chart 2. India's 2010 Marginal Abatement Cost Curve and Gains from Trade

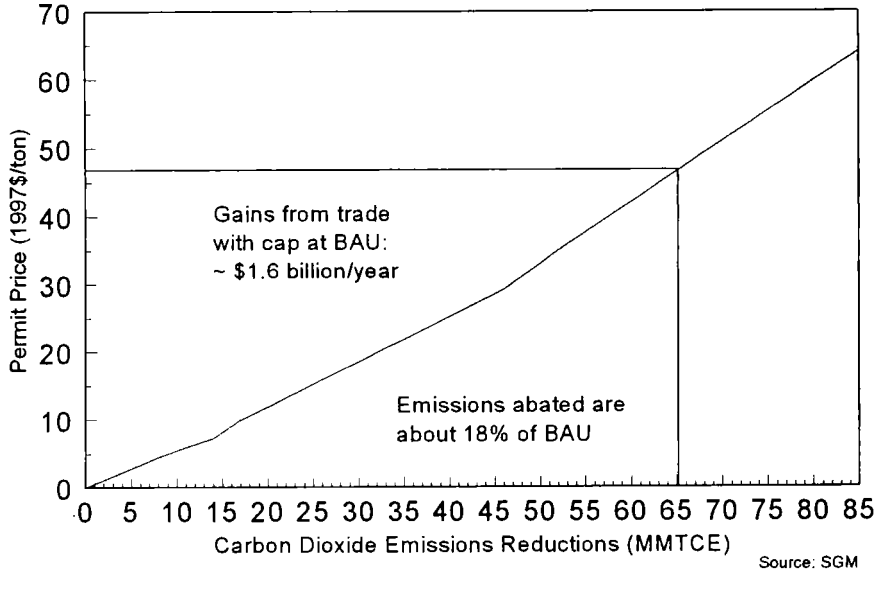
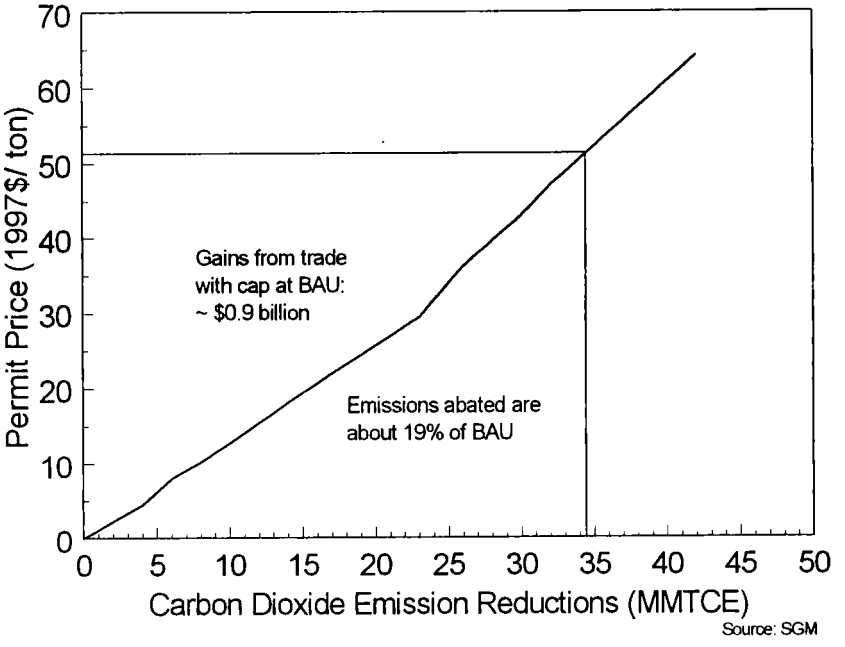


Chart 3. Mexico's 2010 Marginal Abatement Cost Curve and Gains from Trade



Appendix 1. Costs to the U.S. of Developing Countries Adopting Targets Below BAU

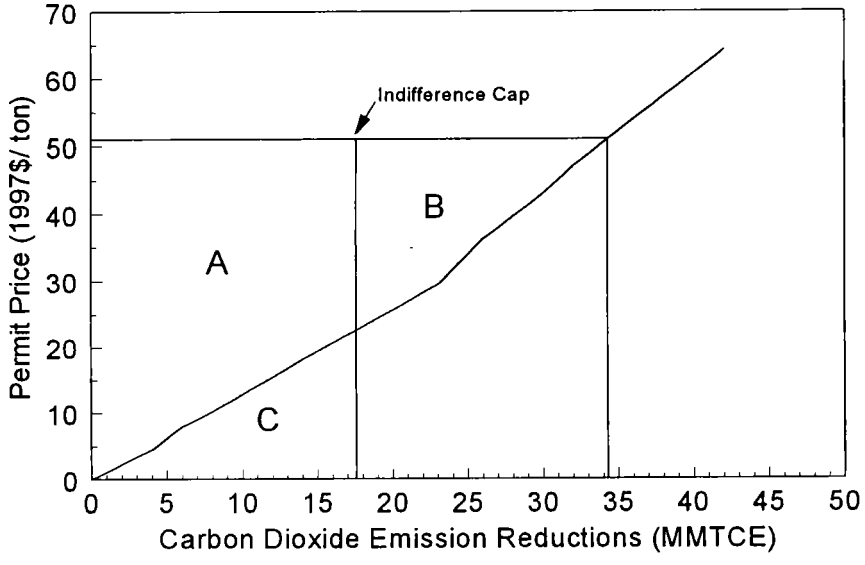
Regarding developing countries, most commonly discussed is the issue of fairness: what commitments to reduce emissions should be made by countries whose economic resources differ substantially? Generally neglected, but discussed below, is the issue of efficiency. In particular, what are the implications for U.S. costs of increasingly more stringent targets on emissions from key developing countries?

The environmental gains from emissions reductions below BAU come at the price not only of economic costs incurred by a developing country that adopts the below-BAU target, but also economic costs by Annex I. More stringent developing country targets raise U.S. costs by restricting the supply of permits in world markets and so raising the price of permits.

To assess the magnitude of this effect consider the target which just leaves a country no better off than no target at all. This "indifference" target is where the costs of meeting the target just equal the net gains from selling permits in world markets. Chart 4 illustrates

gains from trade for a small country. For a target that is equivalent to a reduction from BAU of 17 MMTC, net gains from foreign exports are B, and the cost of meeting the target is C. Since B = C in this example, the net gains from trade are nil.

Chart 4. Illustrative 2010 Marginal Abatement Cost Curve and Indifference Target



Note: For simplicity, this indifference target is illustrated for a country whose participation in world permit markets does not affect world permit prices.

Table 2 provides an illustration of the effects of emissions targets more stringent than BAU on China with Annex I plus China trading. Note that a small reduction below BAU has no real effect on the Annex I trading price, and thus no economic effects on the U.S. However, as the target becomes more stringent, the Annex I trading price increases, resulting in higher total costs of compliance for the U.S. If China accepts a target below BAU, the cost of this additional stringency to the U.S. -- essentially, the cost of supplying the environmental benefits associated with these emissions reductions -- can become significant. Thus developing country participation in the form of acceptance of targets more stringent than business as usual will raise costs to the U.S.

Table 2. Effects of Various Chinese Emissions Targets with Annex I Trading

Emissions Target[1]	Permit Price (1997$/ ton)	Chinese Emissions Reductions (MMTC)	Chinese Emissions Sales (MMTC)[2]	Total Cost to U.S. of Complying with Kyoto	Cost to U.S. of Additional Stringency
BAU	$26	276	276	$13.4 b	not applicable
BAU - 1%	$26	276	262	$13.4 b	~$0
BAU - 5%	$29	304	235	$14.9 b	$22/ton
Indifference	$36	343	172	$17.9 b	$26/ton

[1] We employ the SGM BAU for China for the purposes of these calculations.
[2] Reductions in Chinese emissions less Chinese emissions sales yields net global reductions.

Imposing this "indifference" target on China, given that its participation lowers world permit prices, leads to the following conclusions.

- An indifference target for China increases annual U.S. costs by $4.5 billion or 33% relative to a BAU target for China.

- If China accepts an emissions target requiring reductions of approximately 170 MMTC below BAU, the average cost to the U.S. would be $26/ton. This is <u>not</u> the average cost of a ton of emissions purchased from China, but the average cost to the U.S. of the environmental benefits associated with China complying with a more stringent target.

Appendix 2. Ancillary Environmental Benefits of Target and Trade in Developing Countries

The voluntary reduction of greenhouse gas emissions by developing countries under a target and trade system will simultaneously reduce emissions of several pollutants, producing ancillary environmental and human health benefits in those countries. The environmental and health benefits that accrue to those developing countries are unlikely to be offset by decreases in environmental quality in the United States because of our stringent health-based air quality standards.

A recent study in *Lancet* examines the emissions of one pollutant that are reduced along with carbon emissions: airborne particulate matter (PM). The study projects that by 2020, a climate change policy scenario in which developing countries reduce emissions to 10% below their BAU could produce an annual reduction of 563,000 statistical deaths.

The analysis below adapts the predictions in the *Lancet* study to estimate the mortality risk reduced from participation by three developing countries (China, India, and Mexico) in a target and trade system. These illustrative calculations take as given the emissions reductions from BAU resulting from permit sales that are predicted by SGM. It suggests that significant public health gains could result from developing country participation in international carbon permit markets.

Table 3. The Effects of International Carbon Permit Trading on Mortality Risk Associated with Particulate Matter Emissions

Country	Predicted carbon emissions reduction from international permit sales	Share of non-Annex I population in 2010	Annual PM statistical deaths avoided in 2010 by international carbon permit trading
China	20%	23.7%	136,700
India	18%	20.3%	105,300
Mexico	19%	2.0%	19,700

For developing countries that are too "small" to affect the world permit price, adopting a carbon target more stringent than BAU and participating in international trade does not yield additional ancillary benefits relative to a BAU target. Large countries, by adopting targets below BAU, would raise the world price relative to a BAU target, and thereby achieve greater carbon emissions reductions and ancillary benefits.

Caveats

Major assumptions beyond those in the *Lancet* article include:

- Deaths avoided in each non-Annex I country are proportional to the country's share of non-Annex I population.
- Deaths avoided are proportional to carbon emissions reductions.

- Each key developing country is the sole non-Annex I country to adopt a target and participate in international trading.

Appendix 3. Summary of Analysis

A. Data

We have compiled data on 3 variables: emissions of carbon dioxide, GDP, and population for 117 countries for the time period 1970-1992. The carbon dioxide emissions data, measured in millions of metric tons of carbon, are from the Carbon Dioxide Information Analysis Center (Oak Ridge National Laboratory, DOE). The GDP data, measured in 1987 U.S. dollars, are from the World Bank. The population data, measured in thousands of individuals, are from the United Nations Population Division.

B. Methods

We have estimated a fixed effects linear regression on the logs of these variables, for the countries in our data set, excluding those listed in Annex I. Our regression uses four non-overlapping 5 year intervals for each country. Our forecasts include the country specific constants.

C. Results

The fixed effects regression we estimated is

$$\text{Emissions} = a\,GDP_{t-1} + b\,GDP_{t-2} + c\,\text{Population}_{t-1} + \gamma\,\text{trend}$$

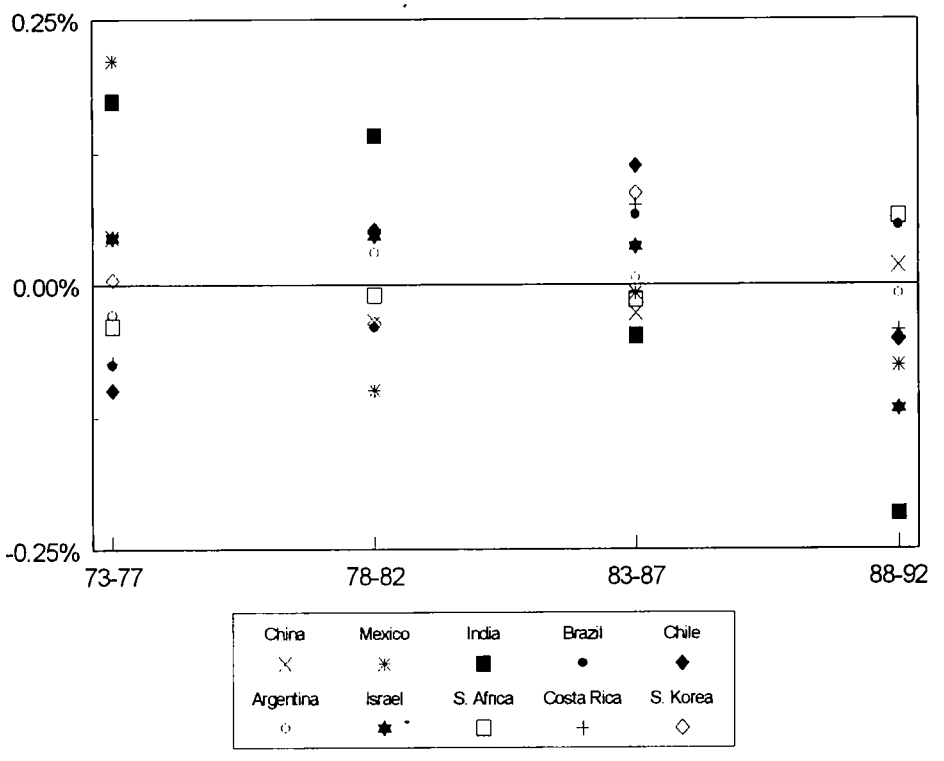
Emissions are the natural logarithm of the five year non-overlapping average of carbon emissions. All independent variables are lagged. GDP_{t-1} is the log of the gross domestic product in the year prior to the first year in the emissions variable, GDP_{t-2} is GDP in the year two years prior to the first year included in the emissions variable, and population_{t-1} is the country's population in the year prior to first year included in the emissions variable. Trend is one in the first 5 year period, and 2, 3, and 4 respectively in the subsequent 5 year periods. The useable data included 376 cross-section time series observations. The fixed effects regression used 98 degrees of freedom. The R squared was in excess of 0.99.

Table 4. Model I Results

Variable Name	Coefficient Estimate	Standard Error
GDP_{t-1}	0.9501823	0.2443047
GDP_{t-2}	-0.411297	0.23894
$Population_{t-1}$	0.4836006	0.2055439
trend	0.0073712	0.0310638

As one illustration of the model's accuracy in predicting emissions, consider the chart below that maps actual and predicted emissions using within sample data for ten selected developing countries. The predicted value is never more than 1/4 of one percent away from the actual emissions average for any of the five year intervals.

Chart 5. Error in Model I Prediction as a Fraction of Actual Emissions



Developing Countries

(Draft #1: 3-25-98)

I. Issue for Decision

How to get developing country participation back on the international agenda, and what kind of participation to encourage.

II. Essential Factors

Process

Despite our gains in Kyoto, developing countries torpedoed New Zealand's proposed "evolution" decision and blocked adoption of the U.S. Article 10/Annex B (A10/AB) proposal. Even if these proposals had been accepted, neither would have met the standard set forth in the Byrd/Hagel Resolution ("quantified emissions limitation commitments in the same compliance period" for all developing countries).

President Clinton has said that he will not submit the Kyoto Protocol to the Senate until we achieve meaningful participation from key developing countries. This standard is different from Byrd/Hagel, but it is also more realistic and flexible.

To advance, we will need to bring two-thirds of the Senate closer to the standard enunciated by the President; we will also need to bring key developing countries more fully into the global response.

Developing country participation inevitably will arise in the June meetings of the Convention's subsidiary bodies. Argentina has asked that our A10/AB proposal be taken up anew in the SBI, and COP-3 remanded Brazil's proposal (to base commitments on responsibility for the increase in global temperature) to the SBSTA.

However, those discussions may prove unproductive or insufficient. We are thus working to promote another, informal process outside the Convention's subsidiary bodies. If we are successful, we may be able to use a new channel to promote discussions with key developing countries aimed ultimately at reaching agreement with them on next steps.

Meanwhile, we are using multiple other channels to stress the importance we attach to this issue and to promote taking up the "unfinished business" of Kyoto. Notable examples are preparations for the G-8 Summit in Birmingham, preparations for the Summit of the Americas in Santiago, the OECD Climate Change Forum, ACAP meetings, etc. We are also using numerous bilateral channels, including our discussions at various levels with the European Union, Japan and Russia, and with such key developing countries such as Brazil, China and India.

Current Possibilities for Voluntary Targets

Because the Kyoto Protocol's Article 17 permits trading among "Annex B" Parties, we have noted the option of amending Annex B to include developing countries that want to take on a binding target. Such an amendment would require the approval of three-fourths of the Parties for adoption and three-fourths of the Parties to submit instruments of acceptance in order to enter into force. An even cleaner option would be for a developing country to join Annex I under the Convention before seeking an amendment to Annex B of the Protocol. As an Annex I Party (not just an Annex B Party), it would be clearer that the various Annex I obligations under the Protocol apply to it. It has been pointed out that a country pursuing this latter option might choose to wait until after the year 2000, so as to avoid the Annex I "aim" under the Convention to return emissions to 1990 levels by the year 2000.

Thresholds for Action

In Kyoto, Brazil (and others) strongly opposed our A10/AB proposal. Brazil argued that it was flawed because it lacked agreed criteria for who should do more, and it contained no guidance on what more they should do. Consequently, Brazil saw the U.S. proposal as a time bomb that would subsequently enable big powers to force smaller countries into unwanted commitments based on subjective judgments as to the appropriateness of commitments. In the past few weeks Brazilian officials have indicated that any effort in the Convention's subsidiary bodies to revive our A10/AB proposal without agreed thresholds for action and agreed approaches to commitments also will fail.

In recent Congressional testimony, Under Secretary Eizenstat continued to frame the developing country issue in terms consistent with the standard enunciated by the President. He rejected 'one-size-fits-all' approaches to meaningful participation and stressed the need to recognize individual national circumstances. He said:

> "In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status."

These categories are similar to the four urged by USAID (where high and low refer to emissions, rich and poor refer to per capita income):

1) low/poor (e.g., Chad, Laos)
2) low/rich (e.g., Nauru, Singapore)
3) high/poor (e.g., China, India), and
4) high/rich (e.g., South Korea, Mexico)

We have thus recently tilted toward two criteria or thresholds for meaningful participation: (1) total greenhouse gas emissions and/or (2) per capita income. In discussions before Kyoto, some within the Administration went further, urging that any country whose emissions amount to more than one half of one percent of the global total and/or any country whose per capita income is greater than the average of the lower half of the OECD (or Annex I) countries ought to accept some greater responsibility for protecting the global atmosphere.

However, we have not proposed internationally that these criteria or thresholds should trigger a requirement for developing countries to adopt growth targets to limit their emissions. It is one thing to use such criteria or thresholds internally for purposes of deciding which developing countries are "key"; it would be very different to table them internationally as triggers for developing country growth targets.

Point/Counterpoint

In contrast, many developing countries have urged that per capita emissions be the measure of "responsibility." Some have also suggested that "responsibility" should be based on historic emissions. Last June, Brazil proposed basing "responsibility" on each nation's contribution to the increase in global temperature, a formula that captures historic emissions and ensures that developing countries need take no significant action until well into 22nd century. Perhaps in response to repeated statements by Annex I countries about how soon developing country emissions are likely to exceed those of the industrialized world, some developing countries are now stressing that increased atmospheric concentrations of greenhouse gases attributable to developing country emissions are not likely to equal those of the industrialized world for many more years into the future.

At the June meetings of the Convention's subsidiary bodies, Argentina's request to reconsider our A10/AB proposal will likely run head long into Brazil's proposal for a temperature metric. There, we could find ourselves engaged in intractable "equity" debates between "per capita emissions" and variations thereof versus total emissions and/or per capita income.

For this reason, we should seek to preserve our A10/AB proposal as a simple, voluntary category (i.e., no threshold for who should sign up) with targets negotiated between the "volunteers" and those already in the trading club. We understand that Argentina (and perhaps others) favors this approach and will seek to promote it between now and COP-4.

Other Problems with A10/AB

We will also face two other problems in this regard. Well before Kyoto many developing countries scoffed at the notion that only countries with targets should be able to decide whether or not the targets proposed by "volunteers" were acceptable. In the negotiating text used in Kyoto, this decision would have been made by all Parties to the Protocol-- both those with and those without targets. Any such approach could seriously undermine the trading regime; potentially, "volunteers" could buy votes from those with no stake in the trading system, weakening environmental protection and undermining confidence in the system. Those developing countries who wish to thwart other developing countries from taking on targets already oppose any voluntary category and can be expected to seize on this issue (and others) in their campaign against it.

Also, before and in Kyoto the European Union (or some therein) took a very different approach in the A10/AB debates. They were prepared to accept energy efficiency goals in all or some economic sectors in lieu of quantified emissions limits. For them, such goals would have been sufficient for entry into a new category between the Annex I and developing countries. Their approach threatened to derail efforts to have advanced developing countries (South Korea, Mexico) sign up to growth targets, and it was not clear whether or how such countries could have engaged in emissions trading without targets. European proponents saw this approach as more positive and realistic than the U.S. proposal. It is unclear at this point whether they have altogether abandoned it -- and it could arise again in June.

The absence of agreement on thresholds for who should act will likely bedevil efforts to reintroduce A10/AB. Proposing such thresholds ourselves (particularly those based on total emissions or per capita income) will invite counterproposals from developing countries. Debate over this issue in the Convention's subsidiary bodies promises to extend over many months, if not years, with no clear basis for resolving it.

Distinct but Related Process

Although it will not be possible to avoid this debate within the Convention's subsidiary bodies, we are more likely to make progress by pursuing it outside the Convention. If a number of key developing countries can be persuaded that there are advantages to taking further action, they may be willing to do so unilaterally or in some combination. With a sufficient "core" group of countries, pressure could build over time for others to join them. For this reason, we have been seeking a candidate to undertake an initial consultation process with key developing countries to explore the possibilities that may exist for further action from them, recognizing that without such action the United States will not move forward to ratify the Kyoto Protocol. Two aspects will be important in this regard:

(1) billing this effort as an informal process, distinct from but related to discussions under the Convention, and

(2) suggesting that it be undertaken in the context of one or more of the various reviews called for under the Convention (e.g., the Convention's Article 4.2(d) review of commitments under Article 4.2(a) and (b), and/or the Convention's Article 7.2(a) review of obligations and institutions in light of the Convention's objective).

If there were enough interest, these initial consultations could be followed by an informal meeting of interested Parties, where discussions might involve a limited number of Parties, a higher level of representation and frank, off-the-record exchanges.

While the prospects for the success of such an effort are uncertain, they may be more positive than what we can expect from the meetings of the Convention's subsidiary bodies. In any event, it would be desirable to pursue this issue on two fronts – one under the Convention and one outside of it.

Action within or outside the Convention

The Byrd/Hagel standard is clearly premised on the notion that additional developing country commitments will be reflected in the Protocol or in another international legal instrument. The President's call for "meaningful participation" of "key" developing countries carefully avoids whether that participation will be found within or outside the Convention and/or the Kyoto Protocol.

Recently, in response to follow-up questions from Under Secretary Eizenstat's March 4 hearing before the Senate Foreign Relations Committee, the Administration indicated that "meaningful participation" could be secured by actions that need not take place pursuant to a commitment reflected in an international legal instrument. This again is an element of flexibility lacking in the Byrd/Hagel standard, but it is also more flexible and realistic.

A number of "key" developing countries (including China and India) are taking many steps domestically to respond to the threat of global warming; in general, they are significantly more willing to commit to actions in a domestic or bilateral context than in a multilateral negotiation, and they are often willing to go beyond the letter of requirements contained in the Convention. China is a prime example. China has made considerable strides in developing a national action plan and in preparing a national communication under the Framework Convention – its national communication once unveiled will likely go well beyond the strict requirements of the Convention. But whenever the issue of national communications for developing countries arises in meetings of the Convention's subsidiary bodies, China publicly resists efforts that might require more detailed reporting obligations or individual review of developing country communications.

To preserve needed flexibility, we should continue to state publicly that what matters is the substance of developing country actions to move forward, not how or

where those actions are recorded. It will be particularly important to avoid suggestions that developing countries must take on commitments in the Kyoto Protocol or another international legal instrument for their actions to "count."

Approaches

As noted by Under Secretary Eizenstat, "the circumstances of developing countries vary widely, along a kind of continuum." At one end, are the low/poor countries of USAID's quartet; at the other end are the high/rich.

Presumably, meaningful participation by low/poor countries would involve little beyond what they are already doing or can already do under the Convention and the Protocol. They can: (1) sign and ratify the Protocol; (2) take various domestic actions to limit their emissions and to adapt to climate change, including through the development of national action plans; (3) prepare and submit their national communications required under the Convention, including an inventory of their greenhouse gas emissions; (4) participate in activities under the Clean Development Mechanism to lower their emissions and protect and enhance their sinks and reservoirs of greenhouse gases, as well as other efforts to promote investment in and diffusion of technology; and (5) take steps domestically to build their capacity to respond, including by promoting education and public awareness.

While we can use these categories as the focus of "meaningful participation" and broadly encourage all developing countries to take actions within them, our focus should be on the developing countries that are considered key (as further discussed under **"Country Specific Strategies"** below).

Growth Targets

Meaningful participation for developing countries at the other end of the continuum presumably would involve all of the actions listed above, as well as a legally-binding commitment to a quantified emissions limitation objective (i.e., a growth target). Politically (in terms of Byrd/Hagel), economically (in terms of the income and technology it will bring to developing countries and the advantages of an expanded trading regime), and environmentally there is no option preferable to a quantified emissions limitation objective for key developing countries.

At the same time, it is not clear that growth targets/emissions trading are appropriate for all developing countries, no matter what their stage of development. The ability to trade presupposes the existence of institutions and the necessary financial infrastructure to support emissions trading in each country involved. The ability to trade also presupposes the existence of data and monitoring systems. This infrastructure is lacking or insufficient in many developing countries and it could well inhibit their ability to trade, even if they were prepared to adopt growth targets and join in with other Annex B countries. We will need to consider carefully which developing countries have the

appropriate infrastructure (or could quickly improve to an adequate level) before urging them to take this path.

South Korea and Mexico, two countries that arguably have the requisite infrastructure and could take on additional commitments, have thus far avoided committing to a growth target. They are unsure how to calculate such a target and they are worried about how it could affect their economic growth.

Advantages to Trading

As an inducement, we are now able to point out the significant advantages of adopting a target and we could do more in this regard. In particular, having targets would enable such countries to engage in emissions trading. As CEA Chair Yellen pointed out in her recent Congressional testimony, with targets only slightly below "business-as-usual," developing countries would enjoy net gains of many billions of dollars through the international sale of emissions reductions achieved at lower cost than the world price.

Participation by large developing countries in international permit markets would greatly lower the costs to the United States of meeting its Kyoto target. In particular, costs would be lower than with trading among only Annex I countries. In addition, targets slightly below "business- as-usual" would lower global emissions relative to a world with only Annex I targets, and most importantly, would reduce the potential for emissions leakage associated with lower world oil prices.

Structuring Targets

To persuade developing countries voluntarily to adopt a target and then trade permits internationally, CEA points out that targets must be structured to reduce the risk of inadvertent stringency and in particular to reduce the possibility of targets so stringent as to cause large economic losses to developing countries. For this reason, CEA urges that our efforts focus on securing targets only slightly below the estimated business as usual emissions level, where this level is expressed in a way that depends on the future values of economic variables, such as GDP. Toward this end, CEA proposes the following basic principles for implementing such an approach:

1) **Reasonable Forecasts:** The relationship between the target (ignoring any real reductions in emissions) and the values of economic variables, when applied to emissions and such variables during recent years, should predict emissions reasonably well (and be without demonstrable statistical bias). Relationships that give reasonably reliable predictions reduce the risk of either inadvertent stringency or inflated targets which could increase global emissions.

2) **Predetermined Targets:** The target should not depend on contemporaneous values of economic variables, so as to avoid uncertainty during the commitment period about the country's target. For example, a target for the 2008-12 commitment period should not vary with 2008 or 2010 GDP levels, but rather with 2007 GDP.

3) **No Perverse Incentives.** The target should depend on values of economic variables only indirectly related to emissions, to avoid creating perverse incentives for developing countries to increase emissions so as to have higher targets in the commitment periods. For example, a target (for the 2008-12 commitment period) should not depend on energy consumption in 2007, but could reflect pre-Kyoto levels.

Domestic Trading?

[As a longer term proposition, it may be useful to encourage key developing countries to adopt domestic emissions trading regimes for sulfur and/or nitrous oxide emissions. These programs could be modeled on the U.S. approach and benefit from U.S. experience and expertise in designing them. Domestic trading regimes for sulfur and/or nitrous oxide in key developing countries (e.g., China and India) would produce important, tangible local benefits and could help build constituencies for participation in international emissions trading.]

Equity

However, many developing countries (e.g., China, India), may not be willing to discuss the issue of targets in the straightforward economic terms suggested by CEA. They will point out that such an approach ignores the environmental objective that should first be established. Brazil has sought to establish such an environmental objective with its proposal related to responsibility for the global temperature increase. The Netherlands and the European Union began down this path in the run-up to Kyoto, urging that an atmospheric concentration ceiling of 550 parts per million of carbon dioxide-equivalent guide the efforts of the Parties over the longer term. Moreover, the E.U.'s Environment Council conclusions ("Community Strategy on Climate Change") of March 23, 1998, reiterate the E.U. view that "global average temperatures should not exceed 2 degrees Celsius above pre-industrial level and that therefore concentration levels lower than 550 ppm CO2 should guide global limitation and reduction efforts."

Some key developing countries may prefer such an approach because it would make it possible then to discuss targets based on an equitable distribution of global emission rights, as India urged be a condition precedent to emissions trading in the final hours of COP-3. These countries may suggest that any such discussion begin by estimating what must be done globally to limit atmospheric concentrations (or the global temperature increase) to "safe" or tolerable levels, then determine the level of global

emissions over a particular time period necessary to limit concentrations (or temperature) to such levels, and finally to negotiate shares globally of the rights to such emissions.

If discussions in the Convention's subsidiary bodies over thresholds at which developing countries might be expected to take more significant action promise to be lengthy and difficult, discussions of an equitable distribution of global emission rights promise to be a new forum for the 1970s North/South dialogue, and equally as unproductive. Partly because he believes that the Kyoto Protocol inevitably will lead to such discussions with such an outcome Richard Cooper in a recent article in *Foreign Affairs* attacked the approach taken in Kyoto as wrong-headed.

Other Target Questions

Thus far, we have considered growth targets for key developing countries only in terms of the possibility of getting a limited number of key developing countries to adopt such targets for the first commitment period (i.e., 2008-12). Many developing countries believe that the industrialized countries should go first and that any such quantified emissions limitation objectives would not apply to them until the second or later commitment periods. Because it could require some time after the end of the first commitment period to determine whether the Protocol's Annex B Parties have met their commitments, it may be difficult under such an approach to get key developing countries to adopt targets until sometime after the beginning of the second commitment period.

Even if a substantial number of key developing countries were to sign up to growth targets for the second commitment period, their action would not satisfy the letter of the Byrd/Hagel Resolution. If some developing countries could be persuaded to consider growth targets for the first commitment period, they will naturally ask what will be expected them for the second commitment period -- presumably they would have growth targets in this period as well, but would they be held to a lower rate of growth than in the first commitment period? If so, would there be advantages to waiting to adopt a growth target until the second or later commitment periods? If not, how would industrialized countries be able to justify lower targets for themselves in the second and subsequent commitment periods?

In the run-up to Kyoto some industrialized countries considered making commitments in the context of two budget periods. Most held back, recognizing that unilateral commitments would reduce their bargaining leverage with other industrialized countries over targets for the second commitment period; more importantly, unilateral commitments would eliminate any leverage they might have to encourage developing countries to adopt quantified emissions limitation commitments for the second or subsequent commitment period.

At the other extreme, some industrialized countries considered making their willingness to act in the second commitment period contingent on obtaining commitments to growth targets from key developing countries. For the most part they

avoided direct linkage, fearing that it could backfire and that they could be estopped from acting to deal with a serious environmental problem if key developing countries refused to do so. Nevertheless, this issue will recur sooner than later. The Protocol's Article 3, paragraph 9, provides that consideration of commitments for the second commitment period must begin in 2005.

Another Macro-Economic Alternative?

The only other macro-economic approach yet suggested to limit emissions of greenhouse gases (aside from a cap and trade system) is a carbon tax. This is the approach recently urged by Richard Cooper in his *Foreign Affairs* article. If given a choice between the two, high/rich developing countries worried about the implications of a target for their economic growth might prefer a tax. A carbon tax would not have the same advantages as a target, primarily because countries without a target would not be able to trade emissions.

Wealthy but Low Emitting Countries

While macro-economic approaches may be appropriate measures of meaningful participation for countries in the high/rich and high/poor categories, we have yet to consider what countries in the low/rich category should be expected to do. While countries such as Singapore or the United Arab Emirates should also be urged to adopt targets to limit their greenhouse gas emissions, it is their wealth not their emissions that suggests they should bear responsibility for greater participation in the global effort. In this context, greater participation should be geared toward efforts to assist other, less fortunate developing countries either regionally or internationally. They could be encouraged to support efforts to develop or diffuse technology, to support education, training and public awareness programs, to assist other developing countries to take part in multilateral efforts such as the Intergovernmental Panel on Climate Change or meetings under the Framework Convention.

As part of our effort to define "meaningful participation", we should begin now to develop a list of specific actions that low/rich countries can be urged to undertake in this regard. This effort could take place in the process further described below.

Country Specific Strategies

To move forward toward identifying "key" developing countries and to assess what they are already doing and what more might be expected, an interagency group has developed a list (attached) of 29 key developing countries. Efforts are now underway to complete country profiles for the first five (Brazil, China, India, Indonesia and Mexico), as well as to develop specific strategies we could pursue bilaterally. We could also urge our OECD and Annex I colleagues to pursue these strategies in their bilateral discussions with these countries. After the first five papers are completed, similar papers will be

prepared with respect to: Argentina, Israel, Korea, Singapore, South Africa and Thailand. Ultimately this effort will extend to the entire list of 29.

While the number of truly "key" developing countries is probably more limited, some of those at the top of the list will be extremely difficult to sway (e.g., China, India). A longer list of "key" developing countries provides more room for maneuver in seeking to change the dynamic that has thus far stymied action. If a certain core group of "key" developing countries can be persuaded to act, others may follow. The logic here is the same as that which has prompted us to promote a process outside of but related to the Convention that can explore potential avenues for progress.

Clean Growth Initiative

As part of our strategy for moving developing countries more fully into the global response to climate change, an interagency group has been examining the role that international financial institutions, including the multilateral development banks (MDBs), especially the World Bank, and to a lesser degree the bilateral and multilateral export credit agencies can play. A separate paper developed in that process details opportunities for market reforms, win-win projects and future power generation. It also considers the role that we could play in leading an aggressive push to refocus the MDBs backed up by Administration influence, Executive Board action, and leverage through upcoming replenishment negotiations. Elements of the strategy the paper proposes include: country power sector development plans, revision of the energy and environment policy, more creative use of MDB guarantees and insurance mechanisms, increased overall MDB investment in environment-friendly power projects, building of small project loans/changing staff incentive structures, changing MDB staff-skill mix, and targeting corruption in the power sector. The paper also considers possible export credit agency initiatives, including climate rationalized export credit. Because these matters are fully discussed in that paper, they are not taken up here.

Cooperation with OECD/Annex I Countries

Prior to Kyoto, the European Union was decidedly reluctant to push hard for developing countries to take meaningful action. The Japanese were more willing, but as host of the Kyoto Conference stressed their need to play the role of a broker. Australia strongly supported us on this issue privately but directed nearly all of its diplomatic energy to the pursuit of differentiated targets for Annex I Parties. Canada and New Zealand also supported us, but in Kyoto only New Zealand took the point.

Since Kyoto, things have changed. The European Union has found a new willingness to address this issue, as have some of its key members states. In the E.U. Environment Council's Conclusions of March 23, 1998, the Council specifically regrets that no progress was made to include a provision in the Kyoto Protocol for non-Annex I Parties to take on quantified obligations on a voluntary basis. The Council also urges continued dialogue with developing countries about how to take forward the issue of

increasing participation in global efforts to combat climate change at COP-4 and beyond. The Council mentions as a possible vehicle an early review of Parties' obligations under the Convention, taking into account the provisions for review in Articles 4.2(d) and 7.2 of the Convention and Article 9 of the Protocol.

Preparations for the G-8 Summit are focusing heavily on how to bring developing countries more fully into the global response to climate change, and G-8 partners have repeatedly asked for our views and suggested that we seek to coordinate our diplomatic strategies vis-a-vis developing countries. We will hope to suggest coordinated action through diplomacy, bilateral assistance and the IFIs.

The recent meetings in Washington with ACAP countries (Australia, Canada, Japan and New Zealand) found strong, shared interests in seeking to engage developing countries, and recent meetings in the Gore/Chernomyrdin process found no objection from Russia in this regard.

Key to coordinating diplomatic strategies will be to reach agreement with our OECD/Annex I partners on the substantive approach we intend to take, i.e., can we agree on which developing countries are "key" and can we agree on what actions we expect from particular countries or categories of countries?

Toward this end, once we have settled on our own approach we should begin coordinating closely with other OECD/Annex I partners. Much can be done in this regard through video conferences and on the margins of various international meetings before the June meetings of the subsidiary bodies. In particular, we will want their support for any informal process that might take hold outside the meetings of the subsidiary bodies.

III. Recommended Actions

We should:

1) Continue efforts already begun by the President and by Under Secretary Eizenstat to bring the Senate closer to the standard enunciated by the President (i.e., "meaningful participation by key developing countries"); in particular, we should continue to urge that:

   - our focus should be on "key" developing countries (not all developing countries), defined for our purposes in terms of total emissions and/or per capita income

   - "meaningful participation" will vary based on the particular national circumstances of developing countries and we should not insist on a uniform, "one-size fits all approach"

- substance matters over form – if we can move "key" developing countries to take significant actions, we should be flexible as to how those actions are recorded (i.e., they need not necessarily be commitments take the form of commitments contained in the Kyoto Protocol or another international legal instrument

2) Welcome further discussions of Argentina's proposal to revisit A10/AB and of Brazil's proposal in the Convention's subsidiary bodies; but accept that those discussions may not proceed quickly or yield significant results; in this connection, we should:

   - seek to avoid merging SBI's discussion of A10/AB with SBSTA's further consideration of the Brazilian proposal

   - seek to avoid considering thresholds and approaches with respect to A10/AB

   - debate the issues on their merits if the two discussions are merged and/or if further consideration of A10/AB leads to consideration of thresholds and approaches, supporting total emissions and/or per capita income as appropriate bases for establishing thresholds but opposing the use of per capita emissions, "historic emissions" and contributions to the global temperature increase as appropriate bases for thresholds

   - maintain strongly that only those with targets should be able to decide whether to accept proposed targets from others because only those with targets have a clear stake in maintaining the integrity of the trading system

   - maintain strongly that acceptance of a legally-binding, quantified emissions limitation commitment (growth target) must be the condition precedent to engaging in emissions trading; other kinds of commitment will not suffice as conditions precedent to emissions trading (e.g., imposition of a carbon tax or adoption of energy efficiency standards in particular industries)

3) Continue efforts to begin an informal process distinct from but related to discussions under the Convention; these discussions could take place in the context of the reviews called for under the Convention.

4) Endorse growth targets/emissions trading as the most meaningful form of developing country participation.

- urge that key developing countries adopt growth targets for the first commitment period (2008-12)

- indicate that the targets of such countries in the second and subsequent commitment periods should be more stringent than in the first commitment period, but indicate also that targets in subsequent periods could still be growth targets

- encourage targets based on reasonable forecasts, that depend on values of economic variables only indirectly related to emissions, and that do not depend on contemporaneous values of economic variables

5) Continue to stress the advantages to developing countries of adopting growth targets and engaging in emissions trading; redouble our efforts at public diplomacy on this issue, using economic analysis developed by CEA.

6) Carefully evaluate whether a particular developing country has, or can realistically improve, the necessary institutions and financial infrastructure to support emissions trading before urging that country to adopt a growth target.

7) Vigorously encourage Korea and Mexico to adopt growth targets -- they are already members of the OECD and their actions will strongly influence other developing countries.

8) Urge prospective OECD members (e.g., Argentina) and others (e.g., Barbados, Chile, Costa Rica, Israel, South Africa) (based on the evaluation in recommendation #6 above) to consider adopting growth targets as well; in this connection, we should:

   - also explore whether Turkey will adopt a growth target, since Turkey is an OECD member but has proposed to amend the Convention to be deleted from Annex I and II, arguing that it is essentially a developing country

9) Continue to maintain that it is premature to establish a medium-term environmental goal (e.g., 550 ppm, 2 degree C maximum temperature increase), but continue to endorse further scientific efforts and cooperation in this area.

10) Thoroughly analyze and develop a comprehensive position on the Brazilian proposal (basing "responsibility" on each nation's contribution to the global temperature increase) in time for the June meeting of the Convention's subsidiary bodies.

11) Consider macro-economic alternatives to growth targets for developing countries, if efforts to encourage them to adopt growth targets are unproductive

12) Develop a list of specific actions that wealthy but low-emitting developing countries can be urged to undertake, in addition to growth targets, so as to participate more fully in the global response to climate change.

13) Endorse the following five areas for the focus of "meaningful participation": (1) compliance with the U.N. Framework Convention on Climate Change and the Kyoto Protocol; (2) climate-related technology transfer, diffusion and investment; (3) domestic policy reform and implementation; (4) long-term commitments, including binding targets; (5) capacity building and education.

14) Continue efforts expeditiously to complete country profile/strategy papers for all 29 developing countries identified as "key;" this will involve determining what specific actions we should encourage each of the 29 to take in the context of item #13 above.

15) Consider new U.S. initiatives to support the efforts of developing countries to engage more fully in responding to climate change, including for example:

- a program to help build capacity in certain key advanced developing countries to undertake macro-economic analysis related to climate change response options and to use climate models
- a new (expanded) program to support developing country efforts to develop national action plans for climate change
- a program to promote climate change technology needs assessments in key developing countries

Attachment:
List of Key Developing Countries

File: H:Developing Countries\Developing Countries.doc

KEY DEVELOPING COUNTRIES

1. Argentina *
2. Barbados
3. Brazil *
4. Chile
5. China *
6. Colombia
7. Costa Rica
8. Egypt
9. India *
10. Indonesia *
11. Israel *
12. Kazakhstan
13. Kenya
14. Korea *
15. Malaysia
16. Mexico *
17. Nauru
18. Nigeria
19. Philippines
20. Senegal
21. Singapore *
22. South Africa *
23. Thailand *
24. Trinidad & Tobago
25. Turkey
26. United Arab Emirates
27. Uruguay
28. Venezuela
29. Zimbabwe

* First tranche of strategy papers

4pm
Brazil
Chile

OES Conf. Room
7835

Preliminary Draft, Close Hold, Do Not Cite, March 19, 1998

A Proposal for Developing Countries:
Participation in a "Target and Trade" System

I. As the U.S. moves ahead in the post-Kyoto process, and seeks to elicit developing country participation, we must identify leading opportunities for constructive engagement. To that end, this analysis demonstrates that, if developing countries (a) accept binding targets at or slightly below their business as usual (BAU) emissions levels, and (b) trade from their respective targets, the gains will be substantial. Developing countries will benefit from additional income, the U.S. (and other Annex I countries) will benefit from lower costs, and the environment will benefit from further reductions in emissions. The strongest case for eliciting developing country participation may be found, ultimately, in persuading them of the substance of the gains from trade. To the extent that we can convince them that they will benefit from participating in a "target and trade" system, we can better draw them into the post-Kyoto process. We believe that participation in a "target and trade" system should be the cornerstone of our international negotiations.

A. The economic and environmental rationale for such participation includes

- **Greater economic benefits to developing countries:** With targets only slightly below BAU, developing countries would enjoy net gains of many billions of dollars through the international sale of emission reductions achieved at lower cost than the world price.

- **Greater cost savings to the U.S.:** Participation by developing countries in international permit markets would greatly lower the costs to the U.S. of meeting its Kyoto target (as CEA testimony showed). In particular, costs would be lower than with trading among only Annex I countries.

- **Greater environmental benefits:** Targets slightly below business as usual would lower global emissions relative to a world with only Annex I targets, and most importantly, would reduce the potential for emissions leakage associated with lower world oil prices.

Section in his paper
append 4,3 ?

- **Target and trade yields greater benefits than CDM:** While the Clean Development Mechanism will likely result in cost savings to the U.S. relative to a world with only Annex I trading, a system including target and trade of developing countries' emissions would yield greater cost savings to the U.S. and greater gains to developing countries than CDM. Further, target and trade could achieve environmental benefits not achievable by pursuing CDM, which only redistributes emissions geographically.

need to explain

B. Other rationale include the long-run benefits of including developing countries into global negotiations, for example, as recognized by the Byrd-Hagel resolution. By establishing participation now, further commitments might be feasible in future periods.

II. Problem: To persuade a developing country *voluntarily* to adopt a target and then to trade permits internationally, international agreements must be structured to reduce the risk of inadvertent stringency and in particular to reduce the possibility of a target so stringent as to cause large economic losses to the developing country.

Proposed Solution: Negotiations should focus on slight reductions from the estimated business as usual emissions level, where this level is expressed in a way that depends on the *future* values of economic variables, such as GDP.

Rationale: Such targets would avoid the risk of inadvertent stringency associated with higher than projected economic growth between now and the beginning of the commitment period in 2008. Developing countries would face only the much smaller risk that emissions would be higher than expected, *given* the economic conditions realized in 2007.

Basic principles for implementing such an approach are:

- **Reasonable Forecasts**: The relationship between the target (ignoring any real reductions in emissions) and the values of economic variables, when applied to emissions and such variables during recent years, should predict emissions reasonably well (and be without demonstrable statistical bias). Relationships that give reasonably reliable predictions reduce the risk of either inadvertent stringency or paper tons which could increase global emissions.

- **Predetermined Targets:** The target should not depend on contemporaneous values of economic variables, so as to avoid uncertainty during the commitment period about the country's target. For example, the target should not vary with 2008 or 2010 GDP levels, but rather with 2007 GDP.

- **No Perverse Incentives:** The target should depend on values of economic variables only indirectly related to emissions, to avoid creating perverse incentives for developing countries to increase emissions so as to have higher targets in the commitment periods. For example, the target should not depend on energy consumption in 2007, but could reflect pre-Kyoto levels.

III. Illustration: One way of implementing the solution is described below. Other ways of implementing the solution may work as well or better. The conclusions are stated below and the details of our work follow.

- Defining the business as usual level for a developing country as a function of its GDP and population in earlier years and setting the emissions target at that level yields a negligible risk of leaving the developing country worse off under target and trade because of inadvertent stringency. A target only slightly below BAU would also yield negligible risk of leaving the developing country worse off.

- Emissions targets for developing countries set below their business as usual emission level would result in gains from trade lower than with a BAU target, though providing environmental benefits. The higher costs of a target set below BAU are borne by both the developing countries and the Annex I countries.

There are significant gains from trade for developing countries and large cost-savings to the U.S. if even one large developing country accepts an emissions target at BAU and participates in emissions trading. Table 1 and Charts 1 through 3 illustrate these gains from trade from a baseline of full Annex I trading.

Table 1. Illustrative Gains from Trade with Developing Countries that Target and Trade

Trading Scenario	Permit Price[1] (1997$/ton)	Country Gaining	Gains from Trade with Developing Countries
Annex I only	$54	United States	not applicable
Annex I + China	$26	China	$3.6 billion/year
		United States	$11.6 billion/year[2]
Annex I + India	$47	India	$1.6 billion/year
		United States	$2.5 billion/year[2]
Annex I + Mexico	$51	Mexico	$0.9 billion/year
		United States	$1.2 billion/year[2]

[1] These scenarios do not account for the cost savings available through the Clean Development Mechanism and carbon sinks.

[2] Gains from trade for the U.S. are estimated as the change in the U.S. total cost of complying with the Kyoto Protocol relative to an Annex I only trading regime.

Chart 1. China's 2010 Marginal Abatement Cost Curve and Gains from Trade

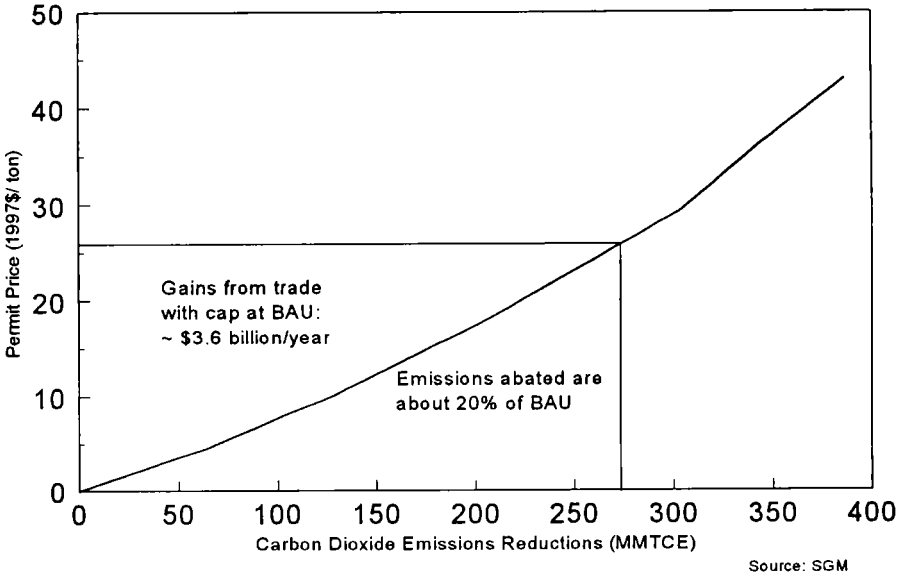


Chart 2. India's 2010 Marginal Abatement Cost Curve and Gains from Trade

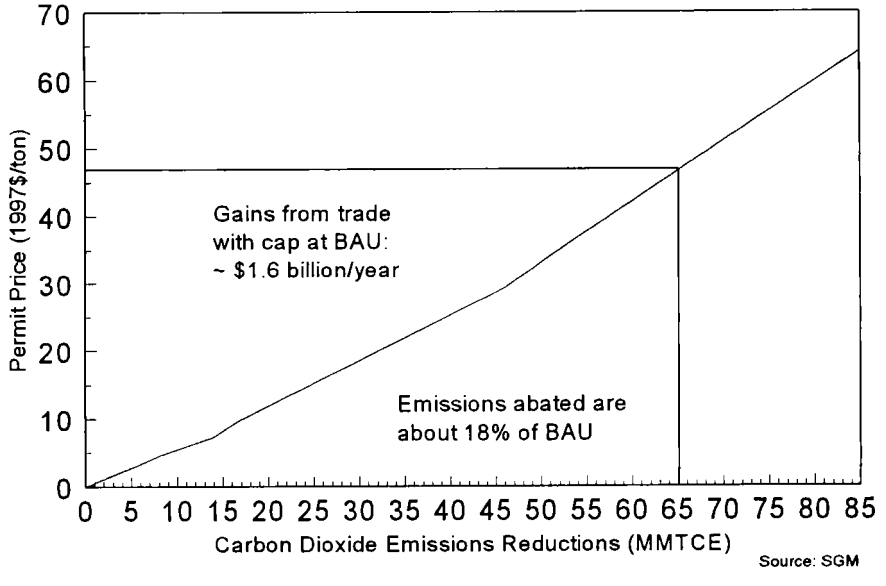
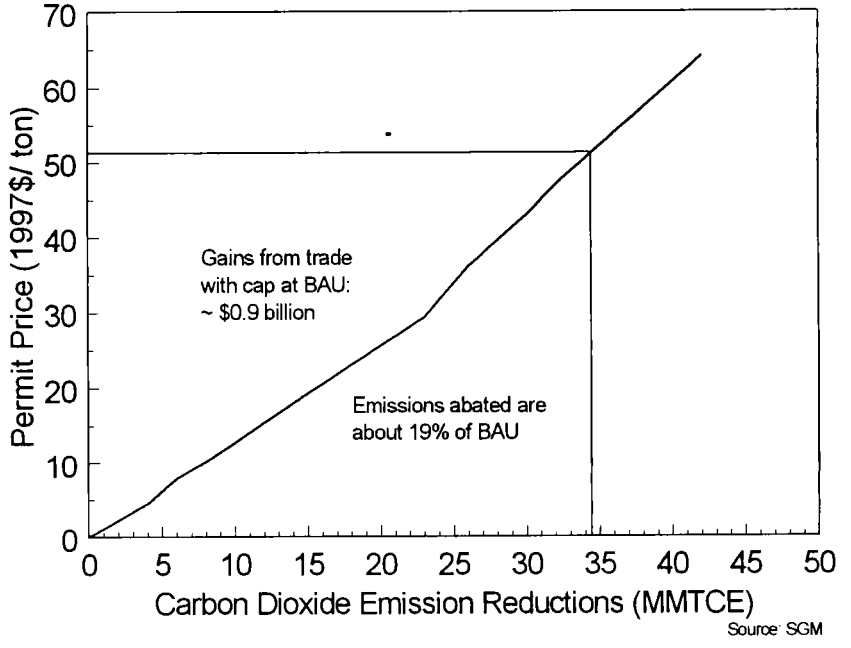


Chart 3. Mexico's 2010 Marginal Abatement Cost Curve and Gains from Trade

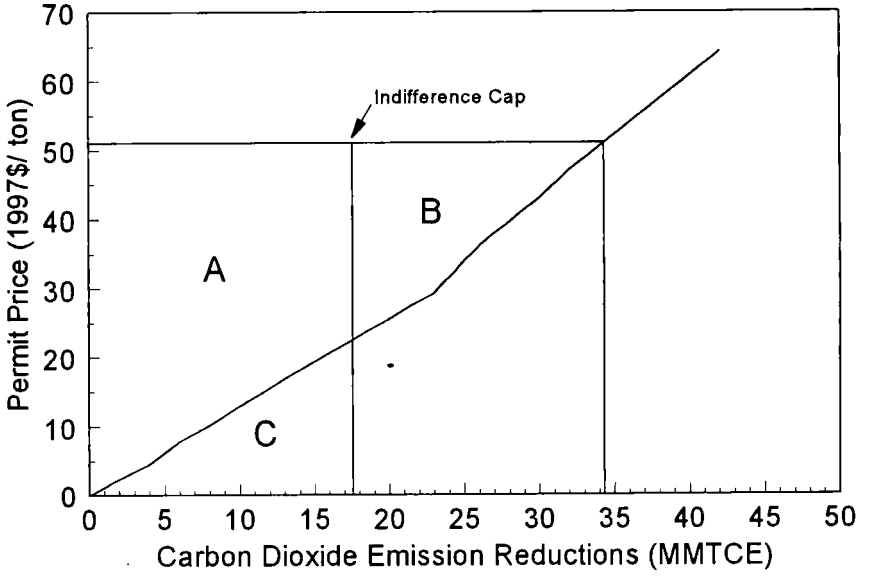


IV. How Far Below BAU Should the Developing Countries' Targets Be Set?

The answer to this question has many dimensions. Most commonly discussed is the issue of fairness: what commitments to reduce emissions should be made by countries whose economic resources differ substantially? Generally neglected but discussed below is the issue of efficiency. In particular, what are the implications for U.S. costs of increasingly more stringent targets on emissions from key developing countries?

More stringent developing country targets raise U.S. costs by restricting the supply of permits in world markets and so raising the price of permits. To assess the magnitude of this effect consider the target which just leaves a country no better off than no target at all. This "indifference" target is where the costs of meeting the target just equal the net gains from selling permits in world markets. Chart 4 illustrates gains from trade for a small country. For a target that is equivalent to a reduction from BAU of 17 MMTC, net gains from foreign exports are B, and the cost of meeting the target is C. Since B = C in this example, the net gains from trade are nil.

Chart 4. Illustrative 2010 Marginal Abatement Cost Curve and Indifference Target



Note: This indifference target is illustrated for a country whose participation in world permit markets does not affect world permit prices.

Table 2 provides an illustration of the effects of emissions targets more stringent than BAU on China with Annex I plus China trading. Note that a small reduction below BAU has no real effect on the Annex I trading price, and thus no economic effects on the U.S. However, as the target becomes more stringent, the Annex I trading price increases, resulting in higher total costs of compliance for the U.S. If China accepts a target below BAU, the cost of this additional stringency to the U.S. -- essentially, the cost of supplying the environmental benefits associated with these emissions reductions -- can become significant. Thus developing country participation in the form of acceptance of targets more stringent than business as usual will raise costs to the U.S.

Table 2. Effects of Various Chinese Emissions Targets with Annex I Trading

Emissions Target[1]	Permit Price (1997$/ ton)	Chinese Emissions Reductions (MMTC)	Chinese Emissions Sales (MMTC)[2]	Total Cost to U.S. of Complying with Kyoto	Cost to U.S. of Additional Stringency
BAU	$26	276	276	$13.4 b	not applicable
BAU - 1%	$26	276	262	$13.4 b	~$0
BAU - 5%	$29	304	235	$14.9 b	$22/ton
Indifference	$36	343	172	$17.9 b	$26/ton

[1] We employ the SGM BAU for China for the purposes of these calculations.
[2] Reductions in Chinese emissions less Chinese emissions sales yields net global reductions.

Imposing this "indifference" target on China, given that its participation lowers world permit prices, leads to the following conclusions.

- An indifference target for China increases annual U.S. costs by $4.5 billion or 33% relative to a BAU target for China.

- If China accepts an emissions target requiring reductions of approximately 170 MMTC below BAU, the average cost to the U.S. would be $26/ton. This is <u>not</u> the average cost of a ton of emissions purchased from China, but the average cost to the U.S. of the environmental benefits associated with China complying with a more stringent target.

Summary of Analysis

A. Data

We have compiled data on 3 variables: emissions of carbon dioxide, GDP, and population for 117 countries for the time period 1970-1992. The carbon dioxide emissions data, measured in millions of metric tons of carbon, are from the Carbon Dioxide Information Analysis Center (Oak Ridge National Laboratory, DOE). The GDP data, measured in 1987 U.S. dollars, are from the World Bank. The population data, measured in thousands of individuals, are from the United Nations Population Division.

B. Methods

We have estimated a fixed effects linear regression on the logs of these variables, for the countries in our data set, excluding those listed in Annex I. Our regression uses four non-overlapping 5 year intervals for each country. Our forecasts include the country specific constants.

C. Results

The fixed effects regression we estimated is

$$\text{Emissions} = a\,GDP_{t-1} + b\,GDP_{t-2} + c\,Population_{t-1} + \gamma\,trend$$

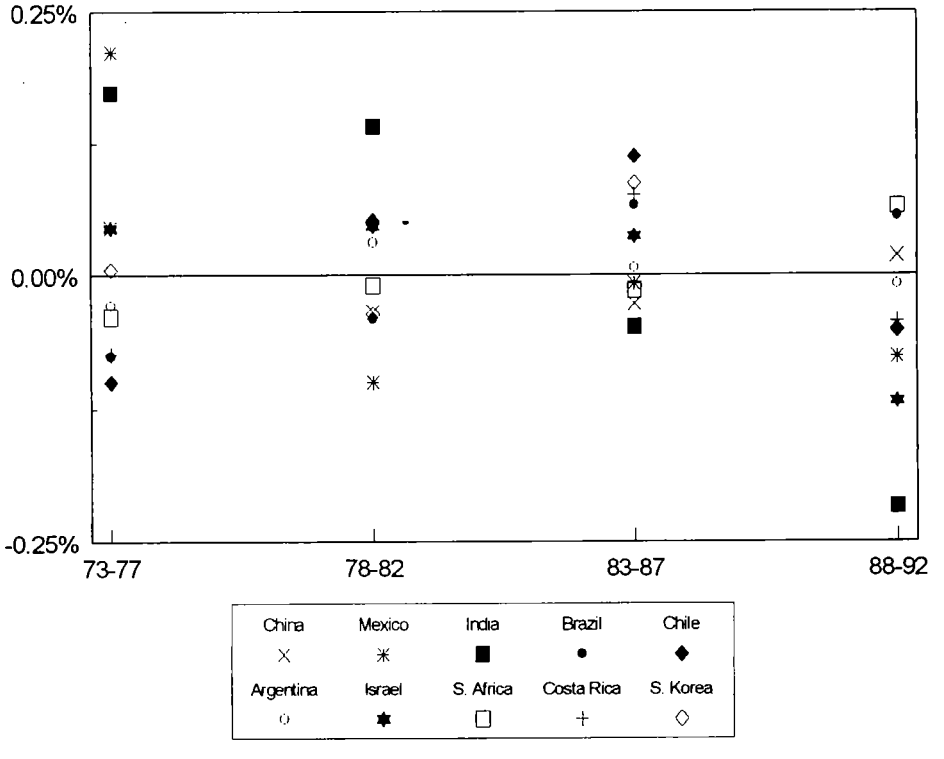
Emissions are the natural logarithm of the five year non-overlapping average of carbon emissions. All independent variables are lagged. GDP_{t-1} is the log of the gross domestic product in the year prior to the first year in the emissions variable, GDP_{t-2} is GDP in the year two years prior to the first year included in the emissions variable, and $population_{t-1}$ is the country's population in the year prior to first year included in the emissions variable. Trend is one in the first 5 year period, and 2, 3, and 4 respectively in the subsequent 5 year periods. The useable data included 376 cross-section time series observations. The fixed effects regression used 98 degrees of freedom. The R squared was in excess of 0.99.

Table 3. Model I Results

Variable Name	Coefficient Estimate	Standard Error
GDP_{t-1}	0.9501823	0.2443047
GDP_{t-2}	-0.411297	0.23894
$Population_{t-1}$	0.4836006	0.2055439
trend	0.0073712	0.0310638

As one illustration of the model's accuracy in predicting emissions, consider the chart below that maps actual and predicted emissions using within sample data for ten selected developing countries. The predicted value is never more than 1/4 of one percent away from the actual emissions average for any of the five year intervals.

Chart 5. Error in Model I Prediction as a Fraction of Actual Emissions



To forecast emissions for the five year period beginning in 2008 using the results of this regression we input the World Bank forecasts of GDP for the years 2007 and 2006, and the United Nations forecasts of 2007 population. The forecasts of emissions for the budget period and the confidence intervals around these forecasts conditional on the assumed 2006 and 2007 values are described in the table below.

Table 4. Predicted Average Emissions, 2008-2012

Country	2006 GDP (1987$, billions)	2007 GDP (1987$, billions)	2007 Population	Predicted Average Emissions, 2008-2012
China	1,385.8	1,493.5	1,357,627,000	2092 MMTC SE: 1.37 MMTC
India	752.1	799.7	1,140,563,000	345 MMTC SE: 1.34 MMTC
Mexico	268.2	282.7	113,385,000	157 MMTC SE: 1.33 MMTC

The 95 percent confidence interval around the predicted emissions is approximately ± two standard errors. As shown in figure 1, these developing countries would incur net costs of a target and trade only if the target were about half the reduction needed to raise the marginal cost of abatement to the world price. Given figures 2-4, these levels are about 9 to 10 percent below BAU. Since such reductions from BAU are more than 10 times greater than the standard error, the risk of net costs is negligible, given the model.

OUTLINE

U.S.G. DIPLOMATIC STRATEGY FOR MEANINGFUL PARTICIPATION

Each country-specific strategy paper is intended to use the information in the individual country profile to help us build on each country's own goals and growth strategies that will best lead to their acceptance of climate change commitments as being in their own self-interest. We will use this USG strategy to prepare for specific meetings and events at which we can encourage and, hopefully, garner commitments by the key developing countrie

Country:

General observations: country's own goals and strategies; best opportunities for influence

Summary of areas for meaningful participation:

Key players/levers:

USG Goals: short term:

long term:

Obstacles:

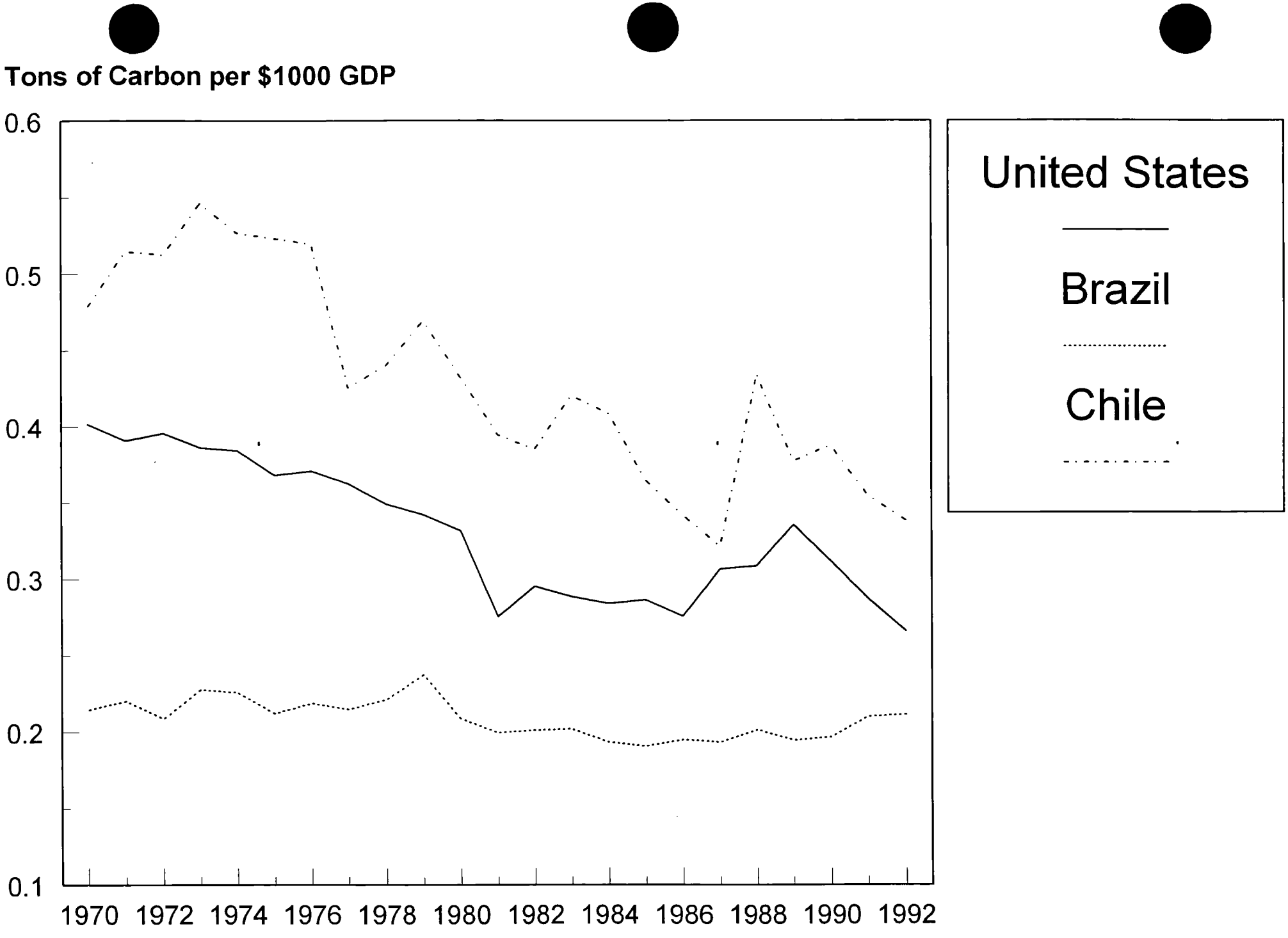
Implementation: USG programmatic and diplomatic tools and responses:

Lead USG agencies:

Allies:

Calendar of opportunities:

Timelines:


Tons of Carbon per $1000 GDP
0.6
0.5
0.4
0.3
0.2
0.1
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992
United States
Brazil
Chile

Brazil:
Energy Sector Profile and Climate Change Issues

I. Economic and Political Background

Brazil is the largest nation in Latin America and one of the largest countries in the world, with a population of more than 160 million and a land area only slightly smaller than that of the U.S. Its economic output of nearly $800 million is about the same as the rest of Latin America.

Brazil has had a democratically elected government since 1985, when a two-party system under the influence of the military was replaced with a multi-party system. Brazil's political system resembles that of the U.S. in many respects. As in the U.S. the legislature is elected separately from the president from single member districts, which tends to encourage parochial and local behavior on the part of legislators. States have significant independent powers in many respects, although state utility commissions do not exist in Brazil.

Brazil's current president is Fernando Henrique Cardoso, who is the leader of a political alliance of his own party, the Partido da Social Democracia Brasileira (PSDB), the Partido da Frente Liberal (PFL), and the Partido Trabalhista Brasileiro (PTB). Elected in January 1995, Cardoso has been a staunch proponent of economic and political reform. The Cardoso administration has been very popular, and is generally expected to win re-election this October.

Brazil's main economic reform program, the *Plano Real*, was launched by then finance minister Cardoso in July 1994 to control inflation, achieve long-term sustainable growth, and reduce social inequities. The Real was established as the official currency of Brazil, and pegged to the U.S. dollar.[1] Within one month, inflation fell from more a monthly rate of more than 50% to less 2%. By 1997 inflation fell to about 5%. Real economic growth has slowed somewhat, from 16.5% in 1996 to 3% in 1996, although economic growth is expected to increase to 5.5% by 2000 (Source: WEFA).

Cardoso has also been a leading reform advocate in the areas of free trade and privatization. In 1995 it entered the Mercosur Free Trade Pact, which includes full members Argentina, Brazil, Paraguay, and Uruguay, and associate members Bolivia and Chile. Cardoso has suggested that Brazil may support regional integration of energy and other policies among Mercosur countries. Brazil's aggressive program of privatization includes the ongoing privatization of the electricity sector and plans to reform the petroleum industry (discussed below). The Brazilian government is also moving to privatize sectors the country" telecommunication network, major ports, roads, and railway.

Despite all of Brazil's recent economic and political accomplishments the international investment community is now highly concerned that Brazil's economy may experience the same problems as recently seen in the Asia/Pacific. These concerns relate partly to Brazil's

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[1]. Since 1994, only a small amount of currency devaluation has been approved. During 1997 a devaluation of about 10% was approved; an additional 8-9% if forecasted for 1998.

deteriorating balance of trade. Partly as a result of the pegged currency, Brazil's trade balance fell from a $10.5 surplus in 1994 to a deficit of $5.5 billion in 1996. Brazil's current account deficit in 1996 was $24 billion.

There is also concern about excessive foreign investment in Brazil. The country's privatization efforts could require annual investment needs of up to $24 billion per year. This amount greatly exceeds the lending capacity of BNDES, Brazil's development bank and the only source of long-term finance in Brazil.[2] Brazil will therefore need to utilize foreign investment to meet its growth targets. To minimize these concerns, Brazil has recently undertaken additional reform measures that include tax reform and new legislative efforts to privatize oil, telecommunications, and other industries.

II. Energy Sector Overview

Brazil's energy sector is based primarily upon hydroelectricity and oil. Brazil's natural gas sector is just beginning to emerge. Coal plays a very small role in Brazil's energy sector.

Brazil relies upon oil for almost 85% of its fossil fuel needs. Most of this oil is used in the transportation sector; some oil is used for industrial applications. Brazil supplements its oil with ethanol derived from sugar cane, which must by law comprise 22% of the energy value of Brazilian gasoline.

Energy for power generation is primarily supplied by hydropower plants, which accounts for 86% of all power generating capacity and about 95% of power. Most of this power is produced by large hydropower plants. The 13.4 GW Itaipu plant, which Brazil shares with Paraguay, is currently the world's largest hydropower facility.

Natural gas currently accounts for only 3-4% of its total primary energy consumption, mostly for industrial purposes. Natural gas use could triple within 10-15 years, mostly as the result of increased consumption in power generation.

Despite its very large size, Brazil has only modest indigenous energy resources. Even its dominant source of energy supply, hydroelectricity, has limitations. While only about 20-25% of the potential having been exploited, two important constraints limit future growth. First, about 40% of the potential hydropower resources are in the Amazon basin, and therefore require the construction of costly electricity transmission infrastructure to be useful to population centers in Southern Brazil. Second, large hydropower plants entail disruption to Brazil's environment and in some cases, relocation of indigenous population.

Brazil's other primary energy source also faces limitations. Domestic oil resources provide only about 60% of the country's needs. Its reserves of 4-5 billion barrels could sustain the country for only about 6-8 years. Much of this oil is offshore and difficult and expensive to produce.

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[2] BNDES's substantial lending capacity of about $15 billion per year is about three times the capacity of the IDB.

Furthermore, Brazil's 5 trillion cubic feet of natural gas resource are only enough gas for about 4 GW of power generation. A major focus of Brazilian energy policy is to increase Brazil's access to natural gas resources, in order to reduce Brazil's reliance on hydroelectric power. Brazil is therefore trying to increase indigenous production and is increasing its natural gas imports. A planned pipeline from Bolivia will allow Brazil to nearly double its gas consumption. Within 10-15 years, the pipeline's capacity will be equal to nearly three times Brazil's current consumption. Additional pipeline projects are being discussed, including an 1,800 mile pipeline from Argentina and another pipeline from Peru.

Coal plays a very small role in the Brazilian energy sector, accounting for only about 10% of the country's fossil fuel use. Brazil's indigenous coal resources are expensive to mine and of poor quality (high ash and sulfur content). About ¾ of the coal Brazil uses is therefore imported.

III. Energy Sector Reform: Current Initiatives and Goals

Brazil has begun the process of privatizing and restructuring its power sector and is beginning to reform its oil and gas sectors.

In the power sector, laws passed in 1995 and new regulations have set the stage for a market-oriented power sector in Brazil, where generators compete for power sales and consumers increasingly have choices of power suppliers. Features of the new competitive power industry include:

- unbundling of generation, distribution, and transmission functions
- creation of a nationwide, open access transmission system where power is traded in a competitive wholesale market
- introduction of a competitive retail market for certain customer groups
- a competitive market for the construction of new generation capacity.
- transfer of Eletrobras' traditional planning role to a new planning agency.

The Concessions Law of 1995 established mechanisms for awarding concessions from public sector entities to "concessionaires" (which can include both private and state-owned companies) through public bidding. Unlike a privatization under which assets are sold to a private entity permanently, a concession is granted for specific periods. The concessionaire will make investments on its own account and at its own risk and will be compensated through contractually determined prices that include no government subsidies or guaranteed returns.

The Public Service Law of 1995 allowed power sector concessions to be granted to the private sector and extended existing concessions in other public utility services. The law allows for the direct sale of power from independent suppliers to certain classes of customers, including concessionaires, large consumers, and small consumers that have received appropriate permits from their distributors. The Public Service Law allows private companies to invest in stalled power projects, and establishes procedures for competitive bidding of new power projects.

Implementation of the power sector reform program started slowly. However, restructuring

activity gained momentum in 1997 with the creation of the new industry regulator ANEEL to replace DNAEE and the completion of the Coopers & Lybrand report containing recommendations on industry restructuring. In addition, Brazil also made significant progress on distribution company privatization.

Brazil has also begun to privatize its natural gas distribution system. The first distribution company was privatized in 1996. Brazil's largest piped natural gas distribution company (Companhia de Gas de Sao Paulo, Comgas) was partially privatized in 1997 and is scheduled for full privatization. Other gas distribution privatizations are scheduled in Rio de Janerio. Elsewhere in the oil/gas sector the Brazilian legislature approved the Petroleum Investment Law, which creates the National Petroleum Council (ANP), which would act as an independent regulatory commission in the oil/gas sector. The Law also established the National Council for Energy Policy, and a Presidential advisory council on integrated energy policy matters.

However, reform of the petroleum sector is proceeding slowly. There have been delays in establishing the ANP. Furthermore, the Energy Ministry is likely to retain certain investment and production responsibilities. Currently, privatization of Petrobras, which is 51% owned by the government is not officially an option, according to a 1997 promise by Cardoso. This issue may, however, be revisited after the election this October.

IV. Energy Sector Trends

Investments

The focus of energy sector investment in Brazil has been its power market, which should be the largest private power market in the world, outside of the United States. There should also be increased investment in Brazil's oil and gas sectors.

Since the beginning of the power sector privatization process in 1996, a total of 14 distribution companies have been privatized, including eight of the 11 largest companies. Private concessions are now responsible for more than 40% of all power distribution in Brazil. Prices for these concession have been high—half of them have been sold at 70-100% premiums over their share price. Generation privatization has not moved as quickly as distribution sell-offs, with the first generation privatization (658 MW in Goais) just occurring in late 1997.

Another dozen or so distribution companies are currently slated for privatization. The most important assets to be privatized will be the federal generation assets held by Eletrobras, which controls about ½ of all the power generation in Brazil. Eletrosul and Furnas should be privatized by June or July. Chesf and Eletronorte should be privatized by the end of the year.

In addition, there will be other important privatization's at the state level, especially in the State of Sao Paulo, Brazil's largest state. CESP, which owns most of the state's generating assets, should be ready for privatization within 2-3 months. Eletropaulo should be privatized later this year. Within the next 1-2 years, distribution company concessions should also be granted in other states in the next, including Para, Ceara, Alogoas, Piaui, and Rondonia, and Santa Catarina

The private sector should also make major new investments in the natural gas sector, including the $2 billion Bolivia pipeline that will serve 29 Brazilian cities along its 1,200 mile route. Private investment will comprise 49% of the equity for this project. Petrobras will supply the remaining 51% of the equity. Elsewhere in the petroleum sector, investment is still controlled by Petrobras, which spent more than $20 billion developing the offshore Campos Basin alone. Petrobras plans to spend more than $2 billion per year during the next five years, in an effort to reduce oil imports.

Policy Decisions

The focus of policy reform in Brazil has been in the power sector, where the entire structure and pricing framework are being completely revised. Reform of the oil/gas sector has been less comprehensive.

Even prior to the initiation of power sector restructuring, Brazil undertook considerable power price reforms. Additional changes in pricing policy are sure to emerge as the result of the ongoing power sector restructuring process. In 1993, Federal Law 8631 abolished the uniform tariff system and the rate-of-return tariff system. Prices can now vary among regions and customer classes depending on cost-of-service and other factors. Distribution company prices are subject to review and approval by government regulators.

A major challenge for power pricing policy has been to allow prices to keep pace with Brazil's historically high rates of inflation. Failure to raise prices with inflation led to very low, subsidized levels, especially for certain classes of consumers (e.g. aluminum smelters). Starting in 1995, however, prices were allowed to rise to more rational levels. Retail rates now range from $35/MWh for customers with a small cost of service (e.g. large industrial consumers) to more than $100/MWh for certain commercial consumers, averaging about $70/MWh.

The power sector restructuring process is now ushering in a new structure for the power sector with a complex framework for power pricing and policy. Generation, transmission, and distribution functions are being unbundled. Private sector companies will control most generation and distribution assets. An agent for the government will act as the Independent System Operator (ISO), which will control power transmission and central dispatch of generating plants.

In this restructured environment prices charged by newly privatized distribution companies will reflect specially negotiated terms that are part of distribution company privatization contracts. Several recent privatization's (e.g., Light, CERJ) have included special tariff adjustment mechanisms and price caps. Such caps allow distribution companies to reap the benefits of power loss reduction and efficiency gains.

Wholesale power pricing policy for new power generators is still being determined. The transition to market prices will be gradual. For the first five years or so, most power prices will be based on pre-determined or contractual prices. After a period of five years or so, market participants would be free to sign new contracts or could sell power in a competitive market

similar to those established elsewhere in Latin America (Argentina, Colombia, and Peru). The precise rules for this market power system have yet to be determined. There are concerns that the new pricing policies may not establish a sufficiently large competitive market, but rather shield a large portion of existing hydropower generators from market competition by granting them prices that reflect an excessively high value of water.

In other parts of the Brazilian energy sector, prices Brazil reflect fair and competitive levels. About 1/3 of the country's oil is imported at world market levels. Domestically, prices are still subject to significant government control, although independent regulation by the AAP may help reform pricing policy.

Pricing policy for natural gas is uncertain. The current market for gas is small and publicly controlled. In the future, the market for natural gas will be expanded and liberalized considerably as a result of the Bolivian pipeline and other projects. However, the prices for natural gas supplied from these new projects is still uncertain. Prices could range from $1.50-$3.00 per MMBtu.

V. National Programs and Activities Related to Climate Change

The government of Brazil has been actively supporting energy efficiency since the 1980s, when it implemented the national CONSERVE program, a national program to encourage more energy efficient behavior on the part of energy consumers. Brazil's energy efficiency efforts have expanded significantly in recent, with expansion of several national programs for electrical energy efficiency. The focus of Brazil's assistance for energy efficiency has evolved from large government-based publicity programs to a more market-oriented approach, under which funds for energy efficiency have raised through the ongoing power sector reform process and multilateral development banks, and utilized for financing private energy service providers.

National Electrical Conservation Program: PROCEL

The Government of Brazil established PROCEL (Programa Nacional de Conserva de Energia Electrica) as its national electricity conservation program in December 1985. In 1993, its mandate was greatly expanded. PROCEL is now is responsible for a core budget of $10 million per year. The organization also receives technical assistance from several bilateral assistance agencies, including USAID. PROCEL's activities have included:

- development and implementation of energy efficiency standards
- creation and dissemination of voluntary programs (testing, labeling, awards)
- research and development of energy efficient technologies
- installation of pilot energy efficiency projects and energy metering equipment
- funding and conducting of consumer education and training programs.

In addition PROCEL facilitates low-interest financing for energy efficiency projects from the

RGR program.[3] PROCEL facilitated $21 million in RGR energy efficiency financing in 1995 and $40 million in 1996. PROCEL's actions in 1996 alone resulted in an estimated 790 GWh/year in electricity savings, equivalent to 0.9% of Brazil's total electricity use.

Distribution Utility Privatization Fund

Brazil recently initiated a policy to insert a provision in the contracts of distribution concessions to require companies to spend 1% of the concession's proceeds as energy efficiency activities. Of this 1%, at least one-quarter of the funds must be used for end-use energy efficiency. The remaining portion of funds can be use for supply-side efficiency activities. The majority of the 14 distribution companies that have been privatized have had to meet this requirement, as will all future concessions. This policy is expected to create approximately $80 million in funding for electrical end-use efficiency. Distribution energy efficiency programs to utilize these funds are to be designed and implemented by the utility under the advice and consent of PROCEL.

World Bank Loan

The World Bank should soon implement the first phase of a $150 million loan for energy efficiency. Working primarily through PROCEL, the World Bank has identified utility energy efficiency programs and public sector projects that will receive $60-70 million in funding. PROCEL will coordinate the provision of matching funds. During the second phase of funding the World Bank hopes to use at least a portion of its funds to leverage greater private sector investment in energy efficiency.

Research and Development

Various public and private sector agencies have been conducting research and development programs of energy efficiency, renewable energy, and other climate friendly technologies.

- COPERSUCAR, the Brazilian alcohol association, has been conducting a research and development program to improve the utilization of alcohol fuels. As an alternative to gasoline, these fuels offer significant GHG reductions.
- COPEL, the Brazilian equivalent of EPRI, and PROCEL has been conducting research and development on metering and electricity end-use efficiency.
- PETROBRAS is conducting research and development on technologies to exploit and utilize petroleum more efficiently.
- Several state utilities, including COELCE in Ceara and COREL in Parana have been assessing wind power technologies.
- Several state utilities in rural areas, including COELCE in Ceara, have been researching

[3] Funded by surcharges on consumers' electric bills, the makes investments in the Brazilian electricity system for several purposes including energy efficiency.

off-grid photovoltaic (PV) technologies. As a result, there are now several commercial PV technologies that are being implemented, some of them by U.S. companies.

- The GEF will fund several feasibility studies and demonstration projects for energy efficiency. One UNDP-GEF project will assess the technical and economic feasibility of integrated gasification/gas turbine technology for power generation, using bagasse and sugar cane trash.

Standards and Voluntary Programs

Brazil has had limited success in implementing energy efficiency standards and voluntary programs to encourage more energy efficient equipment and technologies. PROCEL has worked with manufacturers and government to implement minimum energy efficiency standards in several areas, including refrigeration and motors. So far, only in the area of lighting have standards been implemented where manufacturers now have to meet minimum standards for fluorescent lighting ballasts. Voluntary agreements have been reached for refrigerator/freezer efficiency. These targets have, however, only been partially met.

Brazil has been more successful in the areas of awards and promotion for energy efficiency. Successful nationwide campaigns have been implemented to encourage more energy efficient motors, refrigerators, freezers, and window air conditioners.

Training, Education, and Capacity Building

PROCEL and other organizations in Brazil have been providing education, training, and other forms of capacity building at various levels in Brazilian society. Basic energy efficiency education is being provided at primary and secondary schools. In some secondary schools, technical training on energy efficiency is also being provided. At the university level energy efficient design and construction concepts are being taught at architecture and engineering programs.

Energy efficiency training and education is also being provided to energy practitioners, partly through the funding of USAID-sponsored programs. Courses on demand-side-management, integrated resource planning, and electricity line loss reduction are being provided to utility industry personnel throughout Brazil. Energy service companies (ESCOs) have received training on energy savings verification and ESCO business concepts.

Emerging ESCO Industry

Brazil now has an emerging ESCO industry that is comprised of about 30 firms. Most of these firms are small and provide specialized energy efficiency services (audits, retrofits, etc.) on a fee for service basis. However, within the last two years, the ESCO industry has expanded. A few firms have provided work using performance contracts, under which payments are made to the ESCO based on its delivery of guaranteed energy savings to its customer. Several U.S. firms are conducting large-scale energy efficiency projects (>$10 million) in the steel and pulp and paper industries.

Organizations

Brazil is a member of all major international organizations and a signatory to climate change agreements. It is a developing country according to World Bank designations and therefore eligible for financial assistance. Brazil is a member in of the World Trade Organization. It is a signatory to the Rio and Montreal Protocol Agreements on climate change. There is an ongoing effort to prepare a national action plan under the country studies program.

VI. Proposed U.S. Government Intervention

The U.S. government may wish to consider the following initiatives as part of a program to improve energy efficiency and reduce GHG emissions in Brazil.

Providing Energy Efficiency Incentives in Power Sector Restructuring

While Brazil has taken some steps to promote energy efficiency through its ongoing reform process (energy efficiency funds, cost caps), however, the implications of many parts of power sector reform are still poorly understood, or may even provide disincentives to energy efficiency (e.g. distribution companies can increase profits by increasing sales).

While the reform process is still evolving, Brazil could take steps to ensure that energy efficiency is addressed. The U.S. government (USG) should assist the Brazilian government to understand better the energy efficiency implications of power sector reform. USG can then work with the Brazilian government to develop and implement new rules that promote energy efficiency.

Promoting Capital Markets for Energy Efficiency Finance

Several Brazilian private banks have expressed an interest in energy efficiency finance, but are concerned about credit risks in a new line of finance, and have encountered difficulties in finding bankable projects. The USG can assist lenders and project sponsors during the project pre-screening, design and implementation stages. USG could also help develop credit enhancement mechanisms (e.g. USAID DCA, IFC programs) that can reduce energy efficiency finance risks. The USG could also work with Brazilian banks to introduce project appraisal methods that value GHG emissions reductions and other environmental benefits as part of the fund's operational guidelines.

Development of Private Sector Energy Services Markets.

USG can support the continued development of the Brazilian energy services market to meet the growing needs for turnkey energy solutions in all sectors of the Brazilian economy. This support could include training ESCOs on new business and marketing concepts and facilitation of joint venture relationships with international ESCOs through forums and workshops.

Institutional Support

The USG can promote the development of project appraisal capability at institutions that have a government mandate to address GHG emissions reductions (e.g. PROCEL). Projects to which the Brazilian government is according a high priority include industrial cogeneration.

Energy Efficiency Training for Financiers

Recently, an official of BNDES who is knowledgeable about energy efficiency included a $1 million energy efficient lighting component in a loan for a new development, thereby reducing CO2 emissions by several hundred thousand tons. However, such loans are rare. Most officials at BNDES and other banks do not understand well energy efficiency concepts and are therefore reluctant to extend energy efficiency loans or to include energy efficiency components in loans for new projects. Providing training on energy efficiency concepts can help reduce this market barrier and vastly expand opportunities for energy efficiency finance in Brazil.

Vendor Finance and Marketing

There are many organizations for equipment vendors in Brazil (lighting, motors, refrigerators) who are interested in establishing new programs to market and finance energy efficient equipment. However, most of these vendors have never had to consider large energy efficiency finance programs, because financing has historically been available. Now that new sources of finance are available, vendors need assistance to market energy efficient equipment more aggressively, to use finance as a selling point in their business, and to aggregate many small projects into larger ones that can be financed.

DRAFT - NOT CLEARED

COUNTRY PROFILE: BRAZIL

GENERAL OBSERVATIONS

U.S.-Brazilian cooperation on climate change reached a high point in Kyoto after we melded the U.S. proposal for Joint Implementation with the Brazilian proposal for a Clean Development Fund into the Clean Development Mechanism, something with broad practical and symbolic implications. In practical terms, the hybrid mechanism goes far in bridging the gulf between the various positions at Kyoto. In symbolic terms, the partnership of the largest developed emittor with the third largest LDC emittor (combination of emissions and land use) is significant in gaining global consensus for any future proposals.

President Cardoso takes climate change seriously, recognizing the importance attached to the issue by the international community and the club of developed nations to which Brazil aspires. He will not compromise on Brazil's sovereignty or future development. Cardoso will most likely win re-election to a second four-year term in November of this year. His key negotiator for climate change is S&T Minister Jose Israel Vargas, who found the opening to merge our proposals at Kyoto. Other significant players are Ambassador Antonio Dayrell de Lima, MFA Director of Special Themes and Chief Environmental Negotiator, and Dr. Luiz Gylvan Meira, Space Agency President and Vice Chairman of the IPCC.

The GOB is particularly interested in developing a joint position with the U.S. on operational details of the Clean Development Mechanism before it is negotiated in Buenos Aires. Vargas is eager to develop a mechanism that includes the involvement of the private banking system, explaining that he wants to avoid cumbersome bureaucratic inter-governmental processes like the GEF. Despite concerns expressed by senior Argentine environmental officials, it should be possible to develop a market-based mechanism with Brazil which would permit all developing countries to compete for private sector emission reductions projects and technology transfers in return for emissions credit.

Convincing Brazil to accept emission targets will be much more difficult. Brazil's position remains that developed countries must demonstrate their good faith first by implementing their own targets before asking developing countries to accept emissions limits. Vargas and other GOB officials consistently express their disappointment that voluntary emissions reductions targets set at the 1992 Earth Summit in Rio and confirmed by the Berlin Mandate were never implemented. Brazil regards itself as the keeper of the UNCED flame and is very sensitive about non-compliance with respect to agreements reached at the Rio Summit.

AREAS FOR MEANINGFUL PARTICIPATION

- Limit emissions growth relative to business as usual baseline.
- Adopt appropriate regimes for sink (forest) protection.
- Adopt energy efficiency standards or other forms of "meaningful" involvement with the recognition that this is not likely to occur prior to COP-4.

- Continue to lead in the development of the Clean Development Mechanism (CDM).
- Carefully considered public affairs strategy for climate change education

KEY PLAYERS

- Ministry of Foreign Affairs: Ambassador Antonio Dayrell de Lima, Director of Special Themes and Chief Environmental Negotiator
- Ministry of Science and Technology: Minister Jose Israel Vargas; Oscar Klingl, Chief of Staff; and Jose Domingos Gonzalez Miguez, Coordinator on Global Change Research, Head of Climate Change Division
- Brazilian Space Agency: Dr. Luiz Gylvan Meira Filho, President, UNFCCC negotiator, and co-chairman of IPCC Working Group I, Global Change Research Office, Rio de Janeiro; Jose Cesario Cecchi, Research Advisor; Newton Paciornik, Research Advisor
- Ministry of Mines: Acher Mosse, Director, Interministerial Committee for Sustainable Development (CIDES), linked to Cabinet
- Electric Power Research Insititute (CEPEL)
- Brazilian Foundation for Sustainable Development
- Brazilian Institute for the Environment and Renewable Natural Resources (FUNCATE)
- National Electric Power Conservation Program (PROCEL): Antonio Paggy, Executive Secretary
- Energy Application Agency: Jose Zatz, Director
- National Energy Efficiency Institute: Jayme Buarque de Hollanda, Director
- PETROBRAS - Petroleo Brasileiro: Joao Eudes Touma, Director, National oil and Gas Conservation Program
- Nationa Program for the Rational Use of Oil and Natural Gas Derivatives (CONPET), Department of Energy, Universidad de Campinas (UNICAMP) - Gilberto Jannuzzi, Director
- World Energy Council, Brazilian National Committee - Jose Malhaes da Silva, Executive Director

AVENUES OF INFLUENCE

High Level Visits

- The Ambassador recommends that a high-level delegation, perhaps led by U/S Eizenstat, visit Brazil to engage Minister Vargas directly on preparations for the Buenos Aires negotiations.

USG Activities

USAID

- Support sustainable forest management and land user practices which reduce deforestation in the Amazon; USG donated US$10m to the *G-7 Pilot Program to Conserve the Brazilian Rain Forest* in February 1998.
- Increase protection and sustainable use of natural resources in critical regions of carbon sequestration and biodiversity (e.g., the Amazon and the Atlantic Coastal Rain Forest, and reduce GHG emissions from deforestation and wasteful energy use.

- Commercial applications of renewable energy for rural development and industrial cogeneration.
- Brazil Energy Program (BEP), launced in September 1995, includes activities in renewable energy, energy efficiency, private sector participation, and energy sector regulatory reform. Projects include a Renewable Energy Project Support Office; project to help design a request for a World Bank energy efficiency loan; and technical assistance for efficiency program design and management, and power sector regulation formulation.

USDOE

- Bioenergy and solar pilot projects, funded by the Office of Energy Efficiency and Renewable Energy.
- NREL is providing technical support for Brazilian states' efforts to replicate DOE-sponsored rural electrification projects using renewable energy.

EPA

- Green lights program - border related activities supporting cross border pollution issues, training for regulators, information dissemination focusing on key border cities.
- Commission for Environmental Cooperation - tripartite agency authorized by the U.S. Congress (under NAFTA) active in pollution prevention, energy efficiency, and other training, information and capacity building initiatives.
- Proposed activities for further development of the CDM: bilateral technical discussions on CDM, sinks, and developing country commitment proposal; project to analyze measurement and accounting issues of land use change and forestry emissions; with World Resources Institute, study to evaluate benefits of climate policies, and March 1998 workshop; technical support for GHG mitigation (landfill methane project) and ruminant methane project; opportunity analysis of markets for wast sector methane reduction and adaptation technologies; Pilot Technology Cooperation Agreement; with Brazilian NGO, develop and disseminate country-specific information to constituency groups on climate change impacts and no-regrets options.

U.S. Country Studies Program

- Two AIJ projects in forest conservation, one in energy efficiency, and Support for National Action Plan.

International Finance Institution Issues

- Projects:

World Bank:	US$ 80m	Energy Efficiency Loan
IDB:	US$ 30m	National Environmental Fund II
IDB:	US$240m	Brazil-Bolivia Gas Pipeline Integration
IDB:	US$307m	North-South Electric Interconnection
IDB:	US$0.1m	Sustainable Markets for Sustainable Energy
GEF:	US$ 30m	Energy Efficiency Feasibility Studies
UNDP-GEF		Biomass Power Generation
UNDP-GEF		Alternatives to Slash-and-Burn

Trade and Commercial Issues and Activities

With a population of more than 160 million and a GDP of over $800 billion, Brazil is an important market for U.S. commerce. It is an economic leader in Latin America and has emerged as our primary interlocutor in South America as the leading member of Mercosur. Brazil ranks third as the recipient of U.S. investments. The Brazilians are sensitive to the fact that Brazil's trade deficit rose 50 percent in 1997 to $8.4 billion. Nearly 60 percent of this deficit is with the U.S. Brazil's current account deficit for 1997 came in to 4.2 percent of the GDP, the largest in 15 years. These sobering trade statistics have put considerable pressure on the Cardoso administration as it seeks to push economic reforms through Congress

Other Opportunities

- Brazil hopes for U.S. support for a seat on the UN Security Council.

CALENDAR OF OPPORTUNITIES

- March 16, FM Lampreia meets with the Secretary
- March 30-31, U.S.-Brazil Common Agenda for the Environment will include a climate change component.
- April 18-19, Summit of the Americas, Clinton-Cardoso meeting

CURRENT AND FUTURE ENERGY STRUCTURE

Over 90 percent of Brazil's electric energy matrix is based on hydroelectric power, and Brazil is actively pursuing cleaner energy sources. Brazil is highly interested in developing alternative sources of energy, particularly gas, biomass cogeneration, and ethanol fuel from corn. The largest energy project in Latin America will develop a natural gas pipeline from gas-rich Bolivia to Sao Paulo. Brazil has just promulgated a new power regulator system, the goals for which include continuity of power supply, improved efficiency, and accelerated privatization.

At 6.76 quadrillion Btu (quad) in 1995, Brazil's total energy consumption, excluding biomass except in electricity generation, was behind only that of the United States (88.3 quad) in the hemisphere. Brazil emitted 71.22 million metric tons of energy-related carbon emissions in 1996, roughly 1.2 percent of total world energy-related emissions. In 1995, transport accounted for 41.3% of Brazil's carbon emissions, followed by manufactures and construction at 27.7%. Coal (among measured sources) provided 7% of the country's total primary energy requirements; demand for (imported) metallurgical coal in Brazil's steel industry will continue to make the country one of the world's major coal importers during the next 10 to 15 years. Demand for oil continues to grow, notably in the transport sector, despite the country's impressive ethanol/gasohol program which requires gasoline to contain at least 22 percent sugar cane-derived ethanol. Most of Brazil's electricity -- and almost 39 percent of its total primary energy -- is generated by hydroelectric plants, although additional nuclear and thermal (imported natural gas and imported and domestic coal-fired) plants are being planned to meet future projected electricity shortfalls.

BASELINE DATA

Though Brazil's CO_2 emissions only represent 1% of the global total, Brazil's net CO_2 emissions including land use practices are 5% of the global total, and thus Brazil must clearly play a major role climate change mitigation.

Baseline Emissions[1]			
CO_2 Emissions[2]	217	Per Capita CO_2 Emissions[3]	1.39
U.S. CO_2 Emissions[4]	4,881	Per Capita CO_2 Emissions[5]	19.13
Ratio Relative to Global Average Per Capita Emissions (%)			34%
Fraction of Total Global Emissions (%)			1%
Including land use practices:			
Net CO_2 Emissions[6]	1,100	Per Capita CO_2 Emissions[7]	8.9
Fraction of Total Global Emissions (%)			5%
GDP and Population Data			
Per Capita GDP	$4,912	GDP Growth Rate[8] (%)	2.3%
1990 Population[9]	148,447	Population Growth Rate[10] (%)	+1.7%

[1] The CO_2 emissions data in the table below are taken from the 1996-1997 World Resource Institute (WRI) tables. The data provided are estimates for 1993.
[2] 1000's of metric tons, Data from WRI data representing primarily estimates for 1993 usage.
[3] Metric tons.
[4] 1,000,000's of metric tons, Data from WRI data representing primarily estimates for 1993 usage.
[5] Metric tons.
[6] 1000's of metric tons, Data from WRI data representing primarily estimates for 1993 usage.
[7] Metric tons.
[8] Average growth 1983-1993.
[9] 1000's
[10] Average change 1990-1995.