



POSITION STATEMENT AND RECOMMENDATIONS
ON THE U.S. NATIONAL ACTION PLAN FOR
GLOBAL CLIMATE CHANGE

MARCH 1993

GLOBAL CLIMATE COALITION

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Table of Contents

	Page
Executive Summary	1
Introduction	7
General Issues	
1. Economic Impacts: Jobs, Trade and Competitiveness	8
2. Status of Global Change Science	14
3. Consideration of National Circumstances	16
Mitigation Issues	
4. Problems with Targets and Timetables	19
5. Implementation of the Energy Policy Act of 1992	22
6. Expanding Voluntary Actions	24
7. Opportunities for Methane Emissions Reductions	28
8. Increased Emphasis on Technology R&D	31
Adaptation Issues	
9. Assessing the Benefits and Costs of Adaptation	34
International Issues	
10. Importance of Joint Implementation Actions	36
11. Expanding Carbon Sinks	38
12. Increasing Technology Cooperation	40
Appendices	
A. Provisions of the Energy Policy Act of 1992 Affecting Greenhouse Gas Emissions	
B. Comparison of Projected CO ₂ Emissions from the Developed and the Developing Countries	
C. Suggested Outline for Country Technology Assessments	

Global Climate Coalition
Position Statement and Recommendations on
The U.S. National Action Plan on Global Change

Executive Summary

The Global Climate Coalition supports the Framework Convention on Climate Change, and supports efforts by the United States Government to encourage a prompt start by all of the signatories in implementing the Convention.

The U.S. National Action Plan is the first country plan developed in response to the "Prompt Start" Resolution, and represents continued U.S. leadership on the issue of Global Change. The Global Climate coalition believes that the U.S. National Action Plan is an excellent first step, and contains a comprehensive framework that can endure over the longer term. The Global Climate Coalition strongly believes that the U.S. National Action Plan should be a flexible blueprint, with the ability to change and evolve over time as new scientific information becomes available.

The GCC endorses the basic principles underlying the U.S. National Action Plan, including the *emphasis on actions*, the *comprehensive scope*, the role of *voluntary actions*, and the importance of *technology cooperation*.

The GCC also strongly supports the approach taken in the Plan to reject the use of rigid target and timetables as a strategy for meeting the objectives of the Framework Convention. A commitment to a specific goal, such as stabilization of net greenhouse gas emissions, is not justified by the state of the science, nor are there adequate mechanisms in place on an international basis to support it. Moreover, adoption of rigid targets and timetables does not provide the flexibility to evolve meaningful Action Plans as the science and national circumstances permit. The GCC believes that rhetorical debates over these issues in the past have hindered rather than aided efforts to develop and implement meaningful actions.

The GCC has identified 12 Issue areas where the U.S. National Action Plan can be *strengthened and improved*. These issues, along with specific recommendations, are summarized below.

1. **The economic impact of the U.S. National Action Plan must be analyzed. The impacts on economic growth, jobs, international trade and competitiveness need to be assessed.**
 - The National Action Plan should contain an overall summary of the economic effects of the proposed plan, including the full documentation of baseline economic assumptions and forecasts. The summary should highlight the effects of the actions on GDP, employment, trade and competitiveness - both in the economy as a whole and in the major relevant sectors.
 - The National Action Plan should include an explicit statement of the economic impact of actions already underway, such as the costs of requirements imposed by the Clean Air Act of 1990.
 - The impacts of the Administration's proposed economic plan on projected greenhouse gas emissions should be incorporated into the National Action Plan, once the Plan is enacted. The impacts of increased investment incentives could have a significant favorable impact on investments in new energy efficient technologies.
2. **The status of the U.S. Global Climate Research Program and its implications for national actions should be fully described.**
 - The U.S. National Action Plan should include a complete assessment of the current state of scientific knowledge on global change. This assessment should clearly delineate the major areas of scientific uncertainty.
 - The National Action Plan should include a formal mechanism to ensure that it is adjusted as appropriate in response to new scientific information.
3. **Proposed actions should explicitly take into account unique national circumstances in the U.S., especially where national circumstances may lead the U.S. to take actions that differ from those of other developed countries.**
 - The relationship between proposed actions and national circumstances should be made explicit. This will help others to better understand the rationale for the proposed actions. It also will help facilitate international comparisons.
 - Comparisons of the energy and environmental performance among countries should explicitly take into account unique national circumstances, and quantitative comparisons should be adjusted, to the maximum extent feasible, to remove the effect of unique factors from the data.

- Other countries should seek to develop the sophisticated methods of data collection and analysis common in the U.S., so that the developed countries can achieve a common measure of comparison.
4. **The U.S. National Action Plan should continue to reject the adoption of rigid targets and timetables as a strategy to implement the Framework Convention**
- The U.S. National Action Plan should maintain a "bottoms-up" approach to commitments, and should continue to reject the adoption of rigid "top down" targets and timetables.
 - Specific commitments in the National Action Plan should be focused on actions. The Plan should contain "best estimates" of the outcomes of proposed actions, recognizing that in many cases that those outcomes are not legally binding.
5. **Full implementation of the Energy Policy Act of 1992 should be made a cornerstone of the National Action Plan.**
- The Administration should prepare a detailed assessment of the greenhouse gas reductions that can be achieved as a result of full implementation of the Energy Policy Act of 1992.
 - The U.S. National Action Plan should incorporate the results of the assessments and studies required under Title XVI of the Energy Policy Act, including the least cost energy strategy required in the President's National Energy Policy Plan.
6. **The National Action Plan should be expanded to reflect the full range of voluntary actions underway by U.S. industry. Estimates of the impact of voluntary action should be developed in close cooperation with those responsible for the actions.**
- Voluntary programs should be an important element of the National Action Plan. An expanded effort is needed to gather information on voluntary programs on a more systematic basis.
 - Estimates of the impacts of voluntary programs should be developed in close coordination with the industries or other parties undertaking the voluntary efforts. This will improve greatly the accuracy and credibility of the estimates.
7. **There may be additional opportunities for controlling methane (CH₄) emissions that are not currently part of the National Action Plan.**
- The National Action Plan should reassess the benefits and costs of options for achieving additional methane emission reductions from landfills.

- The National Action Plan should incorporate additional methane emissions reductions resulting from implementation of the coalbed methane provisions of the Energy Policy Act of 1992.
 - The National Action Plan should review and evaluate options for achieving cost-effective reductions in methane emissions in the agriculture sector.
8. **Federal Technology R&D Programs should adopt an explicit objective of achieving greenhouse gas emissions reductions. Federal agency technology R&D programs should be better coordinated.**
- The role of technology development in the National Action Plan should be significantly strengthened. The Plan should include a full discussion of all federally-funded research and technology development that has the potential to reduce greenhouse gas emissions, and provide estimates of the long-term potential for greenhouse gas emissions reductions. As a first step in implementing this recommendation, the Administration should undertake an inventory of all federally-funded research and technology development that has the potential to reduce greenhouse gas emissions.
 - All Federal R&D agencies, particularly DOE, should establish an explicit programmatic objective of reducing greenhouse emissions in each of their relevant research and technology development programs, and accord high priority to these efforts in the budget process.
 - Federally-funded technology development activities should be closely integrated with technology cooperation and Joint Implementation actions. New technologies that have the potential for reducing greenhouse gas emissions in both U.S. and international applications should be assigned highest priority for funding within the federal R&D programs.
9. **The National Action Plan should present an integrated strategy of both mitigation actions and adaptation measures. Costs and benefits of specific adaptation actions should be analyzed in greater detail.**
- Mitigation and adaptation actions should be better integrated in the National Action Plan, including a discussion of relative costs, benefits and trade-offs. The policy framework in the recent National Academy of Sciences Report on Climate Change should be used as the starting point for this analysis.
 - Research and analysis of adaptation measures should be expanded, in order to improve the estimates of costs and benefits of such actions. Priority areas for increased research on adaptation should include programs and strategies designed to:

- improve agricultural practices;
 - understand CO₂ fertilization effects on green plants;
 - improve forest management and grassland practices;
 - improve water resource utilization and planning;
 - manage marine and coastal environments;
 - upgrade design criteria and safety margins in long-lived structures and infrastructure systems; and
 - improve satellite weather predictive capabilities and emergency preparedness programs.
- Increased emphasis needs to be placed on the importance of policies to promote sustained economic growth in all countries of the globe as a necessary factor to facilitate both mitigation and adaptation actions.
10. **The National Action Plan should establish a framework and procedures to facilitate Joint Implementation actions with developing countries.**
- The U.S. National Action Plan should include provisions that would establish a framework for Joint Implementation, and help facilitate individual Joint Implementation actions. Such measure should incorporate as appropriate the technology transfer, financial assistance and other provisions of the Energy Policy Act of 1992.
- U.S. and International policies on Joint Implementation should emphasize actions by non-government organizations and the private sector, rather than government-to-government agreements.
11. **There are additional opportunities to enhance carbon sinks through improved global forestry practices.**
- The U.S. should carefully examine opportunities to enhance carbon sinks in the developing countries through actions to promote improved forest management practices.
- Further research should be supported by the U.S. on methods to improve the utilization of forest products and ensure that all carbonaceous material in a forest can be captured, either as timber or in pelletized fuel.
12. **Technology cooperation activities should be strengthened and expanded.**
- The U.S. should act quickly to establish an interagency policy coordinating mechanism that could provide a single point of contact in support of industry technology cooperation efforts, such as the Technology Cooperation Corps.

- The U.S. should seek to ensure that all country National Plans include a specific technology assessment addressing technology needs and indigenous technology resources.
- The Federal Government should strengthen specific policies and programs to assist U.S. technology transfer activities, including:
 - providing better access to information on environmental technology needs and market opportunities to U.S. business through the embassy and consulate staff, as well as through the Commerce Department's International Trade Administration;
 - coordinating U.S. efforts to provide appropriate financing facilities for the transfer of technology, including the Agency for International Development, the Export-Import Bank, the World Bank and regional development banks;
 - identifying and eliminating impediments to technology transfer, such as lack of protection of intellectual property rights. The U.S. must demand that foreign governments and firms protect U.S. technology and property rights;
 - promoting U.S. businesses as sources of environmental technology to meet the needs to developing countries and their industries;
 - reducing the uncertainty related to the antitrust implications of private firm collaboration, particularly for joint research and technology programs. By reducing the uncertainties related to antitrust enforcement, private companies could form joint ventures, merge their resources, and develop and introduce new products more quickly; and
 - supporting research, development, demonstration and commercialization programs, and facilitating the entry and acceptance of new technologies where appropriate through licensing and cooperative agreements.
- The U.S. Government also should work with international financing and economic development agencies to disseminate information on U.S. environmental technology capabilities and assist U.S. technology suppliers to meet the environmental needs identified by other countries.

INTRODUCTION

The U.S. National Action Plan was developed in response to the "prompt start" resolution adopted by the International Negotiating Committee (INC) at its sixth session in New York City in May 1992. Paragraph 5 of the resolution contained one of the principal recommendations, which was to invite "States and regional economic integration organizations entitled to sign the Convention to communicate as soon as feasible to the head of the Secretariat information regarding measures consistent with provisions of the Convention pending its entry into force."

The U.S. National Action Plan was made public in December 1992. As stated in the Plan, "This document represents the United States' first communication to the Secretariat." Furthermore, the Plan states that: "In accordance with the provision of the Convention, the United States intends this document to represent the first iteration in a series of regular reports."

At the time of its release on December 8, 1992, the State Department invited comments on the Plan within a 90 day period. This report represents the views of the Global Climate Coalition on the U.S. Plan.

The Global Climate Coalition (GCC) is an association of business trade organizations and private companies formed to coordinate the active involvement of U.S. business in the scientific and policy debates on global climate change issues. Current Coalition membership represents a broad spectrum of virtually all elements of U.S. industry from the energy producing and energy using sectors. The GCC believes that there is an inextricable relationship between energy security, economic vitality and environmental policy. Each of these principles must be balanced to form a coherent, rational policy on global climate change.

The GCC recognizes that the U.S. National Action Plan is being issued pursuant to the INC "Prompt Start" Resolution, and not pursuant to a Treaty obligation. Furthermore, the GCC recognizes that there is no overriding reason to modify the U.S. National Action Plan at this time. The U.S. is not obligated under the Convention to communicate any other reports until six months after entry into force of the Treaty. A total of 50 countries must ratify the Convention before it enters into force; to date, only 11 nations have done so. Nevertheless, the GCC wishes to offer comments on the National Action Plan, in response to the request from the Department of State. The comments of the GCC identify a number of issues where, in the view of the GCC, the U.S. National Action Plan can be expanded and strengthened. To assist the Administration in this regard, the GCC offers a series of specific recommendations for improvements in the National Action Plan. The GCC wishes to work closely with the U.S. Government in a constructive manner in fashioning global climate change strategies and actions that are comprehensive, flexible, balanced and effective.

1. **The economic impact of the U.S. National Action Plan must be analyzed. The impacts on economic growth, jobs, international trade and competitiveness need to be assessed.**

The National Action Plan does not contain an analysis of the economic impact of the proposed plan. It is important that the economic impact of these actions be understood by both policy makers and the public, and benefits evaluated relative to anticipated costs. A number of economic models have been developed to analyze the economic impacts of CO₂ emissions controls, including those by DRI, Nordhaus, Manne and Richels and Edmonds and Reilly (for an overview discussion of these models, see U.S. Department of Energy, The Economics of Long-term Global Climate Change, September 1990). None of these models were used to evaluate the economic impacts of the U.S. National Action Plan.

Need For a Detailed Baseline Economic Assessment: The National Action Plan includes a general discussion of economic issues in two places: the section on the U.S. economy and the section of the mitigation chapter discussing emission reductions. The section on the U.S. economy provides only a relatively simplistic description of how the economy has performed over the past twenty years for a limited set of economic variables, including economic growth rates, trade and the federal budget deficit.

While this discussion provides a good overview, it does not adequately discuss the relationship of economic variables to greenhouse gas emissions. In particular, the relationship between the level of industrial activity and greenhouse gas emissions is very important to understanding how industrial growth in the U.S. might be affected by actions to curb greenhouse gas emissions. For example, a recent analysis showed that U.S. aggregate manufacturing energy intensity (i.e., the amount of energy consumed per unit of value added in manufacturing) decreased by 44 percent between 1973 and 1987. (Howarth, Richard B., et al. "Manufacturing Energy Use in Eight OECD Countries," Energy Economics, April 1991, pp. 135-142.) The improvement in energy intensity was due to a combination of increased energy efficiency and a shift toward less energy intensive manufacturing. For example, the analysis indicated that, of the total 44 percent improvement, a 15 percent improvement was achieved through a shift in the structure of the manufacturing sector, and a 32 percent improvement was achieved through increased energy efficiency, with a 3 percent adjustment for interaction between the two. (op. cit, p. 138.) A better understanding of the historical trends and baseline conditions, such as illustrated above, is essential in order to assess the impacts of proposed actions. For example, certain types of proposed actions could further exacerbate structural shifts in the industrial sector, reducing high-wage jobs and negating the effects of other economic growth policies.

In addition, the baseline assumptions used in the U.S. National Action Plan appear to differ significantly from those used in other economic analyses of greenhouse gas emission controls. As a result, it is difficult to determine whether the National Action Plan may have economic impacts similar to those identified in other studies, such as the DRI or the Manne and Richels

analyses. For example, a recent study of the economics of greenhouse gas emissions controls by DRI, prepared for the Department of Commerce, contained baseline estimates of the rate of GNP growth averaging 2.1% annually between 1990 and 2010, based on real wage rate increases of 1.1% annually and unemployment at an average of 5.7%. (DRI/McGraw - Hill, The Economic Effects of Restrictions on Coal and Petroleum Fuels in Stationary Sources, April 1991). This is different from the National Action Plan, which assumes an average GDP growth rate of 1.8% annually between 1990 and 1995 and a 2.8% annual increase between 1995 and 2000. As a result, the baseline greenhouse gas emissions in the National Action Plan may be higher than those in the DRI study, all other factors being equal. This difference, in turn, likely would change the estimate of costs associated with adaptation or mitigation options. Given the significance of the baseline assumptions, a more thorough discussion is needed of the baseline economic projections and the significant dependence of emission levels on the key components of those projections. The National Action Plan should expand and highlight the discussion of these issues.

In addition to overall economic growth rates, the composition of economic growth is also very important. For example, in the DRI analysis, economic growth in the baseline case was primarily due to increased industrial production, with strong growth in exports and little growth in government spending. The DRI baseline assumptions included:

- Industrial production growth ranges between 2.2% and 2.5% annually through 2010;
- Real exports expand and real imports decline. For example, the DRI study forecasts a reduction in the merchandise trade deficit from 1.9% of GNP to 1.2% in 2000 and .9% in 2010 in the base case;
- the growth in income averages between 1% and 1.5% annually; and
- the unemployment rate remains relatively constant, between 5%-6%.

By comparison, the U.S. National Action Plan contains no baseline estimates for these important economic variables. These data are very important for understanding the potential future growth of greenhouse gas emissions. For example, even though the overall rate of economic growth is higher in the baseline case of the National Action Plan than the DRI study, if the composition of the growth is weighted more heavily by growth in the service sector and in government, baseline emissions in the National Action Plan could be lower than in the other analyses. The GCC does not endorse either set of baseline economic assumptions. The point is that the U.S. National Action Plan needs to contain a more complete discussion of the economic assumptions underlying the economic growth and greenhouse gas emission projections, so that policy makers and the public can better understand the factors contributing to those projections. Moreover,

the large sensitivity of greenhouse gas projected emissions to baseline economic projection need to be fully understood.

Assessing the Full Economic Impacts of Actions: The focus of the National Action Plan is on the policies and programs already underway in the U.S. The greenhouse gas emission reductions contained in the National Action Plan include actions resulting from the National Energy Strategy (with an update that partly reflects enactment of the Energy Policy Act of 1992), the Clean Air Act of 1990 and other measures. The National Action Plan, however, does not contain a detailed evaluation of the economic of impact actions already underway. The absence of a detailed discussion could be misinterpreted, creating the impression that the U.S. National Action Plan is costless to the economy. In fact, these costs are very significant.

- The Environmental Law Institute estimated the total annual cost of all environmental protection actions at \$115 billion, or 2 percent of GDP, with a projection that environmental expenditures could rise to \$185 billion, or 3 percent of GDP, by the end of the decade. (Environmental Law Institute, Annual Report, 1991.)
- For the Clean Air Act of 1990 alone, the estimated compliance costs were initially estimated at about \$25 billion annually. However, as implementation proceeds, some of the initial assumptions may have changed -- e.g., some electric utilities report increased reliance on fuel switching and use of low sulfur coal rather than scrubbing. This could change the cost of compliance, and more importantly, provide additional greenhouse gas emission reductions from those assumed in the National Action Plan.

Economic Assessment of Alternative Strategies: The National Action Plan does not compare the costs and economic impacts of the actions described in the Plan with impacts of alternative strategies, such as targets and timetables. These analyses are important, in order to assess the differences in economic costs to society from alternative approaches, such as reduction actions associated with taxes or with fixed regulatory targets and timetables, compared to the current U.S. National Action Plan.

For example, an economic assessment study of targets and timetables revealed significant economic impacts on the U.S. economy. (DRI, op cit.) The analysis assumed the establishment of a policy of stabilization of carbon dioxide emissions (at 1988 levels through the year 2010) from all stationary sources in the U.S. The emission targets would be implemented through two "marketable permits" programs applied to the use of coal and petroleum, separately. The analysis showed that, relative to baseline projections:

- . GNP is reduced by 1.5% in the year 2010, a loss of \$120 billion (1989 \$) in that year alone. Economic growth is reduced by an average of 0.1% annually over the period 1990-2010;
- . the average unemployment rate is increased by 0.2%, depressing employment by 500,000 jobs, and the average real wages of those working are lower;
- . the average consumer price index inflation rate is increased by 0.3% annually over the period 1990-2010; and
- . the price of electricity is increased by 50 - 60% in the industrial sector of the U.S. economy.

Another economic study analyzed the effects of a carbon tax designed to stabilize CO₂ emissions at 1990 levels through the year 2000, and reduce emissions by 20 percent by the year 2020 (Manne, Alan S., and Richard G. Richels, "CO₂ Emission Limits: An Economic Analysis for the USA", paper presented at a workshop on energy and environmental modelling and policy analysis, MIT Center for Energy Policy Research, 1989). The Manne and Richels analysis estimated that the costs of CO₂ controls reduced projected GNP by about 5 percent by the year 2030. In a \$5 trillion economy, this amounts to over \$250 billion annually.

These analyses clearly indicate that a policy of targets and timetables, even if implemented through a "trading" scheme of marketable permits, would impose significant costs of the U.S. economy, decrease jobs and adversely affect the competitiveness of U.S. industry. Inclusion of this analysis would enhance the credibility of the U.S. strategy embodied in the U.S. National Action Plan, which relies on actions that can be justified on the basis of economics and other reasons, is the most cost effective approach to greenhouse gas emissions.

Impact of Economic Policies on Greenhouse Gas Emissions: Economic activity, energy use and environmental quality are inexorably linked. Most of the analyses of these issues is focused on the impact of environmental policies on the economy. It is equally important to understand the impact of economic policies on the environment.

As discussed earlier, the U.S. National Action Plan contains a discussion of baseline economic assumptions and baseline emissions of greenhouse gases. The Plan does not discuss specific national economic policies or their impact on greenhouse gas emissions.

The Administration's economic package, presented to Congress on February 17, 1993, contains a set of proposals designed to provide short term fiscal stimulus, encourage long term investment and achieve multi-year deficit reduction. The latter two parts of the package could affect greenhouse gas emissions, and require further analysis.

The deficit reduction package includes a proposed new broad-based energy tax. Although the tax is intended primarily for deficit reduction, it has been stated that "Energy taxes will encourage conservation by making energy more expensive, reducing pollution, and decreasing the country's dependence on foreign energy suppliers." (U.S. Office of Management and Budget, A Vision of Change for America, February 17, 1993, page 105.) These effects have not been quantified in a comprehensive manner.

One of the principal arguments for the tax is that U.S. energy is "underpriced" relative to other developed countries, and the tax would encourage more efficient energy use by raising U.S. energy prices closer to those of other countries. For example, one proponent of the tax recently stated that, "*Our biggest competitors, Germany and Japan, price all energy much more highly than we do...*" (Jessica T. Matthews, Vice President of the World Resources Institute, remarks on MacNeil/Lehrer News Hour, Monday, January 25, 1993.) This argument appears to be specious for two reasons:

- a comparison of the current costs of electricity in the industrial sector shows that the average electricity price in the industrial sector in 1988 was in the middle of a broad cross-section of the developed countries. Industrial electricity prices in the U.S. were higher than France, Norway and Sweden; comparable to West Germany and the U.K.; and below that of Japan. These values were compared on the basis of purchasing power priorities, a better measure of comparability than exchange rates alone. (Lee Schipper and Stephen Meyers, Energy Efficiency and Human Activities. Past Trends, Future Prospects, 1992, page 92.)
- an analysis of historical trends in energy efficiency improvements in the industrial sector show clearly that industry has achieved substantial energy efficiency improvements in periods of low or stable energy prices as well as during periods of higher prices. For example,

In the USA, energy intensity fell at roughly 2.7%/year between 1958 and 1973, adjusted for structural change, and by about 2.9%/year between 1973 and 1985. In other words, the rate of change was the same when real energy prices were constant or decreasing as when they increased sharply... industrial growth was more rapid in the pre-1973 period, and this growth permitted relatively rapid investments in new technologies. (Richard B. Howarth, Lee Schipper, Peter A. Duerr and Steinar Strom, "Manufacturing Energy Use in Eight OECD Countries," Energy Economics, April 1991.)

The other set of proposals in the Administration's economic plan that could affect greenhouse gas emissions is the long term investment package, including the targeted capital gains exclusion

and the temporary incremental investment tax credit. Again, there has been no detailed analysis of these specific proposals and their effects on greenhouse gas emissions. Analyses of past trends in energy efficiency suggest that capital investment plays an important role in energy efficiency improvements. One recent study noted that:

There is ample evidence that industrial managers moved to adopt specific energy-savings measures as energy prices soared during the 1970s and, we are not suggesting that energy intensity is insensitive to prices. But engineering studies suggest that new technologies will lead to continuing reductions in energy intensities even at current prices, and this change may have important implications for future manufacturing energy use patterns. It is worth noting that when real interest rates were low and investments high (the USA and Norway in the pre-1973 period and Japan in the 1980s) energy intensities fell more rapidly than during periods of increasing real energy prices. The relation between manufacturing energy use, energy prices, interest rates and investments clearly deserves further research. (Howarth, et al, op. cit. p. 141.)

The energy and environmental impacts of the specific investment proposals contained in the Administration's package have not been assessed. But evidence from the scientific literature suggests that, historically, capital investment levels may have been as important or more than energy prices in contributing to increased efficiency and reduced emissions. The energy price "shocks" of the 1970s spurred all sectors of the U.S. economy into actions to increase energy efficiency, but the level of capital investment may have been the limiting factor in the degree of improvement that was achieved. Moreover, shifts in energy prices induces behavioral changes (e.g., switching off lights, adjusting thermostats, maintaining equipment) that are reversible, whereas capital investment in new, more efficient technologies results in permanent, "hard-wired" solutions that increase energy efficiency and reduce greenhouse gas emissions over the long term.

Recommendations:

- The National Action Plan should contain an overall summary of the economic effects of the proposed plan, including the full documentation of baseline economic assumptions and forecasts. The summary should highlight the effects of the actions on GDP, employment, trade and competitiveness - both in the economy as a whole and in the major relevant sectors.
- The National Action Plan should include an explicit statement of the economic impact of actions already underway, such as the costs of requirements imposed by the Clean Air Act of 1990.

- The impacts of the Administration's proposed economic plan on projected greenhouse gas emissions should be incorporated into the National Action Plan, once the plan is enacted. The impacts of increased investment incentives could have a significant favorable impact on investments in new energy efficient technologies.

2. **The status of the U.S. Global Climate Research Program and its implications for national actions should be fully described.**

The U.S. National Action Plan contains an inadequate one page description of the current state of global climate change science. The U.S. has the world's largest program in global climate change research and has been the world leader in advancing the scientific understanding of global climate change issues. The U.S. currently spends over \$1.4 billion on global change research, which represents the vast majority of research spending worldwide. The U.S. also has fostered increased international collaborative scientific research efforts, through coordinated research projects, and through the establishment of regional global change institutes in the Western Hemisphere, Europe and the Far East. In view of the importance of the science and the U.S. role in its development, the discussion of science issues is inadequate and misleading. It is especially important that the linkages between the state of the science and actions be discussed fully, in order to ensure that actions are appropriately justified on the basis of current scientific information. In particular, there are three specific aspects of global climate change science that should be addressed in the National Action Plan.

- A. **Inevitability of Change.** The National Action Plan states that: "The best scientific information indicates that if greenhouse gas concentrations continue to increase as a result of human activities, global climate will eventually change." This statements implies that the future increases in the level of greenhouse gas concentrations can be avoided. Projections of future greenhouse gas emissions prepared by the Intergovernmental Panel on Climate Change (IPCC) show that, even if the developed countries take actions to curb greenhouse gas emissions, atmospheric concentrations will continue to increase due to population growth and economic development in the developing countries. Actually, the climate will surely change in any case due to natural causes, and the direction of change and its precise magnitude may not ever be predictable with certainty.
- B. **Timing of change.** The National Action Plan notes that the current estimates from climate models indicate a potential warming of 1.5°C - 4.5°C due to a doubling of total atmospheric CO₂ or its equivalent. However, the National Action Plan does not address the issue of timing. The 1992 estimates of future emissions, by the Intergovernmental Panel on Climate Change, indicate that a doubling of total CO₂ atmospheric concentrations would occur about the year 2100, almost 50 years later than the estimate

reported in 1990. Moreover, as the National Action Plan notes, model calculations of temperature increases have not been adjusted for "known compounding factors, such as the cooling effects of aerosols." The planned 1995 IPCC update likely will add significantly to the understanding of global change by incorporating sulfate aerosol and ozone depletion issues into the modelling. In general, as models have improved, more completely describing physical and chemical processes, the predicted magnitude of both temperature change and sea level change have decreased from one generation of the models to the next. The continuing change in the predicted consequences of man's additions to the Earth's greenhouse gases has significant implications for both the composition and timing of mitigation actions, but these have not been addressed in the National Action Plan. It maybe a decade or more before the science can detect possible climate change due to anthropogenic emissions.

- C. Flexibility to Respond to New Scientific Developments. The pace of improvement in the scientific knowledge of global climate change has been relatively rapid. For example, a significant amount of new scientific information was developed in the two year period between the 1990 IPCC Working Group I Report and the 1992 Update. And the state of the science continues to evolve rapidly. For example, an article in the January 28, 1993 issue of Nature reports new data showing an *"absence of evidence for greenhouse warming over the Arctic Ocean in the past 40 years."* The article further notes that *"... we detect significant surface cooling trends over the western Arctic Ocean during winter and autumn. This discrepancy suggests that present climate models do not adequately incorporate the physical processes that affect the polar regions."* (Kahl, Jonathan D., et. al., "Absence of Evidence for Greenhouse Warming Over the Arctic Ocean in the Past 40 Years," Nature, Vol. 361, January 28, 1993.) The National Action Plan notes that future revisions to the plan will reflect the latest scientific information. However, the National Action Plan does not provide for a mechanism to ensure that the appropriate level of U.S. actions can be adjusted in response to new scientific information. Without a formal adjustment mechanism, government programs have a tendency to become permanent, even if the initial rationale for those programs has become obsolete. The National Action Plan should provide for a formal mechanism for adjustments.

Recommendations:

- The U.S. National Action Plan should include a complete assessment of the current state of scientific knowledge on global change. This assessment should clearly delineate the major areas of scientific uncertainty.
- The National Action Plan should include a formal mechanism to ensure that it is adjusted as appropriate in response to new scientific information.

3. **Proposed actions should explicitly take into account unique national circumstances in the U.S., especially where national circumstances may lead the U.S. to take actions that differ from those of other developed countries.**

Article 4, Section 2(a) of the Framework Convention on Climate Change establishes the significance of national circumstances:

... These policies and measures will ... [take] into account the differences in these Parties' starting points and approaches, economic structures, and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances...

This provision originally was intended to provide flexibility to the developing countries. However, it also is applicable to the U.S. and the other developed countries.

The National Action Plan includes a general discussion on national circumstances that addresses geographic, demographic and socioeconomic factors within the United States. However, the National Action Plan does not establish a direct relationship between the actions described in the plan and unique national circumstances. For example, within the industrial sector, a strategy of encouraging voluntary energy efficiency improvements through government sponsored R&D, technology transfer and technical assistance is entirely appropriate in view of the diversity of U.S. industry, the high degree of domestic competition within U.S. industry sectors, and the pressures of international competition resulting from government policies that encourage free trade. By comparison, the same actions may not be appropriate in a country with state-owned industries or strong protectionist policies. Similarly, regulatory actions may have different impacts in different countries, depending upon enforcement policies and procedures.

The importance of national circumstances in establishing the framework for actions should be enhanced substantially and the specific linkages between actions and national circumstances should be clearly delineated in the National Plan. An explicit discussion of the relationship of national circumstances to country actions is also critical in order to compare and understand actions on an international basis. In comparing the energy and environmental performance of one country with that of another, economic, cultural, structural and other differences need to be explicitly considered in order to reach proper conclusion about a particular national activity or the economy as a whole. These differences can be significant in three respects.

First, structural and other differences affect energy use. The full dimensions of this point can be elusive; a discussion of patterns of food consumption and distribution is offered as an illustrative example. Consumers in some countries, such as France, have a strong preference for farm-freshness and tend to buy fresh food stuffs daily. Foods are less likely to be preserved (frozen, dehydrated, or chemically treated) before sale to the consumer. Moreover,

transportation at all steps in the distribution chain is time-critical, often involving smaller loads and more frequent trips over shorter distances. The attention to freshness without preservatives requires short market shelf life and high inventory turnover to prevent spoilage. Thus, retail markets are often small, specialized (e.g., bakeries, cheese shops), and located in neighborhoods. The economy has accommodated this attitude toward food, so households do not need freezers or large refrigerators.

In contrast, although freshness is also important to American consumers, they tend to shop weekly. Consequently, Americans buy large quantities of preserved foods. Also, most American farms are enormous enterprises compared with those in other countries. Distributors may use larger shipments over longer distances, and transportation is not as time-critical after the food has been preserved. Retail markets are large supermarkets, and price competition can be aggressive. Inventory turnover of preserved foods is driven more by business competitive factors rather than spoilage prevention. Accordingly, American households require large refrigerators with freezers.

This difference in patterns of food distribution and consumption affects how each country's economy is organized to harvest, process, distribute, and sell food to the consumer, which in turn affects how energy is consumed by this aspect of the country's economic activity.

Second, the mix of industries within a country or a region affects its energy use and carbon emissions. For example, a country or region with a concentration of basic industry and heavy manufacturing will consume more energy per unit of economic output than another country with a concentration of light industry or services (e.g. textiles, banking). For example, as the accompanying table shows, there are significant differences in the composition of manufacturing industries among the developed countries. The U.S., Norway and Sweden have relatively large pulp and paper industries (relative to total manufacturing in those countries), while the U.S. has relatively small ferrous and nonferrous metals industries (again, relative to total manufacturing).

These differences must be recognized when comparing energy consumption and carbon emissions among different countries or regions. More importantly, these differences in national circumstances among the developed countries need to be incorporated into the National Action Plans. Actions affecting industrial energy use in one country may not be appropriate or effective in other countries. The U.S. National Action Plan currently does not provide the analytical basis to assess the feasibility of proposed actions relative to national circumstances.

COMPOSITION OF THE MANUFACTURING SECTOR BY TYPE OF INDUSTRY
(% Value-added Shares)(1988)

	<u>PULP& PAPER</u>	<u>CHEMICALS</u>	<u>STONE, CLAY GLASS</u>	<u>FERROUS METALS</u>	<u>NONFERROUS METALS</u>	<u>ALL OTHER</u>
Germany	2.4%	10.3%	3.2%	4.1%	1.8%	78.2%
Denmark	2.5%	8.9%	4.3%	1.1%	0.2%	82.9%
France	2.6%	10.4%	6.0%	2.8%	2.3%	75.7%
Japan	2.6%	8.8%	3.8%	5.6%	2.2%	77.0%
Norway	6.0%	9.8%	4.1%	4.5%	7.5%	68.3%
Sweden	7.9%	7.7%	2.8%	4.8%	0.9%	75.8%
U.K.	2.9%	11.0%	5.8%	2.4%	1.6%	76.3%
U.S.	3.9%	10.2%	2.8%	2.3%	1.6%	79.2%

Source: Lee Schipper, Lawrence Berkeley Laboratory, U.S. Department of Energy

Third, most countries have established their own criteria and methods for defining and measuring economic activity and environmental conditions. There can be significant differences among national data, so that it becomes quite difficult to draw valid conclusions when evaluating the disparate data.

-- Energy consumption data reported by the developed countries is not directly comparable.

- The U.S. includes data on petroleum refining in the industrial sector, while the International Energy Agency (IEA) data reports petroleum refining in a separate category on energy conversion.
- Italy, for example, combines residential and commercial energy consumption data in its data submission to the IEA.

- In addition, data on the energy efficiency of technologies are not comparable; for example, countries use different testing procedures for automobile fuel economy and appliances, and consequently the results cannot be compared directly.

As a result, great caution should be used when comparing national data. Other countries should seek to develop the sophisticated methods of data collection and analysis common in the U.S., so that the developed countries can achieve common measure of comparison.

In summary, International and interregional comparability is important for several reasons.

- it provides a basis for analyzing the effects of an action against the national circumstances, and thus against the criteria established in the Framework Convention;
- it can help a country determine whether an action taken by another country could help with a similar problem; and
- it can help in comparing national policies and actions among countries and in gaining international consensus that the priorities are reasonable.

Recommendations:

- The relationship between proposed actions and national circumstances should be made explicit. This will help others to better understand the rationale for the proposed actions. It also will help facilitate international comparisons.
- Comparisons of the energy and environmental performance among countries should explicitly take into account unique national circumstances, and quantitative comparisons should be adjusted, to the maximum extent feasible, to remove the effect of unique factors from the data.
- Other countries should seek to develop the sophisticated methods of data collection and analysis common in the U.S., so that the developed countries can achieve a common measure of comparison.

4. **The U.S. National Action Plan should continue to reject the adoption of rigid targets and timetables as a strategy to implement the Framework Convention.**

The U.S. National Action Plan reflects a strong, continuing commitment to taking actions to curb net greenhouse gas emissions and mitigate potential climate change. The National Action Plan reflects a "bottoms-up" approach to curbing greenhouse gas emissions, consisting of :

- an identification of actions to be taken, in keeping with particular national circumstances; and
- an assessment of the impact of these actions on projected greenhouse gas emissions, aiming for the best results possible.

Although the U.S. National Action Plan has been proposed pursuant to the "prompt start" resolution rather than the Framework Convention itself, the approach adopted in the Plan is fully consistent with the provisions of the Convention.

An issue raised by some is whether the National Action Plan, to be consistent with the provisions of the Framework Convention, should adopt specific targets and timetables for the stabilization of net greenhouse gas emissions. The GCC strongly believes that specific targets and timetables are neither analytically justified nor legally required.

There are many factors which create a level of uncertainty that precludes the establishment of specific targets and timetables. None of these factors have changed since the Convention was signed in June of 1992. Moreover, there are other factors which argue against accelerated implementation. These factors are described below:

- Scientific Uncertainties are Unresolved: The scientific uncertainties about direction and magnitude of climate change must be resolved before commitments to targets and timetables would be justified. Both internationally and nationally, governments should further enhance scientific and economic research to help lessen the uncertainties regarding the direction, magnitude, timing and regional impacts of potential climate change. Scientific uncertainty about climate change should not be a reason for inaction when actions can be justified on the basis of economics and on other grounds. However, there is no scientific basis at this time to establish any specific emissions reduction targets for greenhouse gases.
- Economic Costs are Substantial: The economic impacts of climate change and the economic impacts associated with mitigation or

adaptation remain unknown. The effectiveness of response options and their impact on economic growth and on other socioeconomic factors have not been evaluated in a comprehensive manner. As discussed earlier, several studies have indicated that a fixed target of stabilization of greenhouse gas emissions could have serious adverse impacts on U.S. economic growth, jobs and competitiveness. Japan also is reported to be analyzing in more detail the economic impacts of a CO² tax. A major research program on economics issues related to climate change has been initiated by the U.S. This program should be expanded on an international level to include all sectors and all impacts, and the results of this effort should be made available to policy makers before further commitments are made.

- Need for a Comprehensive Approach: A comprehensive approach, addressing all greenhouse gases all sources and sinks, is one of the basic principles underlying the Framework Convention. Specific targets and timetables for specific greenhouse gases for specific industries, as envisioned by many of the advocates of targets and timetables, is inefficient and eliminates flexibility.
- Technology Innovation May Be Stifled: In order to meet fixed targets and timetables, affected U.S. industries would have to make commitments to the deployment of extant emissions control technologies, which in many cases may not be the most cost effective or technically optimal solution. Technologies are evolving and on-going R&D likely will lead to significantly improved technologies in the future, with lower greenhouse gas emissions. Capital investment planning cycles, however, are long and can not allow for the application of new technology if investment decisions are dictated by specific targets and timetables.
- Top-Down Central Planning Does Not Work: Targets and timetables represent a top-down approach that has been more closely associated with the failed policies of centrally-planned economies, and not consistent with diverse market economies such as the U.S., where national outcomes are the result of millions of individual decisions. The approach of targets and timetables already has been tested in the U.S., and has failed, with regard to Federal budget deficit reduction. As noted in a recent report of the World Resources Institute:

"One might also draw the analogy to the Gramm-Rudman anti-deficit law, which eerily resembles a climate 'framework' convention in that it contains targets and

timetables but leaves specific agreement on cuts and tax increases for later. As such, this law served for years as an expedient political 'solution'-at a time of intense public deficit concern- allowing executive and legislative officials to declare the problem 'solved' and return to budgetary chicanery. It is quite possible that the large number of unilaterally adopted greenhouse gas control targets... would have an analogous effect." (World Resources Institute, Greenhouse Warming: Negotiating a Global Regime, January 1991).

From a legal standpoint, the most important argument against the establishment of fixed targets and timetables was the legislative record developed during Senate review and ratification of the Framework Convention on Climate Change. As noted in the Report of the Senate Foreign Relations Committee:

"[A] decision by the Conference of the Parties to adopt targets and timetables would have to be submitted to the Senate for its advice and consent before the United States could deposit its instrument of ratification for such an agreement.

The committee notes further that a decision by the executive branch to reinterpret the Convention to apply legally binding targets and timetables for reducing emissions of greenhouse gases to the United States would alter the "shared understanding" of the Convention between the Senate and the executive branch and would therefore require the Senate's advice and consent." (S. Rep. No. 55, 102nd Congress, 2nd session, 1992)

In summary, the approach adopted in the U.S. National Action Plan -- a commitment to actions, best estimates of the impacts of proposed actions, and flexibility in the implementation of those actions -- is effective, consistent with the Framework Convention, and in keeping with national circumstances. Achieving rigid targets and timetables depends upon too many uncontrollable factors in a market economy, including population and economic growth rates and international market competition. It would not be prudent to legally bind the U.S. to international commitments whose feasibility is uncertain.

Recommendations:

- The U.S. National Action Plan should maintain a "bottoms-up" approach to commitments, and should continue to reject the adoption of rigid "top down" targets and timetables.
- Specific commitments in the National Action Plan should be focused on actions. The Plan should contain "best estimates" of the outcomes of proposed actions, recognizing that in many cases that those outcomes are not legally binding.

5. **Full implementation of the Energy Policy Act of 1992 should be made a cornerstone of the National Action Plan.**

The National Action Plan identifies 11 titles of the Energy Policy Act of 1992 as being extremely important to the overall strategy of reducing greenhouse gases. However, the detailed description of actions and the analysis of greenhouse gas emission impacts is largely based upon the National Energy Strategy (NES) proposals that preceded final action on the Energy Policy Act. Some adjustments appear to have been made for a few of the specific provisions of the Act, such as expanded building and appliance standards. But this piecemeal attempt to incorporate the provisions of the Act into the National Action Plan fails to provide adequate coverage of the full range of provisions in the Act.

The Energy Policy Act of 1992 contains a number of provisions which, if fully implemented, will have a significant impact on greenhouse gas emissions in the years and decades ahead. In its report on H.R. 776, the House Energy and Commerce Committee stated:

"The Committee expects that, if fully implemented[,] H.R. 776 will result in a substantial reduction in U.S. greenhouse gas emissions relative to forecasted levels. The bulk of these reductions result from the programs that will demonstrate and transfer advanced clean coal and renewable technologies abroad, and from the domestic energy efficiency and renewable energy initiatives. The provisions on electric utilities, alternative fuels and coal bed methane are also significant."

The Global Climate Coalition has undertaken a special analysis of the Energy Policy Act of 1992. The GCC analysis identifies almost 100 specific provisions, in 18 separate titles, affecting greenhouse gas emissions. Many of these provisions appear to be new or expanded relative to the National Energy Strategy proposals which formed the basis for the National Action Plan. A summary of these provisions is attached as Appendix A.

In particular, Title XVI of the Energy Policy Act creates a framework for a flexible, long-term strategy for addressing greenhouse gas emissions. The main elements of this strategy include:

- requiring a comprehensive assessment of the feasibility and economic, energy, social, environmental and competitive implications for stabilizing, or reducing by 20 percent, CO₂ and other greenhouse gases by the year 2005 (Section 1601);
- directing the Secretary of Energy to include a least cost energy strategy in the President's National Energy Policy Plan, required to be submitted to Congress by April 1, 1993. The strategy is to be designed to achieve "to the maximum extent practicable and at least cost to the

Nation" stabilization and eventual reduction in the generation of greenhouse gases (Section 1602). Least cost is based on an analysis of:

"...all direct and quantifiable net costs for the resource over its available life, including the cost of production, transportation, distribution, utilization, waste management, environmental compliance, and in the case of imported energy resources, maintaining access to foreign sources of supply..."

The least cost analysis criteria do not include environmental externalities or other non-market cost elements that could distort the economic cost comparisons;

- strengthening the focus within the U.S. Department of Energy on climate change issues by establishing a Director of Climate Protection (Section 1603);
- requiring a comparative assessment of alternative policy mechanisms for reducing the generation of greenhouse gases, with a report to Congress within 18 months of enactment of the Act (Section 1604);
- developing within one year a national inventory of aggregate greenhouse gas emissions for each year of the baseline period, 1987-1990 (Subsection 1605(a));
- developing guidelines for the voluntary collection and reporting of information on greenhouse gas emissions and reductions by entities for 1987-1990 and subsequent years (Subsections 1605(b) and (c));
- establishing an innovative environmental technology transfer program, within an authorization of appropriations of \$100 million for each fiscal year FY1993-1998 (Section 1608); and
- establishing a Global Climate Change Response Fund for contributions to the financial mechanism negotiated pursuant to the Framework Convention on Climate Change. A total of \$50 million is authorized for FY1994, and such sums as necessary for FY1995 and FY1996 (Section 1609).

Overall, the Energy Policy Act of 1992 establishes a comprehensive, but flexible framework to support a long-term program for greenhouse gas emissions reductions.

Recommendations:

- The Administration should prepare a detailed assessment of the greenhouse gas reductions that can be achieved as a result of full implementation of the Energy Policy Act of 1992.
 - The U.S. National Action Plan should incorporate the results of the assessments and studies required under Title XVI of the Energy Policy Act, including the least cost energy strategy required in the President's National Energy Policy Plan.
6. **The National Action Plan should be expanded to reflect the full range of voluntary actions underway by U.S. industry. Estimates of the impact of voluntary actions should be developed in close cooperation with those responsible for the actions.**

The discussion of mitigation actions contained in the National Action Plan includes not only federal government actions (e.g., regulatory actions, R&D, etc.), but also voluntary programs and state and local actions. This framework is extremely beneficial because it conveys the full range of activities within the U.S. and is consistent with U.S. national circumstances, such as the division of responsibility within the U.S. governmental structure and "mixed" economy that is relatively unique to the U.S. However, there are two areas of concern regarding the discussion of voluntary actions contained in the National Action Plan.

First, the estimates of the impacts of the voluntary actions require further validation. By their nature, voluntary actions are dependent upon market mechanisms for their implementation. The voluntary actions described in the National Action Plan largely consist of efforts to promote the adoption of more efficient energy technologies and practices. Because these actions describe technologies that are commercially available, there are no significant technical issues. The key issue is the rate of market penetration of these technologies. The estimates of market penetration contained in the National Action Plan were developed by government experts without widespread consultation with key private sector entities actually responsible for the production, marketing and financing of these technologies. Moreover, the estimates of market penetration were presented as national averages with little or no explanation of the underlying rationale or assumptions. Market penetration rates are likely to vary significantly across geographic regions, across industries and across income groups. More importantly, market penetration is greatly affected not only by the economics of the technology, but also by the cost and availability of investment capital and the relative rates of return on alternative investment opportunities. As a result, market penetration rates cannot be estimated in isolation, and require a careful analysis of broader economic trends and close consultation with private sector experts in these fields.

The second concern regarding the discussion of voluntary actions is that it does not capture the complete range of voluntary actions underway in the U.S. Consequently, the impacts of voluntary actions are underestimated. Significant examples of additional voluntary actions that do not appear to be reflected in the National Action Plan are summarized below:

- Electric Utility Boiler Efficiencies. Both the 1991 OTA report, Changing by Degrees : Steps to Reduce Greenhouse Gas Emissions, and the 1991 National Academy of Sciences (NAS) summary report, Policy Implications of Greenhouse Warming suggest that the electric utility industry can improve generating unit efficiencies as a means of helping to reduce greenhouse gas emissions. EPRI conducted a survey of 120 utilities in 1986 that suggested that the potential for heat rate improvements was generally 2-4 percent. Using the guidelines resulting from that survey in demonstrations, EPRI subsequently has estimated the potential for heat rate improvements at five utilities to range from 1 to 5 percent. At some units, EPRI has cautioned, heat rate improvements either may not be possible or may not be cost effective.
- Clean Coal Technologies: Several utilities are already embarking on plans to convert older, less efficient coal-fired units into more efficient combined-cycle systems that will utilize natural gas turbines, pressurized fluidized bed combustion, coal gasification technologies or even advanced fuel cells. Moreover, the federal government and industry are participating in a joint, \$5 billion clean coal technology demonstration program to help commercialize these new technologies. These new technologies could improve generating efficiency by 10 - 15%. However, most of these advanced systems will not be available commercially until after the year 2000.
- Renewable Energy Resources: Many electric utility companies are actively engaged in the use of renewable generating resources. Hydroelectric resources -- clean, efficient and relatively inexpensive -- are the ones most widely available in most areas of the country and comprise 10 percent of the national electricity generation mix. Other renewable resources being actively pursued by utilities include: solar (54 large-scale projects); geothermal (more than 1,000 MW in California); and wind (\$2.5 billion worth of electricity purchased from wind power plants in 1990).
- Nuclear Energy: The 1991 OTA report (op cit) suggested two ways to enhance the greenhouse gas-reducing capability of nuclear plants: 1) increase their capacity factors from 65 to 70 percent; and 2) extend their useful lives to 45 years. The nuclear utility industry achieved a 68.4 percent equivalent availability factor during 1990, and it has set as a goal a 76 percent factor. In addition, an industry-wide

effort has been initiated to support a license renewal program to extend the useful life of nuclear plants to 60 years.

- Hydroelectric Generating Efficiency: Utilities have been replacing old hydroelectric turbines with new generation turbines and achieving dramatic improvements in efficiency - up to 60%. The increased generation from these non-greenhouse gas emitting plants offsets generation from fossil-fuel units and on balance reduces the growth in CO₂ emissions.
- Investments in Efficient Transmission Systems: Many electric utilities utilize a highly efficient transmission system employing extra-high voltage (EHV) transmission. One 345 kv line has the power carrying capability of about six - 138 kv lines and one 765 kv line has about five times the capability of a 345 kv line. Significantly less energy is lost from EHV transmission lines than high- or low-voltage lines, which in turn averts CO₂ emissions. A single 765 kv line can save about 60 MW in electricity losses when put in service. Utilities have invested in EHV lines since 1990, and more EHV enhancements of the electrical grid are expected between now and the year 2000.
- Oil production and refining: Oil companies are developing cogeneration projects that produce electricity for sale in addition to producing steam for oil field production. For example, two cogeneration plants in the Kern County, California oil fields generate enough electricity to power 500,000 households, saving energy that would otherwise be needed for electricity generation. Overall, the American Petroleum Institute reports that U.S. oil refineries will use about 33 percent less energy to process a barrel of oil than they did in 1972.
- Refrigerator recycling: These programs encourage customers to turn in their second, working refrigerators for recycling. This effort results in the destruction of PCB-filled capacitors, the safe capture of CFCs and the recycling of metal components. It also saves energy and reduces CO₂ emissions by taking these older machines out of service. By comparison, government programs tend to focus on increasing the energy efficiency of new refrigerators. Estimates by the Association of Home Appliance Manufacturers indicate that roughly 15% of all homes contain second, operating refrigerators, or about 9 million units.
- Automobile Manufacturing. Improved paint processes and the use of water-based paints for reduced HC emissions have been and continue to be developed. Manufacturers also have been involved in improving the degree of recycling of materials from vehicles taken out of service.

- Intelligent Vehicle Highway Systems. Work in the U.S., Japan, and other countries will be utilized in intelligent vehicle highway systems (IVHS), which should help reduce fuel consumption and vehicle miles traveled (compared to not using IVHS) in specific situations. This technology will result in reduced emissions of CO₂, methane and nitrogen oxides.
- Chemicals: The Chemical Manufacturers Association (CMA) recently adopted an Energy Efficiency Continuous Improvement Program, consisting of an annual member company survey of energy efficiency and CO₂ emissions. The survey will provide a means of gauging aggregate progress in improving energy efficiency. In concert with the survey, CMA will sponsor periodic meetings and seminars for member company representatives focusing on energy efficiency programs and achievements. CMA also will sponsor an annual Energy Efficiency Award program in recognition of individual member company performance. One major chemical company has undertaken an expanded effort, known as the Waste Reduction Always Pays (WRAP) program, to increase energy efficiency and reduce waste. The program has fostered a spirit of continuous improvement, and has resulted in savings of \$20 million annually, from improved energy efficiency, reduced waste and more efficient operations.
- Aluminum Production: A major U.S. Aluminum Company has been involved in a number of projects involving smelters in developing countries. In each case, these plants were built with the latest technology for emissions controls, essentially to meet U.S. EPA standards, even though such standards were not required by the host country.

These are but a few of the examples of additional voluntary programs that should be included in the U.S. National Action Plan.

Recommendations:

- Voluntary programs should be an important element of the National Action Plan. An expanded effort is needed to gather information on voluntary programs on a more systematic basis.
- Estimates of the impacts of voluntary programs should be developed in close coordination with the industries or other parties undertaking the voluntary efforts. This will improve greatly the accuracy and credibility of the estimates.

7. **There may be additional opportunities for controlling methane (CH₄) emissions that are not currently part of the National Action Plan.**

The U.S. National Action Plan is focused heavily on possible actions that are likely to reduce CO₂ emissions over the next two decades. This is because, worldwide, CO₂ is the second most dominant greenhouse gas potentially affecting global climate change (water vapor is the first).

Methane also is an important greenhouse gas potentially affecting global climate change. The U.S. National Action Plan notes that the global warming potential of methane is estimated to be 11-22 times greater than CO₂ on a per unit basis. In 1990, methane is estimated to have contributed about 18 percent to global radiative forcing (U.S. National Action Plan, p 88).

The control of methane emissions should receive greater priority than is currently provided for in the U.S. National Plan, for three reasons:

- 1) on a worldwide basis, about 70 percent of all methane emissions result from anthropogenic activities (Fung, et. al., "Three Dimensional Model Synthesis of Global Methane Cycle, Journal of Geographical Research);
- 2) methane has a relatively short atmospheric life (about a decade); and,
- 3) the methane released by human activities is a wasted resource that, if captured, has economic value.

Because of these factors, methane emissions should be more responsive to control actions. The most significant problem with methane is the large uncertainties in the measurement of emissions. Because the estimates of both U.S. and global emissions are subject to significant uncertainty, it is difficult to estimate the costs and benefits of control actions.

Developing an accurate global inventory of methane emissions has been very difficult. Fung (*et al*) have recently published what most analysts believe is a reasonable composite estimate of methane sources and emissions from both anthropogenic and natural sources. Also, The World Resources Institute has published data on anthropogenic methane emissions. A comparison of these data is shown in the following table:

ESTIMATED GLOBAL METHANE (CH₄) EMISSIONS
(Million Metric Tonnes Per Year)

SOURCE	WRI	FUNG et al.	IPCC RANGE
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ANTHROPOGENIC	270	350	--
Natural Gas Leaks	37	30	--
Natural Gas Vents	--	10	40 - 100
Coal Mining	39	35	---
Landfills	49	40	---
Biomass Burning	--	55	20 - 70
Animals	76	80	20 - 80
Rice	72	100	65 - 100
NATURAL		150	---
Methane Hydrates		5	0 - 100
Oceans/Fresh Water		10	6 - 45
Termites		20	10 - 100
Wetlands		--	100 - 200
swamps/alluvial		80	
bogs/tundra		35	
TOTAL		500	

Sources: Fung, Lerner, Matthews, Prather Steel and Fraser. "Three Dimensional Model Synthesis of Global Methane Cycle." *Journal of Geographical Research*, pp. 13,033 - 13,066. World Resources Institute, *World Resources, 1992-93*, Table 24.2, pp. 348-349.

It is important to note that half of the global anthropogenic emissions of methane are derived from agriculture-related practices.

The U.S. National Action Plan contains estimates of reductions in methane emission resulting from three actions: better management of livestock waste lagoons, emission controls from landfills and methane recovery from coal seams.

Additional methane emissions could be achieved by extending landfill emission controls to additional landfills (only the largest landfill emitters were covered by the proposed EPA regulation), if justified on a benefit/cost basis. Additional reductions of methane from coal seams can be achieved through implementation of the new authorities for coalbed methane recovery contained in Title XIII, Subtitles A and C, of the Energy Policy Act of 1992. The Act

establishes procedures for resolving disputes regarding ownership of coalbed methane rights on federal lands and subsurface mineral estates. The Act also requires studies of the institutional barriers to coalbed methane recovery on non-federal lands and establishes a national demonstration and commercial application program.

There are additional opportunities to control (both U.S. and global) methane emissions resulting from agricultural activities. The U.S. National Action Plan assumes virtually no emissions reductions in this area. As noted earlier, more than half of total global anthropogenic emissions of methane are the result of agriculture activities, principally from rice and animal production. Moreover, the IPCC concluded that rice production is projected to increase worldwide by 20% through the year 2000 as a result of projected world population growth. There may be significant additional opportunities to control methane emissions from these sources, both in the U.S. and other countries. For example, U.S. rice production activities are subsidized by the U.S. Government, because of excess domestic production levels, and it may be feasible to achieve emissions reductions through a continuing review and evaluation of the relevant government policies and their impacts on the economy and trade.

A discussion paper by the Climate Action Network, released at the INC negotiating session at Nairobi, Kenya in 1991, summarized many of the potential methane emissions reductions in agriculture activities. (Daniel A Lashof, "Methane Controls in the Climate Convention," Climate Action Network Discussion Paper, September 18, 1991.) With respect to animal production, a number of new feed and feed supplements are under development which could reduce per unit animal emissions by 25 - 75% over the long run. Given expected increases in herd size worldwide, consistent with world population and economic growth, those new programs could prevent methane emission increases if not actually reduce emissions.

With respect to rice production, new cultivation practices that increase yield and reduce methane emissions are under development. Alternative water management practices are also under development as part of water conservation requirements in the western region of the U.S. Many of these practices have reduced methane emissions dramatically in pilot tests currently underway. The initial results suggest that half of the projected increase in baseline methane emissions could be avoided if these low cost alternatives were adopted.

Recommendations:

- The National Action Plan should reassess the benefits and costs of options for achieving additional methane emission reductions from landfills.
- The National Action Plan should incorporate additional methane emissions reductions resulting from implementation of the coalbed methane provisions of the Energy Policy Act of 1992.

- The National Action Plan should review and evaluate options for achieving cost-effective reductions in methane emissions in the agriculture sector.

8. **Federal Technology R&D Programs should adopt an explicit objective of achieving greenhouse gas emissions reductions. Federal agency technology R&D programs should be better coordinated.**

The National Action Plan includes an Environmental Technologies Research Program, which aims to develop technologies for reducing greenhouse gas emissions and to formulate adaptive response strategies for reducing vulnerability to global changes. As described in the plan, the research program is "less formally structured", and in fact contains few details. More importantly, the estimates of impacts of the National Action Plan on projected greenhouse gas emissions excludes any contribution from the development and application of new technology in the U.S. While technology development will have an impact on projected greenhouse gas emissions in the year 2000, new technology likely will be the most important longer-term option for both mitigation and adaption to global change. New technologies also will play a significant role in minimizing the emissions of greenhouse gases in developing countries, whose share of CO₂ emissions is projected to reach 68 percent of the world total by the year 2025. However, in order for the longer term impacts to be achieved, it is important that the R&D programs be well-planned and coordinated in the near term.

Many new energy technologies have the potential to reduce greenhouse gas emissions by virtue of their increased efficiency. Examples of advanced technologies currently supported by DOE include:

- superinsulating materials (gas-filled reflective panels, compact vacuum insulation and evacuated powder panels);
- advanced refrigeration systems, employing novel heat exchangers and non-CFC refrigerants;
- advanced chemical and mechanical heat pumps;
- improved process heat exchangers and ceramic recuperators; and,
- new applications for advanced materials, such as continuous fiber-ceramic composites.

None of these advanced technology options are included in the National Action Plan. The National Energy Strategy (NES), issued by the Department of Energy in 1991, emphasized the

importance of new energy technologies in achieving national energy and environmental goals. The NES noted that R&D was essential for improving energy efficiency and increasing the range of economical, clean technology choices. The important role of R&D in achieving long-term energy goals was underscored by projections in the NES showing that by the year 2030, between 5 million and 8 million barrels per day of oil would be saved through the development and deployment of new energy technologies (U.S. Department of Energy, National Energy Strategy, 1991, p. 136). By comparison, U.S. net imports of petroleum and petroleum products averaged 6.6 million barrels per day in 1992. (U.S. Department of Energy, Annual Energy Review 1991, June 1992, p. 116.)

In FY1993, DOE has a total budget of over \$1.3 billion for R&D on new energy technologies, as shown in the table below. Many of these technology programs are slated for increased funding in the Clinton Economic Program, except for nuclear R&D, which is proposed for reduction (U.S. Office of Management and Budget, A Vision of Change for America, February 17, 1993, pp. 48-49.) In addition, the Environmental Protection Agency supports a broad range of studies, technology development and other cooperative activities that are focused on mitigating the emissions of greenhouse gases.

In total, EPA will have a total of about \$50 million in FY 1993 for these activities, increasing to about \$80 million in FY 1994, under the Administration's economic plan (op. cit., p. 37, p. 45). Most of the increases in the EPA Budget are for expanded voluntary programs such as "Green Lights" and "Energy Star" computers.

**DEPARTMENT OF ENERGY
FUNDING FOR ENERGY TECHNOLOGY DEVELOPMENT**

	FY1993 \$ millions
Solar/Renewable R&D	257
Conservation R&D	
Transportation	140
Industrial	113
Buildings	53
Utility	5
Other	39
	350
Nuclear R&D	342
Fossil Energy R&D	
Coal	239
Petroleum	62
Natural Gas	30
Program Directorate	87
	418
TOTAL	\$1,367

Source: DOE

DOE technology development programs support a number of policy and programmatic objectives (e.g., reducing oil imports, providing fuel diversity, etc.). The reduction of greenhouse gas emissions is an important benefit from these new technologies, and those benefits should be quantified. Increased recognition should be given to R&D programs and technologies that can have a significant impact on greenhouse gas emission. By comparison, the EPA programs currently do have global change mitigation as their principal focus. However, these programs are not jointly planned or closely coordinated with DOE R&D programs. In addition, neither is closely coordinated with other federally-funded technology programs, such as the Department of Commerce Advanced Technology Program or the Manufacturing Technology Transfer program.

Recommendations:

- The role of technology development in the National Action Plan should be significantly strengthened. The Plan should include a full discussion of all federally-funded research and technology development that has the potential to reduce greenhouse gas emissions, and provide estimates of the long-term potential for greenhouse gas emissions reductions. As a first step in implementing this recommendation, the Administration should undertake an inventory of all federally-funded research and technology development that has the potential to reduce greenhouse gas emissions.
 - All Federal R&D agencies, particularly DOE, should establish an explicit programmatic objective of reducing greenhouse emissions in each of their relevant research and technology development programs, and accord high priority to these efforts in the budget process.
 - Federally-funded technology development activities should be closely integrated with technology cooperation and Joint Implementation actions. New technologies that have the potential for reducing greenhouse gas emissions in both U.S. and international applications should be assigned highest priority for funding within the federal R&D programs.
9. **The National Action Plan should present an integrated strategy of both mitigation actions and adaptation measures. Costs and benefits of specific adaptation actions should be analyzed in greater detail.**

The major focus of the U.S. National Action Plan is on mitigation measures (i.e. actions to avert or lessen the possibility of climate change). The National Action Plan also contains a chapter on adaptation to climate change (i.e. the process of adjustment to a new or altered environmental resulting from climate change.)

Historical records indicate that the climate has always been highly variable and that natural ecosystems have adapted to past natural climate changes. There is no reason to believe that mankind will not have to continue to adapt to future climate variability, regardless of the cause of climate change. The 1991 Report of National Academy of Science stated: "It would be fruitless to try to maintain all human and natural communities in their current forms" (National Academy of Sciences, Policy Implications of Greenhouse Warming: Mitigation, Adaptation and the Science Base, 1992, p. 47). The periodic droughts, floods, hurricanes, tornadoes, and other weather anomalies associated with climate variability worldwide cause considerable economic

damage and human suffering. Some nations are more insulated from these effects than others due to a variety of factors, including their locations relative to where these events occur, the resiliency of their economies, the nature of their land-use and water-use practices and their technological capabilities. A graphic example of this concept can be found in the large property damage yet minimal loss of life from Hurricane Andrew last year in the U.S., versus the 1991 typhoon that struck Bangladesh and killed 120,000 people. The ability to forecast and prepare for climatic or weather events substantially reduced the human toll in the U.S. compared to Bangladesh. Strategies for adaptation to climate variability can have significant benefits today and can provide insurance against longer-term climate change that evolves more slowly.

The National Action Plan contains a good framework discussion of adaptation, outlining a comprehensive and integrated approach to the issue. For example, adaptation issues are discussed within the context of a comprehensive approach that has the additional benefit of reducing the emissions of all greenhouse gases, increasing the sinks for greenhouse gases and improving the flexibility of societies to adapt to or insulate themselves from the consequences of climate variability or climate change as scientific uncertainties are resolved.

However, the National Action Plan does not fully integrate adaptation and mitigation actions. For example, the discussion does not analyze the relative benefits, costs and tradeoffs among mitigation and adaptation actions. In some cases it is likely that adaptation options will be less costly to society than some mitigation measures. A conceptual framework for comparing mitigation and adaptation options was presented in the National Academy of Sciences report (op. cit., p. 31) Unfortunately, this framework was not incorporated into the U.S. National Action Plan.

The National Academy of Sciences report stated that "People of the U.S. likely will have no more difficulty adapting to such future changes than to the most severe conditions in the past, such as the Dust Bowl. Other countries may have more difficulty, especially poor countries or those with fewer climate zones." (op. cit. page 47.) For this reason, economical adaptation that lessens sensitivity to climate is desirable. Programs to support research on adaptation and strategies to implement these concepts both in the U.S. and throughout the world should enable society to deal with weather variability today and position society to cope with potential climate change in the future. Examples of such measures include the development of drought resistant crops, improved water management techniques and improved thermal insulation of structures.

Finally, the National Academy of Sciences Report noted that there were four limiting factors on the human responses to greenhouse warming: time, water, money and decision-making techniques and information (op. cit., pp. 43-44). Increased research and studies can address three of these four factors. The remaining limiting factor, money, can be affected only through sound national economic policies. Clearly, achieving economic growth in all countries will be essential in facilitating both mitigation and adaptation actions.

Recommendations:

- Mitigation and adaptation actions should be better integrated in the National Action Plan, including a discussion of relative costs, benefits and trade-offs. The policy framework in the recent National Academy of Sciences Report on Climate Change should be used as the starting point for this analysis.
- Research and analysis of adaptation measures should be expanded, in order to improve the estimates of costs and benefits of such actions. Priority areas for increased research on adaptation should include programs and strategies designed to:
 - improve agricultural practices;
 - understand CO₂ fertilization effects on green plants;
 - improve forest management and grassland practices;
 - improve water resource utilization and planning;
 - manage marine and coastal environments;
 - upgrade design criteria and safety margins in long-lived structures and infrastructure systems; and
 - improve satellite weather predictive capabilities and emergency preparedness programs.
- Increased emphasis needs to be placed on the importance of policies to promote sustained economic growth in all countries of the globe as a necessary factor to facilitate both mitigation and adaptation actions.

10. **The National Action Plan should establish a framework and procedures to facilitate Joint Implementation actions with developing countries.**

The National Action Plan describes examples of current activities that are consistent with the concept of "Joint Implementation". These examples include actions by U.S. government agencies, non-government organizations and U.S. companies. Joint Implementation actions represent a significant aspect of global change policy. However, the National Action Plan does not establish the foundation that is necessary to promote such actions on a scale that would achieve their full potential. Joint implementation actions will become increasingly important in the future because of the large projected increase in emissions from developing countries. Moreover, actions taken by the developed countries to reduce emissions could be largely negated by the response of the developing countries.

Significance of greenhouse gas emissions in developing countries: Achieving a significant change in projected global greenhouse gas emissions requires a strong response by both the developed and developing countries. This is of particular importance since the majority of CO₂ is currently emitted by developing countries. Data compiled by the IPCC show that in 1990, OECD countries were responsible for 47 percent of global CO₂ while developing countries were responsible for 53 percent. Current scenarios predict that the developing countries share of global CO₂ would increase if current trends continue. In the future, both economic and population growth will contribute to an increase in greenhouse gas emissions in developing countries. According to one IPCC scenario (considered by some as the "business as usual" scenario), by 2025 the OECD share would have decreased to 32 percent while the developing countries share would have increased to 68 percent. These trends are illustrated in the Figure attached as Appendix B.

In view of the projections of the growth of greenhouse gas emissions in developing countries, the United States should promote strategies for economic growth in the developing countries which are based upon the use of energy efficient technology that minimizes emissions of CO₂ and other greenhouse gases.

Potential for offsetting emission increases: In addition, the U.S. National Action Plan should take into account the possibility of an unintended increase in global energy use that could result from unilateral decrease in fossil fuel consumption by the developed countries. For example:

- reduced demand for fossil fuels in the developed countries could reduce world fossil fuel prices, encouraging other countries to increase their use of fossil fuels;
- reduced production of CO₂ emissions-intensive products in the developed countries, without an equal reduced global demand for such products, encourages developing countries to increase their production of such products; and
- global CO₂ emissions may even increase, if new energy technologies deployed in developing countries are less efficient than the technologies in use in the developed countries.

A recent study of potential offsets from a unilateral reduction of CO₂ emissions of 20 percent in the OECD countries found that 70 percent of the OECD emissions reduction would be offset by emissions increases elsewhere. (John Pezzey, "Analysis of Unilateral CO₂ Control in the EC and OECD, The Energy Journal, Volume 13, Number 3, 1992).

Recommendations:

- The U.S. National Action Plan should include provisions that would establish a framework for Joint Implementation, and help facilitate individual Joint

Implementation actions. Such measure should incorporate as appropriate the technology transfer, financial assistance and other provisions of the Energy Policy Act of 1992.

- U.S. and International policies on Joint Implementation should emphasize actions by non-government organizations and the private sector, rather than government-to-government agreements.

11. **There are additional opportunities to enhance carbon sinks through improved global forestry practices.**

The National Action Plan states that responsible resource management is a longstanding tradition in the U.S. The plan notes that forest cover in the U.S. has been effectively stabilized since the beginning of the 20th century. In addition, the Plan notes that U.S. forestry practices currently resulted in a net sequestering from the atmosphere of 188-563 million metric tons of CO₂ in 1988 (op. cit. page 40).

The Plan proposes to further enhance the capability of U.S. forests to sequester carbon through a new program to plant 1 billion trees annually and through voluntary efforts by U.S. industry to increase forest products utilization, including recycling.

The National Action Plan does not address the international dimension of the loss of CO₂ sinks as a result of deforestation. The problem of deforestation is two-fold: first, deforestation may reduce total CO₂ sink capability and it may liberate CO₂ if felled timber is allowed to decay. Second, in those cases where forests are used for economic development, inefficient or improper forest management practices may exacerbate the ecological harm. For example, clearing of forest through burning, as is practiced in some developing countries, liberates methane and other greenhouse gases.

The problem is that the vast majority of the world's forest land lies outside of the U.S., and on a global basis, the rate of deforestation exceeds reforestation efforts.

- a total of 94% of all forest and woodlands lies outside the U.S. (World Resources Institute, World Resources 1992-93, 1992, p. 286);
- 55% of all organic carbon is currently sequestered in the dense biomass of tropical forests (The World Bank, The Forest Sector, 1991, p. 30);

- forests in the developing countries have declined by nearly half and the rate of loss has increased in recent years, from 11.4 million hectares annually in the early 1980's to 17-20 million hectares annually from more recent studies (World Bank, op. cit., p. 28);
- land conversion globally, primarily tropical deforestation, has led to a net average flux of 0.6-2.6 billion metric tons of carbon over the past decade (U.S. national Action Plan, p. 40); and
- in the Amazon region alone, forest clearing and burning was estimated to result in emissions of up to 260 million tons of carbon annually over the period 1978-89. (Fearnside, Philip M., Antonio Tebaldi Tardin, and Luiz Gylvan Meira Filmo, "Deforestation Rate in Brazilian Amazon," National Secretariat of Science and Technology, Brasilia, 1990).

Deforestation in the developing countries is the result of several activities: agricultural settlement, logging, construction of roads, urbanization, and gathering of fuel wood. In developing countries, economic and cultural factors provide strong incentives for greater logging and clearing of forests. First, increased population has engendered greater harvesting of fuel wood in the tropical dry forests of Africa and Asia. Second, access to forest frontiers has increased as a result of mining, oil drilling, and infrastructure expansion. Third, some developed countries are providing subsidies for logging and alternative land use.

More effective "sustainable forestry" practices, as is practiced in the U.S., would help ensure the continued existence of forests as CO₂ sinks. For example, Costa Rica has adopted a model policy that could counteract the incentives for deforestation. A conservation fund has been established that is projected to reduce CO₂ emissions from deforestation by 2 million tons CO₂ annually over the next 40 years. Although this is a small fraction of global deforestation, it is significant when compared to the roughly 3.5 million tons currently emitted annually in Costa Rica as a result of deforestation activities.

Enhancing carbon sinks in the ecosystem does not necessarily mean that all forest conversion must be halted. There is some scientific research that shows that forests converted to grasslands actually take up more CO₂ than the forests did. In such cases the conversion needs to be undertaken in an environmentally responsible manner, such as through harvest and utilization rather than burning.

The environmental community has proposed that the Costa Rica conservation endowment concept be expanded to other countries. Instituting such a policy in developing countries would protect existing forests and, in those cases where forests must be utilized, would provide a disincentive for clearing forests by burning. The goal of such a policy would be to compensate land users

who convert to more ecologically sound practices for the additional income they would have otherwise received as a result of less desirable practices. To meet such a goal, the environmental community has proposed placing \$200 per hectare of forest land in a financial institution. Interest drawn on the fund would be utilized to promote sustainable forestry practices. The World Wildlife Fund estimates that implementing this policy in developing countries would reduce emissions of all greenhouse gases by 7 billion tons of CO₂ equivalent annually at a cost of \$0.40 per ton of CO₂ reduced. More effective "sustainable forestry" practices would provide for the continued existence of forests as CO₂ sinks.

Recommendations:

- The U.S. should carefully examine opportunities to enhance carbon sinks in the developing countries through actions to promote improved forest management practices.
- Further research should be supported by the U.S. on methods to improve the utilization of forest products and ensure that all carbonaceous material in a forest can be captured, either as timber or in pelletized fuel.

12. **Technology cooperation activities should be strengthened and expanded.**

The U.S. National Action Plan includes technology cooperation as an important element. The Plan states a clear policy on the role of government in technology cooperation.

"Governments in free-market democracies are not usually in the business of developing or owning technology. Consequently, they are not in a position to give technologies away. However, governments can, and the United States does, facilitate technology transfer through programs and activities designed to stimulate and support transfers. Governments can promote partnerships and more sustainable patterns of economic growth. Clear and reliable policies governing investment and joint ventures, as well as sound policies related to the protection of intellectual property rights, encourage cooperation across national borders. The most effective and extensive transfer of technology occurs in countries where the business and investment environment encourages these activities."

The Plan describes a broad array of actions designed to foster technology cooperation, including capacity building through technical assistance and training. However, the vast majority of these actions are government actions, or partnerships between government agencies and the private

sector. Industry believes that these efforts can be significantly strengthened and expanded through greater recognition of and reliance on private sector led technology cooperation programs.

The private sector's participation in environmental technology transfer is of critical importance. As noted in the National Action Plan, technology transfer is principally a private sector to private sector, rather than a government to government activity. The worldwide movement away from centrally planned economies toward private markets further underscores this fact.

U.S. industry has proposed the Technology Cooperation Corps as a mechanism to promote U.S. industry-led technology cooperation efforts. This effort would be greatly assisted by better access to information on opportunities for technology transfer, business and government technology assistance programs and by a coordinated U.S. effort to provide appropriate financing facilities for the transfer of such technology. Programs partially or fully supported by the U.S. at the Agency for International Development, the Export-Import Bank, the World Bank, and regional development banks should be reassessed to facilitate transfer of U.S. technology and improve the competitive position of the U.S. in this arena. The Environmental Protection Agency, Department of Commerce, and Department of Energy all have important resources and programs which could provide needed information to industry. The DOE program of Assisting Deployment of Energy Practices and Technologies (ADEPT) is a good example of technology cooperation. ADEPT will assist developing countries and countries with economies in transition in their choice and application of new energy technologies. These programs should be better coordinated among the agencies, and private sector interaction should be increased.

Inadequate protection of intellectual property rights creates substantial barriers to technology transfer. Without guaranteed protection for patents, trademarks and copyrights, U.S. companies have a strong disincentive to pursue the costly work of technological and industrial innovation and to transfer that technology overseas. To facilitate technology transfer, the U.S. must continue to demand that foreign governments and firms protect U.S. technology and property rights.

A final barrier to technology transfer is the uncertainty related to the antitrust implications of private firm collaboration. Private firms frequently are reluctant to establish joint research and technology development programs with other firms. Yet, because of the prohibitive costs and highly speculative nature of technology development programs, private companies are hesitant to sustain the costs alone. Thus, rapid development and diffusion of technology may suffer. If the uncertainties related to antitrust enforcement were reduced, private companies could form joint ventures, merge their resources, and development and introduce new products more quickly.

The provisions of the Convention encourage information exchange and the transfer of technology from the developed countries to those countries that are now developing their economies and

their resources. If properly prepared, the National Action Plans that will be developed by those countries ratifying the Convention can provide a wealth of information about the capabilities of countries to supply technology and the needs of the countries that wish to receive technology. The Global Climate Coalition has recommended that each plan contain a "Technology Assessment" component. This would draw together information needed to facilitate cooperative efforts among the suppliers and the receivers of technology in the most expeditious manner possible. A suggested outline for country technology assessments is attached at Appendix C.

Finally, it is important that technology cooperation be interpreted in the broadest sense, including not only "hard" technology but also "soft" technology -- techniques, practices and "know how". It is in this area that the role of the private sector is the most crucial, because the private sector is the source of operational experience. Furthermore, it may be that the transfer of "soft" technology provides the best opportunity for early technology collaboration. For example, through the Technology Cooperation Corps, private industry experts could provide assistance on issues such as reducing methane leakage in natural gas systems, or improving the operating efficiency of fossil fuel power plants. Actions in these areas could have a significant impact on greenhouse gas emissions, at relatively low cost, without encountering significant impediments with intellectual property rights, financing or other issues associated with "hard" technology transfer.

Recommendations:

- The U.S. should act quickly to establish an interagency policy coordinating mechanism that could provide a single point of contact in support of industry technology cooperation efforts, such as the Technology Cooperation Corps.
- The U.S. should seek to ensure that all country National Plans include a specific technology assessment addressing technology needs and indigenous technology resources.
- The Federal Government should strengthen specific policies and programs to assist U.S. technology transfer activities, including:
 - providing better access to information on environmental technology needs and market opportunities to U.S. business through the embassy and consulate staff, as well as through the Commerce Department's International Trade Administration;
 - coordinating U.S. efforts to provide appropriate financing facilities for the transfer of technology, including the Agency for International Development, the Export-Import Bank, the World Bank and regional development banks;

- identifying and eliminating impediments to technology transfer, such as lack of protection of intellectual property rights. The U.S. must demand that foreign governments and firms protect U.S. technology and property rights;
- promoting U.S. businesses as sources of environmental technology to meet the needs to developing countries and their industries;
- reducing the uncertainty related to the antitrust implications of private firm collaboration, particularly for joint research and technology programs. By reducing the uncertainties related to antitrust enforcement, private companies could form joint ventures, merge their resources, and develop and introduce new products more quickly; and
- supporting research, development, demonstration and commercialization programs, and facilitating the entry and acceptance of new technologies where appropriate through licensing and cooperative agreements.

- The U.S. Government also should work with international financing and economic development agencies to disseminate information on U.S. environmental technology capabilities and assist U.S. technology suppliers to meet the environmental needs identified by other countries.

PROVISIONS OF THE ENERGY POLICY ACT OF 1992 AFFECTING GREENHOUSE GAS EMISSIONS

TITLE I -- ENERGY EFFICIENCY

Subtitle A -- Buildings

Building Codes: State minimum commercial building energy codes, tied to Federal mortgage assistance (FHA, FmHA, VA).

Energy Ratings: Voluntary Home Energy Rating Guidelines.

Efficiency Centers: Energy Efficiency Lighting and Building Centers.

Manufactured Housing: New energy efficiency standards for manufactured housing.

Residential Efficiency Improvements: Pilot programs for financing of energy efficiency improvements in existing homes.

Subtitle B -- Utilities

Integrated Resource Planning: Programs to promote Integrated Resource Planning, including grants to State regulatory authorities and requirements for Federal power agencies.

Utility Efficiency Investments: Actions to promote comparable economic returns for investments in efficiency and new supply options.

Subtitle C -- Standards

Energy Efficiency Standards: Standards established for commercial heating and air-conditioning equipment; large electric motors; and common types of fluorescent and incandescent reflector lamps.

Authorized Standards: DOE authorized to establish energy efficiency standards which are technologically feasible and economically justified for: small electric motors; utility distribution transformers; and high-intensity discharge lamps.

Windows: Energy efficiency labeling programs for windows and window systems.

Water and Energy Conservation Standards: Maximum flow rates established for showerheads, faucets, water closets and other plumbing products.

Office Equipment: Voluntary national testing and information program for commercial office equipment and luminaries.

Advanced Appliance Development: Study of the potential for the development of appliances which are substantially more efficient than standards.

Appliance Early Replacement Programs: Study of the feasibility of early replacement of less energy efficient appliances.

Subtitle D -- Industrial

Industrial Energy Efficiency Programs: Industrial energy efficiency grant program to encourage industrial associations to establish or strengthen their energy efficiency programs.

Industrial Targets and Data Reporting: Study of federally mandated energy efficiency reporting and voluntary energy efficiency targets.

Industrial Efficiency Improvements: Grants to States to encourage States and utilities to cooperate with local industries to assess industrial energy efficiency opportunities, and to finance cost-effective energy efficiency improvements.

Energy Efficiency Audits: Voluntary guidelines for the conduct of industrial energy audits.

Subtitle E -- State and Local Assistance

Weatherization: Updates and expands the Energy Conservation and Low-Income Weatherization Programs.

Subtitle F -- Federal Energy Management

Efficiency Improvement Requirements: 20 percent reduction in energy consumption per gross square foot in federal buildings by the year 2000.

Energy Efficiency Projects: Installation of all energy and water conservation measures in federal buildings with payback periods of less than 10 years by the year 2005.

Federal Energy Efficiency Fund: Federal fund to support federal agency energy efficiency projects.

New Technology Demonstrations: Demonstrations of energy efficiency measures that would accelerate commercial viability.

Energy Performance Contracts: Requires new regulations for the use of energy performance contracts with which the Federal Government can tap private-sector funding for Federal Government energy efficiency improvements.

Expanded Coverage: Expands coverage of the Federal energy management requirements to the U.S. Postal Service and the Congress.

Subtitle G -- Miscellaneous

District Heating and Cooling: Study and assessment of the benefits of district heating and cooling, including the removal of institutional constraints.

TITLE III -- ALTERNATIVE FUELS - GENERAL

Federal Fleets: Establishes purchase requirements of 5,000 vehicles in 1993, increasing to 75% of fleet acquisitions in 1999, and thereafter.

TITLE IV -- ALTERNATIVE FUELS - NONFEDERAL PROGRAMS

Alternative Fuel Bus Program: Cooperative arguments and joint ventures to demonstrate the feasibility of alternative fuel buses.

State and Local Incentives: Guidelines for State and local alternative fuel vehicle programs.

Nonroad Vehicles and Engines: Study of the potential for nonroad vehicles and engines to use alternative fuels.

Low Interest Loans: Program of low interest loans for purchases and conversion of alternative fuel vehicles.

**TITLE V-- AVAILABILITY AND USE OF REPLACEMENT FUELS,
ALTERNATIVE FUELS AND ALTERNATIVE FUELED PRIVATE VEHICLES**

Alternative Fuel Provider Fleet Program: Fuel providers required to purchase alternative fuel vehicles, increasing from 30 percent for model year 1996 to 90 percent for model year 1999 and thereafter.

Replacement Fuel Goals: DOE is to determine the feasibility of producing sufficient replacement fuels to replace 10% of projected motor fuel consumption by 2000 and 30% by

2010. The Secretary has authority to modify these goals and is to obtain voluntary supply commitments to achieve the goals.

Private Fleets: Establish an alternative fuel vehicle program for private fleets, subject to regulations issued by DOE.

State Fleets: Provides for a State fleet program in large cities, starting with 10 percent of acquisitions in 1995, increasing to 75 percent in 2000, and thereafter.

TITLE VI -- ELECTRIC MOTOR VEHICLES

Subtitle A - Electric Motor Vehicle Commercial Demonstration Program

Technology Demonstration Program: Program of financial assistance to accelerate the development and use of electric motor vehicles.

Subtitle B - Electric Motor Vehicle Infrastructure and Support Systems Development Program.

Infrastructure Development Program: Program of financial assistance for infrastructure and support systems.

TITLE VII -- PUHCA AND ELECTRIC TRANSMISSION

Creation of EWGs: Allows for the creation of exempt wholesale generators (EWGs), engaged exclusively in the business of wholesale electric generation, that are exempt from corporate organizational restrictions under the Public Utility Holding Company Act of 1935 (PUHCA).

Wholesale Transmission Orders: Allows The Federal Energy Regulatory Commission (FERC), upon application, to order the provision of wholesale transmission service by utilities, subject to certain protections.

TITLE VIII -- HIGH LEVEL NUCLEAR WASTE DISPOSAL

National Academy of Sciences Study: Requires EPA to contract with the National Academy of Sciences to make recommendations with respect to new health-based standards. In addition, the National Academy is asked to examine the issue of post-closure oversight of the repository.

New EPA Standards: Requires EPA to set new health-based standards based upon the National Academy of Science's recommendations.

Revised NRC Licensing Requirements: Requires NRC to modify its licensing requirements to reflect the new EPA standards.

TITLE XII -- RENEWABLE ENERGY

Demonstration and Commercial Application Projects: Provides DOE with greater flexibility in granting Federal financing for the demonstration and commercial application of renewable energy and energy efficiency technologies.

Renewable Energy Production Incentive: Provides a 1.5 cents per Kwh production incentive payment to public power facilities that produce electricity from renewable energy resources.

Renewable Energy Technology Transfer Program: Establishes a project oriented program for facilitating the transfer of U.S. renewable energy technologies to developing countries.

Renewable Energy Advancement Awards: Establishes an awards program to recognize outstanding achievement in the development and utilization of renewable energy resources and technologies.

Study of Export Promotion Practices: A study of subsidies, incentives, and policies that other countries use to promote exports of their own renewable energy and energy efficiency services and technologies.

Study of Tax and Rate Treatment of Renewable Energy Projects: A study to determine whether conventional taxation and rate making procedures result in an economic bias against renewable energy power generation compared to conventional power generation facilities.

Study of Rice Milling Energy By-Product Marketing: Requires a study to facilitate the marketing of energy by-products from rice milling.

Interagency Working Group: Establishes an interagency subgroup on exports of energy efficiency and one on exports of renewable energy. Provides funding for expanded training of foreign nationals in energy efficiency and renewable energy technologies and the establishment of a comprehensive data base and information dissemination system.

Outreach Program: Directs the Secretary of Commerce, funding permitting, to assign officers or employees of the United States Foreign and Commercial Service, who have experience in renewable energy and energy efficiency technologies, to serve in agency offices in the Pacific Rim and the Caribbean Basin.

TITLE XIII -- COAL RESEARCH, DEVELOPMENT, DEMONSTRATION AND COMMERCIAL APPLICATION

Subtitle A - Research, Development, Demonstration, and Commercial Application

Coal Research, Development, Demonstration and Commercial Application: Establishes a comprehensive, cost shared program, whose objectives include greater efficiency in coal conversion and improved control of emissions from the utilization of coal.

Coalbed Methane Recovery: Requires a study of the institutional barriers to coalbed methane recovery and establishes a demonstration and commercial application program.

Subtitle B -- Clean Coal Technology Program

Additional Clean Coal Technology Solicitations: Authorization for additional clean coal technology solicitations, emphasizing technologies that achieve greater efficiency.

Subtitle C -- Other Coal Provisions

Clean Coal Technology Export Promotion and Interagency Coordination: Establishes an interagency subgroup to expand the export of clean coal technologies, particularly in applications with increased efficiency and reduced emissions.

Innovative Clean Coal Technology Transfer Program: Authorizes financial assistance for international projects utilizing U.S. clean coal technologies in order to: promote exports; expand U.S. manufacturing; and accelerate deployment internationally of technologies that are more energy efficient and environmentally acceptable.

Coalbed Methane Recovery: Establishes procedures for the resolution of disputes regarding ownership of coalbed methane in cases where the U.S. owns the surface estate or the subsurface mineral estate.

TITLE XVI -- GLOBAL CLIMATE CHANGE

Report on Stabilization of Emissions: Assessment of the feasibility and impacts of stabilizing and reducing the emissions of greenhouse gases in the U.S.

Least Cost Energy Strategy: Inclusion of least cost energy strategy in the National Energy Policy Plan.

DOE Director of Climate Protection: Establishes a lead official within DOE to monitor and coordinate the Department's activities on global climate change.

Assessment of Alternative Policy Mechanisms for addressing Greenhouse Gas Emissions:

Comparative assessment of alternative policy mechanisms for reducing the generation of greenhouse gases.

National Inventory and Voluntary Reporting of Greenhouse Gases: Development of an inventory of national aggregate emissions and provision for voluntary collection and reporting of information on greenhouse gas reductions.

Innovative Environmental Technology Transfer Program: Establishes a cooperative program to transfer and deploy innovative environmental technologies.

Global Climate Change Response Fund: Establishes a fund to serve as the mechanism for U.S. contributions to assist global efforts in mitigating and adapting to global climate change.

TITLE XIX -- REVENUE PROVISIONS

Subtitle A - Energy Conservation and Production Incentives

Treatment of Employer - Provided Transportation Benefits: *permits \$60 per month in tax-free employer provided transportation benefits.*

Energy Conservation Subsidies Provided by Public Utilities: *permits certain utility - provided subsidies to be excluded from taxable income.*

Clean Fuel Vehicles: *permits deductions for the costs of clean fuel vehicles and vehicle refueling property.*

Tax credit for electric vehicles: *permits a 10% tax credit for qualified electric vehicles.*

Renewable energy production tax credit: *provides a production tax credit of 1.5 per kilowatt-hour.*

Permanent Extension of Energy Investment Credit for Solar and Geothermal Property
Reduced Tax on Gasohol Mixtures

TITLE XX -- REDUCTION OF OIL VULNERABILITY

Subtitle B - Oil and Gas Demand Reduction and Substitution

General Transportation: 5 year program to reduce transportation oil demand through increased energy efficiency and the use of alternative fuels.

Advanced Automotive Fuel Economy: Accelerated development of advanced technologies to

improve automotive fuel economy.

Alternative Fuel Vehicle Program: Program to investigate techniques to improve natural gas and other alternative fuel technology.

Biofuels User Facility: User facility to expedite industry adoption of biofuels technology

Electric Motors Vehicles R&D: R&D program on electric motor vehicles and associated equipment.

Renewable Hydrogen Energy: R&D program on renewable hydrogen energy systems.

Telecommuting: Study of the potential costs and benefits of telecommuting.

TITLE XXI -- ENERGY AND ENVIRONMENT

Subtitle A - Improved Energy Efficiency

Improved Energy Efficiency: Program to utilize cost effective technologies to improve energy efficiency and increase renewable energy in the buildings, industrial and utility sectors.

Natural Gas and Electric Heating and Cooling Technologies: Program on energy efficient natural gas and electric heating and cooling technologies for residential and commercial buildings.

Pulp and Paper: Program on advanced pulp and paper technologies.

Advanced Buildings for 2005: Program to increase building energy efficiency.

Steel, Aluminum and Metal Research: Extended industrial energy efficiency R&D programs.

Improving Efficiency in Energy-Intensive Industries: R&D, demonstration and commercial application program to improve energy efficiency and productivity in energy intensive industries.

Energy Efficient Environmental Program: Program to improve energy efficiency and cost effectiveness of pollution prevention technologies and processes.

Subtitle B - Electricity Generation and Use

Renewable Energy: Program to promote cost-effective options for the generation of electricity from renewable energy sources.

High Efficiency Heat Engines: Program to improve the efficiency of heat engines

Fuel Cells: Program on efficient and environmentally benign power generation using fuel cells.

High Temperature Superconductivity Program: Program on high temperature superconducting electric power equipment technology.

Subtitle C - Advanced Nuclear Reactors

Commercialization of Advanced Light Water Reactor Technology: Development and submission for certification of advanced light water reactor designs.

Prototype Demonstration of Advanced Nuclear Reactor Technology: Prototype design of advanced nuclear reactor technologies.

XXII -- ENERGY AND ECONOMIC GROWTH

National Advanced Materials Initiative: Program for commercialization of techniques for processing, synthesizing, fabricating and manufacturing advanced materials.

National Advanced Manufacturing Technologies Initiative: Program for commercialization of advanced manufacturing technologies to improve energy efficiency and productivity.

TITLE XXIV -- NON-FEDERAL POWER ACT HYDROPOWER PROVISIONS

Rights of Way on Certain Federal Land: Clarification of rights of way for hydropower facilities.

Improvement at Existing Federal Facilities: Studies of cost effective opportunities to increase hydropower production at existing federal water projects.

Water Conservation and Energy Production: Studies of opportunities to increase hydropower generation resulting from increased water conservation.

TITLE XXV -- COAL, OIL AND GAS

Hot Dry Rock Geothermal Energy: Cooperative government - private sector program with respect to hot dry rock geothermal energy resources on federal lands.

TITLE XXVIII -- NUCLEAR PLANT LICENSING

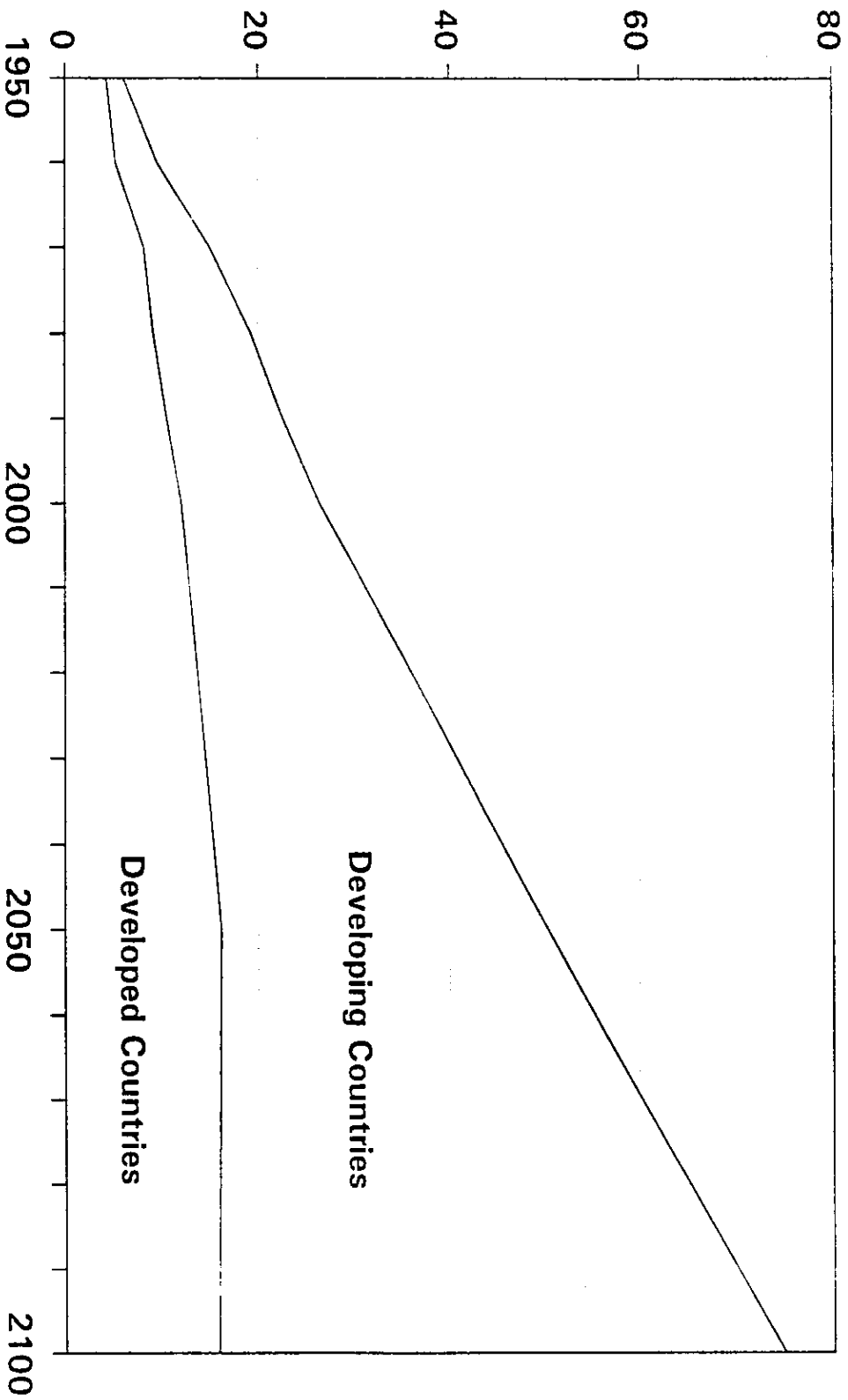
Combined Licenses: Affirms and amends the new Nuclear Regulatory Commission rule, known as "Part 52," governing the issuance of combined construction and operating licenses. In general, the new rule requires that safety issues be resolved earlier in the licensing process than under the old "two-step" process.

TITLE XXX -- MISCELLANEOUS

Subtitle B - Other Miscellaneous Provisions

Geothermal Heat Pumps: Encourage State and local governments to permit use of public water supplies for geothermal heat pumps.

Baseline Projections of CO₂ Emissions (in billion tons of CO₂)



Source: IPCC and DOE

Suggested Outline for Country Technology Assessments

I. Country Technology Assessment

- A. Conditions within the country that would be conducive to improvement by technology, in both the public and private sectors
- B. Specific technological requirements or technologies available for direct reduction of emissions, improvements in energy efficiency, enhancement of sinks, or for other adaptation or mitigation requirements
- C. System support requirements and support available for education and training systems, management systems, maintenance and repair systems and financing requirements
- D. Changes in existing technologies which may be required to meet country needs
- E. Barriers to technology transfer, and remedial actions required to remove barriers
- F. Sources of technology and systems, including indigenous capability, technology import requirements and research capability to assess and adapt existing technologies to unique country requirements

II. Country Technology Acquisition and Utilization Plan

- A. Priority programs for technology applications, in both the public and private sectors
- B. Acquisition or export programs, including purchases, joint ventures and foreign aid requirements
- C. Description of the support programs of the receiving/supplying country
- D. Maintenance and monitoring programs planned