CLIMATE CHANGE 101
International Action

Climate change is a global challenge and requires a global solution. Greenhouse gas emissions have the same impact on the atmosphere whether they originate in Washington, London or Beijing. To avoid dangerous climate change, emissions ultimately must be reduced worldwide. An effective global strategy requires leadership by the United States, and commitments and action by all the world's major economies.

GLOBAL EMISSIONS

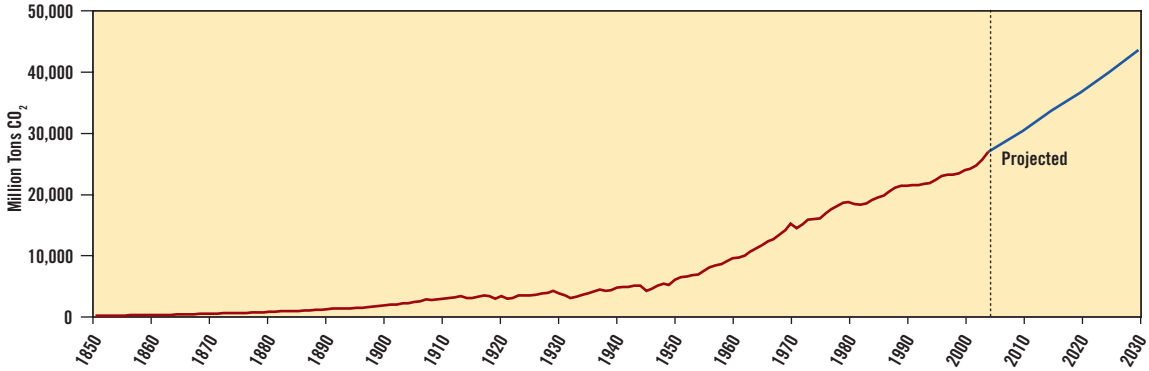
Greenhouse gas (GHG) emissions, largely carbon dioxide (CO_2) from the combustion of fossil fuels, have risen dramatically since the start of the industrial revolution. Globally, energy-related CO_2 emissions have risen 130-fold since 1850—from 200 million tons to 27 billion tons a year—and are projected to rise another 60 percent by 2030 (see Figure 1).[1]

Most of the world's emissions come from a relatively small number of countries. The seven largest emitters—the United States, the European Union (EU),[2] China, Russia, Japan, India and Canada—accounted for more than 70 percent of energy-related CO_2 emissions in 2004. The United States, with 5 percent of the world's population, is responsible for 20 percent of energy-related global emissions[3] and 30 percent of cumulative emissions since 1850. (Cumulative emissions are an important measure because of the long-lasting nature of greenhouse gases in the atmosphere.)

Among members of the Organization for Economic Cooperation and Development (OECD), the United States, the EU, and Japan are the three largest emitters (see Figure 2). In absolute terms, the United States is by far the largest. On an intensity basis (emissions per gross domestic product or GDP), U.S. emissions are significantly higher than the EU's and Japan's (see Figure 3). On a per capita basis, U.S. emis-

Figure 1

Global Carbon Dioxide Emissions: 1850–2030



PEW CENTER ON Global CLIMATE CHANGE

PEW CENTER ON THE STATES

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Figure 2

CO_2 Emissions of Major Economies

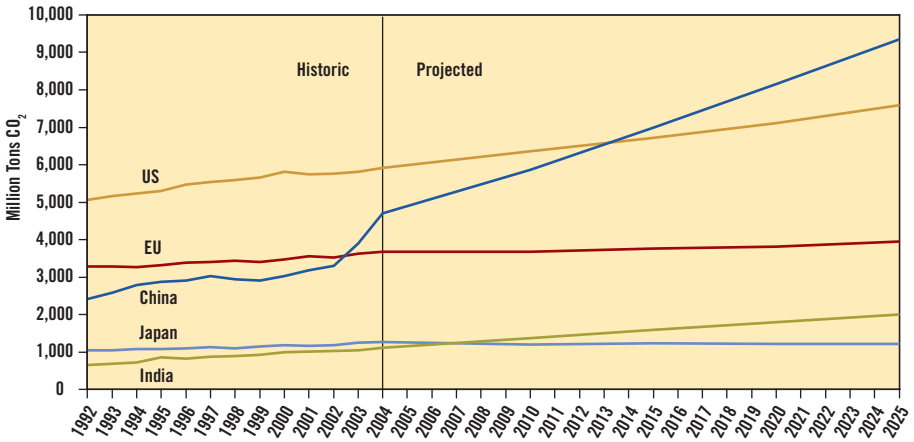


Figure 3

Carbon Intensity: 2002

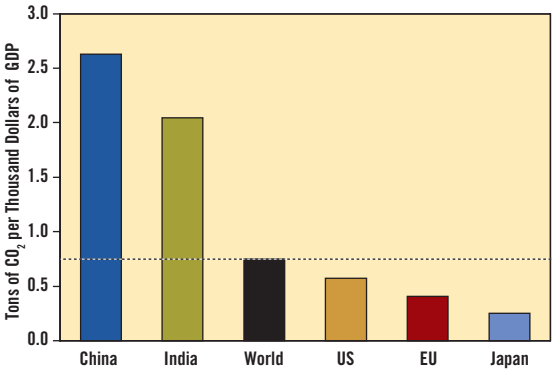
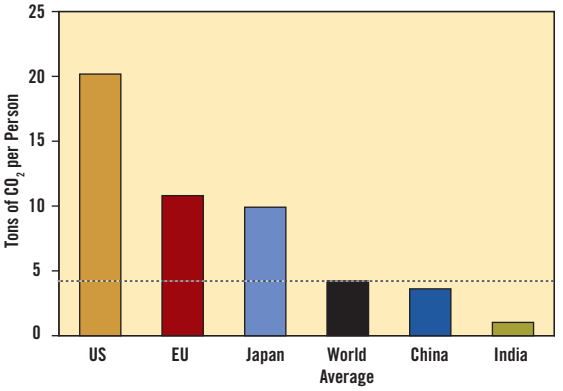


Figure 4

Per Capita CO_2 Emissions: 2004



sions are roughly twice as high as those of the EU and Japan and five times the world average (see Figure 4).

Looking ahead, U.S. emissions are projected to rise 8 percent above 2004 levels by 2010 (and 28 percent by 2025). By comparison, emissions are projected to hold steady in the EU, and decline 5 percent in Japan, by 2010.[4]

Emissions are rising fastest in developing countries. China's emissions are projected to nearly double, and India's increase an estimated 80 percent, by 2025. Annual emissions from all developing countries are projected to surpass those of developed countries between 2013 and 2018. However, the cumulative emissions of developing countries will not reach those of developed countries until several decades later.

At the same time that overall emissions from developing countries are rising, their per capita emissions will remain much lower than those of developed countries. While China's per capita emissions are expected to more than double by 2025, to slightly above the world average, they will still be just one-quarter those of the United States. Over the same period, India's per capita emissions are expected to rise slightly, to about half the world average, and one-fourteenth those of the United States.

THE INTERNATIONAL CLIMATE EFFORT

Governments launched the international climate change effort at the "Earth Summit" in 1992 with the signing of the United Nations Framework Convention on Climate Change. Signed by President George H.W. Bush and ratified by the U.S. Senate, the Convention now has 189 parties.

The Convention set as its ultimate objective stabilizing atmospheric GHG concentrations "at a level that would prevent dangerous anthropogenic [human] interference with the climate system." Recognizing the wide range in countries' historic contributions to climate change, and in their capacities to address it, governments agreed they had "common but differentiated responsibilities." In keeping with that principle, developed countries agreed to "take the lead" and to assist developing countries in combating climate change. Developed countries also agreed to a non-binding "aim" of reducing their emissions to 1990 levels by 2000.

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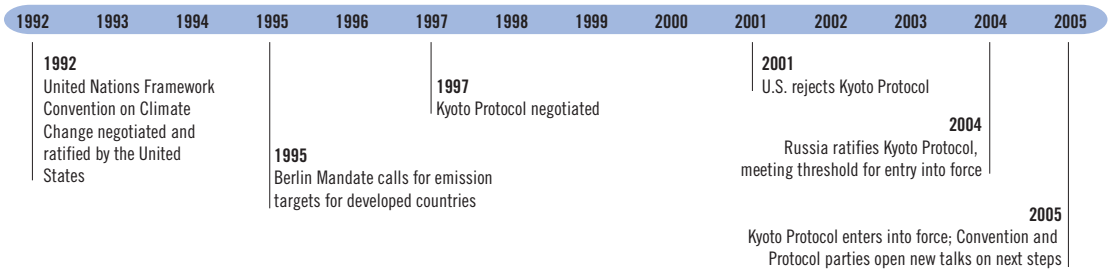
In 1995, recognizing that this voluntary target was insufficient and in most cases would not be met, governments adopted the Berlin Mandate, calling for the negotiation of binding targets for developed countries. These negotiations led in 1997 to the Kyoto Protocol. Under the Protocol, developed countries agreed to an average emission reduction of 5.2 percent below 1990 levels by 2008–2012 (the first commitment period). Individual targets range from –8 percent for EU countries to +10 percent for Iceland; the target the United States negotiated for itself was –7 percent.

Key provisions of the Protocol, urged largely by U.S. negotiators, provide countries with flexibility to meet their targets cost-effectively. These include three market-based mechanisms: international emissions trading (trading of emission allowances[5] among countries with targets); and Joint Implementation and the Clean Development Mechanism (JI and CDM, which credit emission reductions from projects in developed and developing countries, respectively). Other flexibility provisions include: setting emission targets as five-year averages, rather than single-year limits; counting a "basket" of six greenhouse gases, not just carbon dioxide; and providing credit for carbon sequestration (i.e., storage) in forests and farmland.

Following the United States' renunciation of Kyoto in early 2001, other governments completed negotiations on the Protocol's detailed implementation rules and proceeded to ratify it. Russia's ratification in 2004 provided the necessary quorum (at least 55 countries representing 55 percent of 1990 developed country emissions), triggering the Protocol's entry into force in February 2005. Kyoto has now been ratified by 166 countries. The 36 industrialized countries with binding targets (Australia is the only other major industrialized country not to ratify) account for 66 percent of developed country emissions and roughly a third of global emissions.

Timeline: International Action on Climate Change



Climate Action Around the World

Many countries have policies and programs that help reduce or avoid GHG emissions. Some are undertaken specifically to address climate change; others are driven principally by economic, energy, or development objectives, but at the same time contribute to climate efforts.

In the United States, state and local governments are taking the lead. California has enacted GHG standards for cars and light trucks and a mandatory target to reduce statewide emissions from all sources to 1990 levels by 2020 (a 25-percent reduction compared to "business as usual" projections). Eight northeastern states have established the Regional Greenhouse Gas Initiative, a cap-and-trade program to reduce emissions from power plants. Twenty-two states and the District of Columbia require that a significant percentage of their electric power come from renewable sources. At the federal level, the United States has a number of voluntary programs and bills have been proposed in Congress to establish mandatory economy-wide GHG limits. (For more information on U.S. action, see three other reports in the Climate Change 101 series: *Local Action, State Action,* and *Business Solutions*.)

Here is a sampling of policies and programs in other major GHG-emitting countries:

European Union

- *Kyoto Target*—Reduce EU emissions 8 percent below 1990 level by 2008–2012.
- *Emissions Trading Scheme*—Mandatory CO_2 emission limits for 12,000 installations in six major industrial sectors, with emissions trading. Links to the Kyoto Protocol's emission crediting mechanisms.
- *Community Tax Framework*—Minimum tax rates for energy and electricity depending on fuel type, with exemptions for electricity from renewables, biomass, and combined heat and power.
- *Renewable Electricity Directive*—Goal of increasing the share of renewables in the electricity supply to 21 percent in 2010 (from 14 percent in 1997).
- *Agreement with Automakers*—Goal of reducing the CO_2 emissions of new cars by 25 percent from 1995 levels by 2008–2009.

United Kingdom

- *Emission Targets*—National target of reducing CO_2 emissions 20 percent below 1990 level by 2010 (more than required under Kyoto or the EU's internal target-setting), with a long-term goal of 60-percent reduction by 2050.
- *Climate Change Levy*—Tax on fossil fuel-based electricity for industry and other large users, with most revenues used for energy efficiency research.
- *Renewables Obligation Order*—Target of 10 percent of electricity from renewable sources by 2010.

Japan

- *Kyoto Target*—Reduce emissions 6 percent below 1990 level by 2008-2012.
- *Industry Agreements*—Agreements with Nippon Keidanren, Japan's leading industry association, to reduce industrial GHG emissions to 1990 levels by 2010; and with the Federation of Electric Power Companies, to reduce emissions intensity of the electricity sector about 20 percent below 1990 levels by 2010.
- *Energy Taxes*—Schedule of taxes based in part on carbon content of fuel (e.g., $0.45/liter for gasoline; $2/ton for coal, rising to $7/ton by 2007), with a portion of the revenues used for climate purposes.
- *Auto Fuel Economy*—Standards to increase fuel economy of new light-duty passenger and commercial vehicles by about 20 percent by 2010.

China

- *Fuel Economy Standards*—Require all new cars and light trucks to achieve 19 to 38 miles per gallon (mpg) by 2005 (depending on class) and 21 to 43 mpg by 2008. Projected to save 960 million barrels of oil and avoid 130 million tons of carbon emissions through 2030.
- *Energy Intensity Goals*—National goals of reducing energy intensity by 20 percent from 2006 to 2010, and a total of 50 percent from 2000 to 2020; follows a 68-percent reduction in energy intensity from 1980 to 2000.

Climate Action Around the World *(continued)*

- *Renewable Energy Initiatives*—National targets for renewables to provide 15 percent of primary energy (up from 7 percent today) and 20 percent of electricity by 2020, including specific targets for wind power, biomass and hydropower capacity.

India

- *Energy Reforms*—Privatization, decentralization and reduced subsidies in the electric power sector to promote competition among suppliers and improve energy efficiency.
- *Renewable Energy*—Goal of using renewable energy for 10 percent of new power generation by 2010.
- *Rural Electrification*—Goal of electrifying 18,000 rural villages by 2012 from non-conventional sources such as biomass, solar, wind, and small hydropower.
- *Vehicle Conversion*—Rules requiring conversion of taxis, buses and three-wheelers from gasoline and diesel to compressed natural gas in key cities.

EU Emissions Trading Scheme

The world's most far-reaching GHG reduction policy is the EU's Emissions Trading Scheme (ETS), which limits CO_2 emissions from 12,000 facilities across Europe. Launched in 2005, the ETS covers electricity and major industrial sectors (including oil, iron and steel, cement, and pulp and paper) that together produce nearly half of the EU's CO_2 emissions.

Most ETS rules are set for the EU region, but allocation of emission allowances is left to member states. An initial phase runs through 2007; a second will coincide with the Kyoto Protocol compliance period (2008–2012). Excess emissions incur a penalty (100 Euros/ton in phase II) and must be made up in the next phase.

Emission allowance prices have ranged from about 7 Euros to about 30 Euros. Market analysts attribute the price volatility to weather (affecting energy demand), shifts in relative energy prices, and updated information on emission levels; most regard it as characteristic of a new emissions market. EU policymakers have said the ETS will continue beyond 2012 with or without new international climate agreements.

How Does the U.S. Climate Effort Compare?

There are many ways to compare how different countries are responding to climate change. If government spending is the measure, the United States stands well above other countries. In its latest national climate change report to the United Nations, the United States reported spending $1.7 billion a year on climate change research alone, more than the EU and Japan combined, and roughly half of total expenditures globally.

Another measure of effort—and results—is national emission trends. For example, the economies of the EU (the 15 member states prior to 2004) and the United States are roughly comparable in size, and the EU's population is about one-third larger. However, the EU's emissions are one-third lower than those of the United States, and the gap is projected to grow larger.

The Bush Administration's goal—an 18-percent reduction in U.S. emissions *intensity* from 2002 to 2012—allows *actual* emissions to grow 12 percent. (Emissions intensity is the emissions level relative to GDP). Over that same period, EU emissions are projected to remain flat or decline. The European Environment Agency, a watchdog agency of the European Commission, projects that current and planned policies will reduce emissions within the EU's 15 pre-2004 member states to 4.6 percent below 1990 levels. The use of carbon sinks (storing carbon in soil and forests), and anticipated purchases of additional emission reductions outside the EU through the Kyoto Protocol's "flexibility mechanisms" (see page 3), are projected to produce a total reduction of 8 percent, as required under the EU's Kyoto target.[6]

Meeting in Montreal in late 2005, governments launched two processes to begin considering next steps under both the Framework Convention and the Kyoto Protocol. Kyoto parties opened a negotiation on post-2012 commitments for developed countries, to conclude in time to "ensure…no gap" between commitment periods. Convention parties opened a nonbinding "dialogue on long-term cooperative action" focused on sustainable development, climate adaptation, technologies, and market-based opportunities for reducing emissions. The dialogue will conclude in late 2007.

TECHNOLOGY INITIATIVES

The United States and other governments have launched a range of other initiatives to promote development and deployment of climate-friendly technologies, particularly in developing countries.

These include U.S.-initiated efforts such as the Methane-to-Markets Partnership, the Carbon Sequestration Leadership Forum, and the Asia-Pacific Partnership on Clean Development and Climate; and EU partnerships with China and India. Most governments view the efforts as complementary—not alternatives—to the UN Framework Convention and the Kyoto Protocol.

To be fair and effective, the international effort must engage all the world's major economies, which requires a flexible international framework allowing countries to take on different types of commitments.

These initiatives contribute to international climate efforts by identifying technology options and obstacles and developing pilot projects. However, as now designed, they are unlikely to produce the major policy shifts and investments needed for large-scale deployment of climate-friendly technologies. A recent World Bank analysis estimated the cost of reducing GHG emissions in developing countries at $10 billion to $200 billion a year. The largest potential source of funding, the Bank concluded, is a stronger international emissions market, which "will require a long-term, stable and predictable [policy] framework and accompanying regulatory system."[7]

COMPETITIVENESS

In considering the U.S. policy response to climate change, both at home and abroad, one concern is the potential impact on U.S. competitiveness.

Emission limits like those proposed in recent Senate legislation are projected to affect economic growth rates only marginally,[8] and thus pose little risk to the competitiveness of the U.S. economy as a whole. Any potential competitiveness risks would be felt most directly by energy-intensive industries whose goods are traded internationally, a relatively small segment of the U.S. economy.[9] Potential concerns include relocation of energy-intensive U.S. industry to countries with no or looser controls, loss of market share to competitors in those countries, or a shift in U.S. investment to those countries.

However, past experience with the adoption of new environmental standards shows little evidence of such impacts. One major review—synthesizing dozens of studies assessing the impacts of a range of U.S. regulations across a range of sectors—concluded that while environmental standards may impose significant costs on regulated industries, they do not appreciably affect patterns of trade.[10] Other studies indicate that when U.S. producers do relocate to developing countries, factors such as wages and access to raw materials and markets are far more decisive than environmental costs.[11]

Policy options are available to minimize or mitigate potential competitiveness impacts. For example, assuming the United States establishes a cap-and-trade system to regulate emissions economy-wide, "grandfathering" emission allowances to potentially vulnerable firms would help them by conferring assets whose sale can offset any losses.[12] Other policy options include: tax and other incentives for accelerated deployment of cleaner technologies; support for research and development of long-term technologies; and transition assistance for affected workers.

Some economists believe that stronger environmental standards in many cases confer a competitive *advantage* by driving firms to innovate and become more efficient.[13] By spawning markets for new technologies, new standards are as likely to create jobs as reduce them, according to some studies.[14] A recent analysis of proposed climate change policies in California found that by reducing energy use and energy spending, they would likely in-

crease employment and economic growth, and give the state a competitive advantage in climate-friendly technologies.[15]

THE INTERNATIONAL CLIMATE EFFORT POST-2012

As the United States develops its domestic response to climate change, parallel efforts are needed to broaden and strengthen the international climate effort beyond 2012, when the Kyoto targets expire.

To weigh post-2012 options, the Pew Center on Global Climate Change brought together senior policymakers and stakeholders from 15 countries in the Climate Dialogue at Pocantico.[16] A key message from the group is that to be fair and effective, the international effort must engage all the world's major economies, which requires a flexible international framework allowing countries to take on different types of commitments.

The Pocantico report envisions a range of actions and agreements under the umbrella of the UN Framework Convention on Climate Change. Possible "elements" include:

Targets and Trading. Emission targets—varying in time, form, and stringency—coupled with international emissions trading. In addition to binding absolute targets, possibilities include intensity, "no-lose,"[17] or conditional targets.

Sectoral Approaches. Commitments structured around key sectors such as power, transportation, or land use. These commitments could take a variety of forms, including: emission targets, performance- or technology-based standards, or "best practice" agreements.

Policy-based Approaches. Commitments to undertake national policies, such as energy policies, that reduce or avoid emissions while advancing economic or development objectives. These could be complemented by a mechanism granting developing countries tradable credits for the resulting emission reductions.

Technology Cooperation. Stronger coordination and support for research and development of long-term technologies, and for the deployment of clean technologies in developing countries.

Pursuing multiple approaches on an ad hoc basis, with different groups of countries engaging along different tracks, is unlikely to produce a strong overall effort. The Pocantico report favors a more integrated approach: linking efforts, and negotiating them as a package, would not only accommodate different strategies, but allow for the reciprocity needed to achieve stronger commitments and action.

NEXT STEPS

The future of the international climate effort hinges in large measure on the United States, which as the world's largest economy and GHG emitter, has both the capacity and the responsibility to lead. Other major emitters are unlikely to commit to stronger action without the United States.

In a bipartisan call for U.S. leadership, the U.S. Senate Foreign Relations Committee passed a resolution introduced by its chairman and ranking minority member, Senators Richard Lugar (R-Indiana) and Joseph Biden (D-Delaware). The May 2006 resolution calls, in part, for the United States to negotiate under the Framework Convention to "establish mitigation commitments" by all major GHG-emitting countries.

As the United States considers a domestic response to climate change, it must also assess its international role, and provide the leadership needed for an effective long-term global effort.

Pew Center on Global Climate Change

More information on climate change solutions is available at www.pewclimate.org.

ENDNOTES

1. All emissions data cited are for energy-related CO_2 only. Other gases, such as methane, nitrous oxide, and CO_2 from land use change, represent up to 40 percent of total GHG emissions. (On average, these other gases represent an estimated 20 percent of GHG emissions in developed countries, and 60 percent in developing countries, although there is considerable uncertainty about emission levels from land use change.) 1850–1990 data: International Energy Agency and Carbon Dioxide Information Analysis Center. 1990–2004 data: Energy Information Administration (EIA), *International Energy Annual*. Projections: EIA, *Annual Energy Outlook 2006* (2005 projections for European Union). GDP data: World Bank 2005. *World Development Indicators*.

2. Figures for the European Union represent emissions of the 15 EU members pre-2004 (Austria, Belgium, Denmark, France, Finland, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom) plus Iceland, Norway, and Switzerland. The EU is treated here as a "country" because, as a regional economic integration organization, the European Community has "Party" status under the U.N. Framework Convention on Climate Change.

3. Percentages are for energy-related CO_2 emissions only. When all GHGs are taken into account—including methane, nitrous oxide, and CO_2 from land use change—the U. S. is responsible for approximately 25% of global emissions.

4. Projections assume only policies in place as of 2005.

5. Allowances are legally established units entitling those holding them to emit a given level of GHGs.

6. European Environment Agency, "Greenhouse gas emission trends and projections in Europe 2006," October 2006 – http://reports.eea.europa.eu/eea_report_2006_9/en/eea_report_9_2006.pdf.

7. World Bank, *Clean Energy and Development: Towards an Investment Framework*, http://siteresources.worldbank.org/DEVCOMMINT/Documentation/20890696/DC2006-0002(E)-CleanEnergy.pdf

8. The Energy Information Administration projects that achieving the emission targets of the McCain-Lieberman Climate Stewardship Act would diminish U.S. GDP by 0.4 percent in 2028; total GDP would be 89.6 percent, rather than 90 percent, higher than GDP in 2006. (EIA, *Analysis of Senate Amendment 2028, the Climate Stewardship Act of 2003*. May 2004. Available: http://www.eia.doe.gov/oiaf/analysispaper/sacsa/pdf/s139amend_analysis.pdf).

9. Repetto et al. found in a 1997 analysis that, among all U.S. industries producing tradeable goods and services, roughly 90 percent of output and employment was in industries with energy costs representing 3 percent or less of output value. (Repetto, R., C. Maurer and G.C. Bird. "U.S. Competitiveness is Not at Risk in the Climate Negotiations." *WRI Issue Brief*, October 1997.)

10. The authors found "relatively little evidence to support the hypothesis that environmental regulations have had a large adverse effect on competitiveness...." Jaffe, A.B., S.R. Peterson, P.R. Portney, and R.N. Stavins. "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Literature*. Vol. XXXIII, March 1995.

11. Goodstein, Eban. 1994. *Jobs and the Environment: The Myth of a National Trade-Off*. Island Press. Jeppesen, Tim, John List and Henk Folmer, 2002. *Environmental Regulations and New Plant Locations Decisions: Evidence from a Meta-Analysis*, 42 J. Regional Science. 19, 36.

12. Under a "grandfathering" approach, emission allowances are granted free to emitters based on their historic emissions. There are a number of alternative approaches including allocation of allowances by environmental performance benchmarks or by auction.

13. Porter, M. "America's Green Strategy," *Scientific American*, 264, 4: 96, 1991; Porter, M. and C. van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives* 9, 4:97–118, 1995.

14. Morgenstern, Richard D. William A. Pizer, and Jhih-Shyang Shih. 1997. Are we Overstating the Economic Costs of Environmental Protection? Resources for the Future, Discussion Paper 97-36-REV June 1997.

15. Hanemann, Michael et al. 2006. "Managing Greenhouse Emissions in California." The California Climate Change Center at UC Berkeley. January. http://calclimate.berkeley.edu/managing_GHGs_in_CA.html. Downloaded January 25, 2006.

16. The report of, and background on, the Climate Dialogue at Pocantico are at http://www.pewclimate.org/pocantico.cfm.

17. Under a "no-lose" target, a country receives credit for any emission reductions beyond its target, and can sell such credits on the international emissions market, but faces no penalty if it fails to meet its target.

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