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An Overview of Issues Concerning International and National Approaches to Global Climate Change Management: A Look at Japan

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Climate Change: A Global Issue Requiring International Agreement and National Management

The United Nations has defined global climate change as a change of climate that alters the composition of the global atmosphere, and is attributed directly or indirectly to human activity. This observable change in the global climate pattern is in addition to natural climate variability observed over comparable periods of time. The pervasiveness and severity of global issues such as climate change must be dealt with internationally because they transcend territorial, political, and even personal, boundaries. The United Nations recognizes that all existence, past, present, and future, is interdependent to some degree and acknowledges that, "change in the Earth's climate and its adverse effects are a common concern of humankind" (United Nations 1992). Recognition of the interdependence necessary to encourage and maintain existence on earth is the major principle that underlies the concept of *sustainability*. The political ramifications inherent in the concept of sustainability is best explained by Donald Kennedy, Editor-in-Chief of *Science*, when he says, "it means adopting policies to ensure that the *n*th generation has access to the same resources, and is therefore as well off, as the current generation" (Kennedy 2001). This definition of sustainability has become the newly agreed upon framework for guiding the regulation of supranational environmental problems like global climate change.

The Kyoto Protocol, as part of the United Nations Framework Convention on Climate Change, strives to protect the global climate for "present and future generations of mankind" (United Nations 1992). This will be no easy task. According to Eileen Claussen of the Pew Center on Global Climate Change: "Meeting the challenge of global climate change calls for no less than a second industrial revolution. We need to promote new technologies and new investments that will put the entire world on a path to clean economic development. And, in creating the global legal framework to make this happen, we need to make absolutely certain that we get it right" (Claussen 2000). The Kyoto Protocol encourages clean economic development and the sustainable use of natural resources, but demands real changes in the way policy is crafted concerning the environment, industry, and human health.

The idea of sustainability has definite implications for the sovereignty of national governments. The propensity to design international policy guidelines around this currently accepted concept of *the global good* does not explain what we mean when we talk of human or environmental welfare and the kinds of resources needed to provide it. Further, it says nothing about whether we should use as our starting point to address international problems the "convenient present—'time zero'—or instead include some consideration of past rates of [climate] change" (Claussen 2000). Fundamentally, in a system of interdependent yet sovereign states, it is up to national governments to decide these issues. Even so, in the context of implementing an international agreement, these questions need to be answered by national regulations that are compatible with regulations in other countries and promote effective cooperation between them. The regimes that have ratified Kyoto already have different domestic climate change policies that are responsive to their unique social, environmental, political, and economic situations. The design of the Kyoto Protocol allows flexible implementation schemes that are responsive to national needs, but it requires much higher levels of international cooperation than already exist. The purpose of this paper is to assess some of the major issues raised by global climate change and the design of the Kyoto Protocol as well as to explain how Japan is responding to these issues with domestic policies and what the global community can learn from them.

The Science of Climate Change: A Very Brief Overview

It is true that climate change science is *uncertain*. Scientists around the world are working to identify global patterns of natural climate variability by analyzing the specific interactions between the ocean, the atmosphere, and the lithosphere—all of which influence global climate change. A major impediment to conclusive research is the lack of long-term data records for climate pattern comparison. Funding is needed to research and reconstruct historical global temperature patterns through the analysis of *proxy indicators* including: tree rings, corals, ice cores, lake and ocean sediments, boreholes, and glacier moraines (UC-Revelle 2002).

The climate change studies that *have* been funded have produced scientific and mathematical models that work to predict how climate change is influenced by both natural and anthropogenic causes. A major cause of climate change is due to human activity through the release of *greenhouse gases* (also referred to as GHGs) into the atmosphere (United Nations 1992, Annex A). GHGs absorb and re-emit infrared radiation in the atmosphere. The interactions between GHGs, aerosols, clouds, and other *sinks* (which are defined by the United Nations as any process, activity, or mechanism that removes a GHG, an aerosol, or the precursor of a GHG from the atmosphere) are also being analyzed in order to find out how much damage is *really* being done to the ozone by human activity. The problem with most climate change models is that they are prone to political manipulation by those who fund the research and select the variables included in modeling calculations. Due to these problems with climate change models, communication between scientists and policymakers is often impaired by what is seen as the unreliability of climate change information and the lack of clarity about its implications. Even so, scientific work is essential to the future of climate change monitoring and advances in environmental science.

Though research on the subject is not infallible, global climate change caused naturally, or by human activity, does in fact produce empirical effects on the global environment and its various inhabitants. The adverse effects of climate change alter the physical environment and biota and have significant deleterious effects on the composition, resilience, and productivity of natural and managed ecosystems. The adverse effects

of climate change are also capable of disrupting the operation of social, political, and economic systems, which directly impact human health and welfare. The possible negative long-term effects of global climate change on earth could include: sharp decreases in the availability of arable land; dramatic rises in sea levels; the extinction of species that are slow to adapt to changes in their native ecosystems; more frequent floods and droughts; increases in heat and vector-borne disease in currently unaffected areas; an increase in water shortages; and the mass migration of climate refugees. This is why, in respect to climate change, the United Nations operates on the *precautionary principle*, which states that the lack of full scientific certainty with regard to the causes and effects of global climate change should not be used as an excuse to postpone action when it poses a threat of serious or irreversible damage to the earth and societal infrastructures worldwide (United Nations 2002). Resources for the Future Fellow, Michael Toman, has warned: "The issue is not whether to respond [to the threat of global climate change] today, but how to respond effectively while retaining options for adjusting policies as new information about risks and response options becomes available" (Toman 2002). This pragmatic approach to global climate change management necessitates flexible response and mitigation policies that promote clean technological development, sustainable use of natural resources, and increased valuation and protection of the environment.

The United Nations Framework Convention on Climate Change

The international response to the global effects of changes to climate induced by human activity produced the United Nations Framework Convention on Climate Change in 1992. The overall goal of the UNFCCC is the

> stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (United Nations 1992).

The UNFCCC does not seek to avoid all human-induced climate change in the future, but rather to reduce it and slow the rate of change to insure

Box 1. Key Features of the United Nations Framework Convention on Climate Change

- The UNFCCC is the guide for international efforts to combat global warming and its effects by stabilizing GHG concentrations in order to "prevent dangerous anthropogenic interference with the climate system" and does the following:
  - Uses the "precautionary principle" in order to urge countries to take a pragmatic approach to GHG emissions reduction
  - Sets out the principle of "common but differentiated responsibilities" for developed and developing countries to deal with climate change through adaptation, mitigation, and research efforts
  - Obligates parties to submit "national communications" that contain: inventories of GHG emissions by source, estimates of GHG removals by "sinks," national emissions reductions strategies, plans for technology transfer, plans for sustainable management and conservation of the environment
  - Encourages parties to take climate change into account in their relevant social, economic, and environmental policies; cooperate in scientific, technical, and educational matters related to climate change; and promote education, public awareness, and the exchange of information related to climate change
  - Commits Annex I countries to adopting policies aimed at returning their GHG emissions to 1990 levels by the year 2000 with OECD countries taking

the adaptive capability and prolonged endurance of existing ecosystems and human societies. The UNFCCC recognizes the international state system

as a network of nationally sovereign units that are interdependent, which is why it calls for each state to deal with the supranational issue of climate change by

> [acknowledging] that the global nature of climate change calls for the widest possible co-operation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions (United Nations 1992, Preamble 6).

The UNFCCC also makes an effort to reassure participating countries that the currently accepted standards of international law, and the UN as an institution committed by its founding charter to promoting international dialogue and consensus, upholds the notion that states have

> the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction (United Nations 1945).

Like any international agreement crafted by the members of the UN, the goals are broad and it is the responsibility of the national governments involved to implement effective regulations to achieve those goals. Some policymakers believe that specific policies and measures should be coordinated internationally as *rules of the game* to ensure fairness. Others believe that flexibility is more practical and cost-effective for the nations involved in the agreement. A major problem is that no international agreement about *responsibility*, current or historic, for global climate change has been decided. This means that domestic policy must define the level of national responsibility and that the optimal policy mix to address climate change will necessarily differ for each country according to it's own definition.

It is only by constructing a balanced portfolio of policy options aimed at reducing GHG emissions, adapting society and the economy to

the consequences of climate change, and improving the scientific knowledge base, that national policymakers can reduce the risks of rapid climate change while promoting sustainability (United Nations 1997). To help provide guidelines for national climate policy the UNFCCC created the Conference of the Parties. This annual meeting of Convention participants streamlines the goals of the Convention and reviews the progress of each participant in attaining those goals. Table 1 provides a chronology of COP meetings and accomplishments.

Table 1. UNFCCC Conferences of the Parties: A Chronology (OECD 1999).

Event	**Dates**	**Main Development**
COP1, Berlin	28 March-7 April 1995	Berlin Mandate was established to negotiate stronger commitments for Annex I Countries
COP2, Geneva	8-19 July 1996	Geneva Declaration where a number of Annex I countries announce the intention to adopt legally binding mitigation commitments
COP3, Kyoto	1-10 December 1997	Kyoto Protocol was agreed
COP4, Buenos Aires	2-13 November 1998	Buenos Aires Action Plan was adopted, laying timetables for the completion of necessary technical work and decisions to fill in the details of the Kyoto Protocol
COP5, Bonn	22 October-5 November 1999	The Bonn Agreement created
COP6, the Hague	Late 2000	Deadline established in the Buenos Aires Action Plan for the completion of much of the necessary technical work to implement the Protocol (*e.g.*, agreement on modalities and rules for the Kyoto mechanisms)
COP7, Marrakech	9 November 2001	Rules for implementing Kyoto (*e.g.*, operating rules and eligibility guidelines for flexibility mechanisms, consequences for failing to meet targets, procedures for emission unit fungibility, sink credits, consideration of further developing country efforts)
COP 8, New Delhi	23 October-1November 2002	Guidelines for the technical review of GHG inventories
COP 9, Milan	1-12 December 2003	Arrangements for the first session of the COP serving as the meeting of the parties to Kyoto

The Kyoto Protocol

The Kyoto Protocol to the UNFCCC acts to strengthen the international response to climate change. Adopted in 1997, Kyoto contains new emissions targets for Annex I countries (*i.e.*, "developed" countries as defined by the UN) set to arrest and reverse the upward trend in GHG emissions that started with the *industrial revolution* that these countries experienced approximately 150 years ago. Specifically, Kyoto requires developed countries to commit themselves to reducing their collective emissions of six key GHGs (see Box 2) by at least 5%. This group target is to be achieved through emission cuts of 8% by Switzerland, most Central and East European states, and the EU (which will meet its target by distributing different rates of emission reductions to each member state); 7% by the US; and 6% by Canada, Hungary, Japan, and Poland. Russia, New Zealand, and Ukraine are to stabilize their emissions, while Norway may increase emissions by up to 1%, Australia by up to 8%, and Iceland by up to 10%. The six gases are to be combined in a *basket*, with reductions in individual gases translated into *carbon dioxide equivalents* that are then added together to produce a single figure (United Nations 1997).

Box 2. Key Features of the Kyoto Protocol

- The Kyoto Protocol strengthens the commitments of industrialized countries to reduce GHG emissions by establishing legally binding targets in the time frame 2008-2012 for a *basket* of six GHGs (CO2, CH4, N2O, PFCs, HFCs, and SF6)
- Aims to achieve at least a 5% reduction in Annex I country emissions compared to 1990 for the period 2008-2012
- Establishes legally-binding, differentiated and quantitative emission targets for Annex I countries
- Allows for the use of market mechanisms to help countries achieve cost-effective reductions including: *bubbling*, *international emission trading, joint implementation,* and *clean development mechanisms*
- Allows for banking of reductions from one commitment period to another
- Requires regular national reporting and national systems for the preparation of inventories, places added emphasis on review as a means to follow and identify implementation problems and establishes the importance of verification of Annex I country performance with respect to targets and in the context of the new market mechanisms

Each country's emissions target must be achieved by the period 2008-2012. It will be calculated as an average over the five years and in the meantime "demonstrable progress" must be made by 2005. Cuts in the three most important gases—carbon dioxide, methane, and nitrous oxide—will be measured against emissions from the base year 1990. Cuts in the other three long-lived industrial

gases—hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride—can be measured against emissions levels from either 1990 or 1995 as a base year (United Nations 1997). Compared to the emissions levels that would be expected by 2010 without measures to control them, the Protocol target represents a 30% cut in overall GHG emissions (United Nations 1997).

Kyoto gives individual countries a certain amount of flexibility in how they make and measure their emission reductions by introducing four market-oriented mechanisms that help them to achieve emission targets more cost-effectively. These mechanisms include *bubbling*, which allows industrialized Parties to work together and share the burden of emission reduction through more formalized agreements among themselves (United Nations 1997, Article 4.1). Kyoto also allows *international emission trading* between developed countries and allows for domestic *cap-and-trade*, or *emissions credit*, programs. The Protocol also permits *joint implementation* among Annex I countries, which allows emissions credit to be given for the implementation of emissions reduction projects. A *clean development mechanism* is also provided and aims to enhance cooperation among developed and developing countries (*i.e.*, "developing" countries as defined by the UN and referred to as "Annex II" countries in the Kyoto Protocol) to implement and manage projects related to the Convention (United Nations 1997, Articles 17 and 12.2). Ultimately, the Kyoto Protocol aims to help the Parties achieve the most cost-effective GHG emission reductions possible.

Table 2. Kyoto Commitments: Japan and US
(Commitment/Kyoto Target: represented as % of 1990 base year emission reduction levels to be achieved between 2008-2012)

Country	**1990 GHG Emissions** (1, 000 Gg CO2 equivalent)	**Commitment**	**Kyoto Target**
Japan	1, 176	94	-6
United States (proposed)	5, 918	93	7

Source: OECD 1999

Issues with the Kyoto Protocol: Timing, Equity, and International Enforcement

Policy-makers face major problems when trying to lower the costs of achieving the long-term objectives of the UNFCCC and those decided at subsequent COP meetings. The Kyoto Protocol has been criticized because it raises issues that may impede its cost-effectiveness and efforts to promote sustainable development. The major issues that pose problems are the *timing* of emissions

targets, how *equity* is defined in the context of the agreement, and how *international enforcement* will be conducted.

One problem with the Kyoto Protocol is the *time limit* it sets for GHG emission reductions. Countries that have ratified Kyoto have agreed to reduce emissions by the amounts mandated in the time period between 2008-2012. Proponents of strong action to mitigate global climate change as soon as possible argue that people will not take emissions reductions seriously without dramatic and forceful regulations. Proponents also argue that viable guidelines need to be established for a system of emission reductions so that as climate change science evolves a system will be in place to guide subsequent, and necessary, climate change policies. There are also critics of the Kyoto GHG emission reductions time table. Michael Toman, for example, argues that "The sharp reductions in emissions by the period 2008-2012 under the Kyoto treaty provide little 'when' flexibility and thus do not lie on the lowest-cost path to any plausible long-term GHG concentration target" (Toman 2002). Critics of Kyoto's timing flexibility, like Toman, generally offer reasons for *back-loading* the heavier cuts in emissions, that is to say, requiring more emission reductions at a later point in time in order to allow clean technology and markets to evolve.

A major problem with the Kyoto time table is that, even though technologies are available that use energy more efficiently and emit less GHGs than much of the equipment currently in use, the world has made spectacular investments in fuel-burning equipment and replacing that equipment with newer and cleaner technologies before the older and less efficient equipment is obsolete would be very expensive. For example, an electric power generating plant is often built with an expected life of forty years and to replace it after only twenty years can impose a drastic cost on society and the economy (Toman 2002). Critics argue that by postponing drastic cuts in emissions for several decades, the global economy could take advantage of cleaner technologies that are being developed and may not yet be available through the market.

Another contention when considering the Kyoto Protocol arises from the fact that carbon dioxide in the atmosphere is constantly absorbed by oceans, forests, soil, and other natural *sinks*. It is estimated a great amount carbon dioxide emissions disappear because of sinks. Therefore, if the sharp cuts in emissions are postponed, some of the carbon dioxide emitted to the atmosphere will have disappeared naturally before the concentration reaches the target. This is relevant because it is the long-term concentration of GHGs that influences climate change. Even so, CO2 sinks are not likely to be significant enough to warrant a prolonged delay in the creation of climate change policies. A flexible policy framework that is consistent with the precautionary principle should be in place to address environmental concerns.

An alternative measure to the Kyoto time limits on emissions reduction postulates that it makes sense to offer rewards for the early reduction of GHG emissions. When suitable international climate change policies have evolved out of

national emission reduction experiences, and are formally implemented, either nationally or internationally, then industries that have made voluntary emissions reduction efforts will be recognized. It is argued that, "by starting with more modest policy targets and gaining experience with GHG control while also providing more time for scientific knowledge to accumulate, the world gives up little in the way of options to act more decisively in the future as warranted to limit GHG's" (Toman 2002). A common problem with these types of early GHG reduction proposals is that their effectiveness is impeded by uncertainty about if, and when, mandatory emissions limits will be imposed in the future.

The concept of *equity* also causes problems for policymakers when trying to implement Kyoto Protocol regulations. This issue is raised by the differing responsibilities that developed and developing countries have agreed to in the treaty. The major question about equity asks if developing countries should make binding emissions reduction agreements now, or at some point in the future. Most developing countries want to postpone emissions reduction because of their equal per capita right to emit GHGs. Developing countries reject binding emission reduction commitments because the historical responsibility for GHG emissions is not theirs, they have less money to pay for reductions, and the limited resources that they do have must be allocated for more urgent priorities like providing for population survival and securing political infrastructures.

Developed countries are generally willing to accept differentiated responsibility for past emissions, but they want assurance that developing countries will assume greater responsibility for emissions reduction in the future. Currently, the major GHG emitters include the US, EU, and Russia. These developed countries realize that the major future emitters are developing countries including China, India, Indonesia, Brazil, and Nigeria (Schelling 2002, 2-9). These major future emitters are more vulnerable to the consequences of climate change because their economies rely on natural systems to a greater extent. Oftentimes developing countries do not have the resources to prepare for the consequences of climate change, but they must begin to prepare for the future.

To be sure, developed and developing countries have different concepts of *equity* and *fairness*. The issue of property rights becomes a major variable when deciding how the use of the global atmospheric commons should be allotted to different countries for the release of GHGs. Climate change causes are distributed globally through GHG emissions, and other practices like changing land use, which are activities tied to global wealth distribution. Therefore, alternative equity criteria for climate change mitigation responsibility need to be continuously debated (see Table 3).

Table 3. Alternative Equity Criteria for Climate Change Policy

Equity Principle	**Interpretation**	**Implied Burden-Sharing Rule**
Egalitarian	People have equal rights to use atmospheric resources	Reduce emissions in proportion to population or equal per capita emission
Ability to pay	Equalize abatement costs across nations relative to economic circumstances	Net cost proportions are inversely correlated with per capita GDP
Sovereignty	Current rate of emissions constitutes a status quo right now	Reduce emissions proportionally across all countries to maintain relative emission levels between them (grandfathering)
Maxi-min	Maximize the net benefit to the poorest nations	Distribute the majority of abatement costs to wealthier nations
Horizontal	Similar economic circumstances have similar emission rights and burden sharing responsibilities	Equalize net welfare change across countries so that net cost of abatement as a proportion of GDP is the same for each country
Vertical	The greater the ability to pay, the greater the economic burden	Set each country's emissions reduction so that net cost of abatement grows relative to GDP
Compensation (Pareto Rule)	"Winners" should compensate "losers" so that they are both better off	Share abatement costs so that no nation suffers a net loss of welfare

Market justice	Make greater use of markets	Create tradable permits to achieve lowest net world cost for emissions abatement
Consensus	Seek a political solution that promotes stability	Distribute abatement costs (power weighted) so the majority of nations are satisfied
Sovereign bargaining	Principles of fairness emerge endogenously as a result of multistage negotiations	Distribute abatement costs according to equity principles that result from international bargaining and negotiation over time
Polluter pays	Allocate abatement burden corresponding to emissions (may include historical emissions)	Share abatement costs across countries in proportion to emission levels
Kantian allocation rule	Each country chooses an abatement level at least as large as the uniform abatement level it would like all countries to undertake	Differentiate by country's preferred world abatement, possibly in tiers or groups

Source: Toman and Carzonla 2000

The question with regard to equity is how policymakers can create a process that can gradually increase the engagement of developing countries in GHG controls, while increasing their policy options. In doing this policymakers need to design a credible *monitoring and enforcement* system that does not impose such high transaction costs that it inhibits *clean development mechanisms*.

Box 3. The Montreal Protocol Model

The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer is one of the best examples of successful implementation of equity principles in relation to an international environmental issue. The participation of developing countries was one of the reasons for the success of the Montreal Protocol, and their participation was primarily due to the Protocol's inclusion of developing country concerns about equity, economic constraints, and flexibility. The Intergovernmental Panel on Climate Change Second Assessment Report cites the following elements as important in encouraging developing country participation:

- Differentiated standards for developed and developing country parties,
- Additional financial assistance to developing country parties,
- Technology transfer facilitated by the Protocol's financial resources if necessary, and
- Acknowledgement that developing country compliance is contingent on effective implementation of financial assistance and technology transfer obligations.

The Montreal Protocol was frequently discussed as a model prior to the Kyoto Protocol even though the problems it addressed were less complex than global climate change. Even so, questions of financial assistance and technology transfer continue to be important topics in climate change negotiations.

One possible model has been produced by the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer [see Box 3] (Toman and Carzonla 2000). The Montreal Protocol successfully dealt with issues of financial assistance and technology transfer to developing countries in order to help protect the environment and continue sustainable development.

In the context of Kyoto it is important to delineate how measures will be enforced and how the oversight group will function. Oversight of the Kyoto Protocol requirements could take the form of *self-enforcing agreements* or an *international bureaucracy*. Both options are difficult to implement and maintain, but oversight is necessary to ensure emission reductions and sustainable development.

The basic paradox of an international *self-enforcing agreement* is that "a self-enforcing agreement is most easily maintained when the global net benefits are not much bigger than those in the absence of an agreement" (Toman and Carzonla 2000). In other words, international agreements must satisfy the self-interest of the

parties concerned and are easiest to negotiate when the stakes are small or no other truly viable option exists. Because GHG emissions reduction is a *global good* there is also a chance that some countries entering into Kyoto will become *free-riders* that have nothing to lose if they do not satisfy their responsibilities.

International bureaucracy created to enforce the Protocol regulations must strive not to damage sustainable development projects and economic practices. It is dangerous to design measures and oversight procedures that are too arduous or stringent because they will inhibit the effective progress of the Protocol mechanisms.

Even though the Kyoto Protocol raises contentious issues, it is agreed that international action needs to be taken with regard to global climate change. The adoption of the Kyoto Protocol signifies a political will to address the causes and effects of global climate change, protect the environment, and promote sustainable development.

National Strategies for Kyoto Implementation

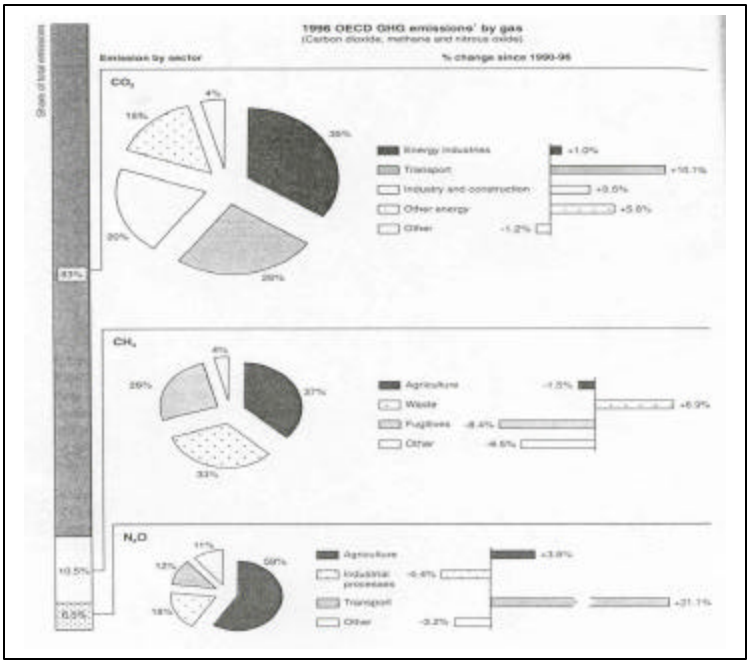
National Reporting of International Requirements

It is critical that national governments share information about how they plan to implement the regulations of the UNFCCC and subsequent Protocol standards. The UNFCCC requires participants to submit *national communications* to the Conference of the Parties on a regular basis. This information about GHG emissions, international cooperation, and national climate change mitigation activities is reviewed periodically so that the Parties can track the Convention's effectiveness and draw lessons for future national and international climate change mitigating actions. The national communications describe what a Party is doing to implement the Convention and could include analysis of policies for: limiting GHG emissions; adapting to climate change; conducting climate research; monitoring impacts of climate on ecosystems or agriculture; encouraging voluntary action by industry to reduce GHG emissions and develop energy efficient products; integrating climate change concerns into long-term policy planning; managing coastal zones; training for disaster preparedness; and for environmental education and the promotion of public awareness about environmental issues (United Nations 1997).

The national communications also include *national inventories* of GHG emissions and removals. It is stipulated that the data from each country should detail the sources and quantity of emissions for each GHG, the estimated quantity of GHGs removed from the atmosphere by sinks, and the subsequent net quantity of GHGs emitted after factoring in removal by sinks. The data is to be collected using a common methodology to ensure that national data are consistent and can be incorporated in global data sets. The national communications are subject to review by a team of experts from developed and developing countries and from international organizations. There are also on-site reviews by experts for developed

countries, which are highlighted in a *compilation and synthesis* report that is produced for each meeting of the COP (see example in Chart 1).

Chart 1. Example Use of a Common Methodology to Incorporate National GHG Emissions from Developed Countries into an International Data Set



Source: (OECD 2002).

Policies and Measures for Dealing with Climate Change

Developed countries are exploring various climate change policies and measures to find solutions suitable to domestic needs. The policies that governments choose are generally dictated by national political and economic systems. Many are *no-regrets* measures that have environmental or economic benefits irrespective of climate change concerns. To be sure, national governments claim to make policies as cost-effective as possible. With this goal in mind many national governments choose a mix of policy instruments to deal with climate change and its pervasive consequences. Climate change policies often aim to remove market barriers and accelerate behavioral and technological innovation. Domestic climate change policies and measures in developed countries tend to be *economic*, *regulatory*, or *procedural*, with a focus on *sustainability* and mitigating the consequences of *energy use*.

Economic measures to promote clean technologies often include *imposing taxes*, *giving tax breaks*, *providing subsidies* or *grants*, *government purchasing*, *emissions permit trading*, and *offering incentives*. Environmental *taxes* discourage the use of fossil fuels by

reflecting some of the cost of depleting natural resources. This is a form of *social-costing*, a practice that targets socially harmful activity, such as GHG emission, for taxation. When managing social-costing measures with regard to the use of fossil fuel it is important to note that often "the impact of a tax depends on the absolute level of all taxes on a specific fuel, as well as the relative tax on that fuel compared to the tax on other fuels" (OECD 1999). Another market instrument, like *emission permits trading*, often requires the simultaneous development of institutions for regulation and verification of compliance. Most importantly, "the central characteristics of the emissions markets, such as price ranges and liquidity, are themselves dependent on the level of participation" (OECD 1999). In other words, there must be a demand for permit trading in order for a regulatory framework to develop and eventually provide regulations that encourage continued trading.

It is also common for government programs to foster the deployment of commercially available and environmentally-friendly technology by offering industries direct *subsidies* for GHG reduction programs or *tax relief* through reduction or credits. *Government purchasing* of clean technologies can shift the focus of product development as well as increase the size of markets and the rate of diffusion for clean technology and practices. When the government creates a niche market for new technology it lowers the perceived risk associated with new product development and marketing.

Regulatory measures pertaining to climate change often take the form of *standards*, *mandates*, and *voluntary agreements*. Individual regulations help focus responsibility and accountability on producers, suppliers, and consumers. Governments often update the *energy performance standards* for products following technological advances. Product standardization includes product labeling, product recycling, extending product life-cycle guarantees, and extending producer responsibility for products. *Mandates* are frequently aimed at raising the share of renewable energy in the domestic energy mix and outlining "objectives" as opposed to "obligations" for energy production and consumption. The motive behind most *voluntary agreements* to reduce GHG emissions is to avoid possible future tax increases. "Cooperative agreements" create a government/private sector partnership that uses a "business-as-usual" scenario for reductions assuming a "no-policy" alternative to set emissions limits that can be reviewed and monitored by governmental or non-governmental agencies.

Box 4. Multiple Policy Objectives and Early Climate Change Strategies in OECD Countries

- Improved energy efficiency
- Restructuring and liberalization of energy markets
- Improved (local/regional) air quality and reduction of traffic congestion
- Waste management, minimization, and methane recovery
- Capture or elimination of fugitive energy emissions
- Environmentally sustainable farming, forestry, and land use practices
- Public education about environmental issues

Procedural policies address the *policy process*; *research, development, and demonstration efforts*; and *private-sector initiatives*. *Policy processes* include consultations on the integration of environmental concerns into all related policy areas and advisory efforts to oversee cost-effective environmental policy implementation. Other processes include outreach programs and public education to achieve lasting changes in business, industry, and consumer attitudes about economics, energy, and the environment. These processes help the public to decide how environmental attributes should be valued and used appropriately. *Research, development, and demonstration efforts* are most often government funded because the research period can be economically risky and the payback period can be quite a long time coming. Also, "knowledge capital" produced through research and development investment is often an intangible asset that cannot be mortgaged or used as collateral when looking for market financing. Even so, the private sector does continue to fund these programs because the long-term profitability can be astounding if definite technological advances are made. And finally, *private sector initiatives* include: voluntary industry-wide agreements to reduce GHG emissions; the use of external auditors and non-governmental agencies to examine corporate environmental performance; and the use of government programs as a framework for public reporting on industrial environmental action. Non-governmental leadership and institutions in support of environmental standards are as crucial as government leadership in finding cost-effective policies to reduce GHG emission, foster sustainable development, and address global climate change.

National Climate Change Policy in Japan
Climate Change Legislation and International Commitments

Japan was one of the first developed countries to take full responsibility for maintenance of its share of the global commons and implement a national climate change protection program. The Japanese government launched its Action Program

to Halt Global Warming in 1990. The Action Program set ambitious GHG reduction targets to include:

- *stabilization* of national and per capita carbon dioxide emissions at or below 1990 levels by 2000;
- *capping* national methane emissions at their 1990 level (no deadline); and
- *curbing* the growth in national emissions of nitrous oxide and other GHGs to the extent most feasible.

Japan then ratified the UNFCCC in 1993 and agreed to reduce anthropogenic GHG emissions. Japan ratified the Kyoto Protocol on 4 June 2002 and thereby made a stringent commitment to reduce the total emissions of six targeted GHGs by 6% relative to 1990 emission levels in the 2008 - 2012 time period. In 1998 a specially formed Global Warming Prevention Headquarters, established in 1997 and chaired by the Prime Minister, laid out sub-targets to help in reaching the Kyoto commitment. The six percent net reduction in GHG emissions is to be the result of an overall eight percent reduction, offset in part by a two percent increase from expanded use of SF6, HFCs and PFCs. Examination of the sub-targets shows that Japan is counting heavily on sinks, product innovation, and voluntary changes by industry and private consumers, while the contribution of renewable energy sources to reduce GHG emissions is projected to be very small for the near future (OECD 1999).

Table 4. Projected Distribution of Japan's Kyoto Commitment

Target (in carbon dioxide equivalent)	**Sector/Actor**	**Means/Measures**
Minus 6.0% overall net reduction	All sectors	Japan's Kyoto Commitment
Divided as follows:		
Minus 3.7%	Sinks	Forests, land use change
Minus 2.0%	Industry	Technology improvements (*e.g.*, direct smelting, more efficient cement kilns)
--	Private consumers	Voluntary energy conservation measures
Minus 1.8%	Unspecified	Kyoto mechanisms
Minus 0.5%	Non-energy sectors	Emission controls on CH4, N2O, and CO2
Plus/minus 0%	Energy sector	Stabilization of CO2 emissions at 1990 level
Plus 2.0%	Fluoro-compound users	Expanded use of HFCs, PFCs, and SF6

Source: United Nations 1997

Japan saw climate protection as a top policy priority in the 1990s and formulated the First and Second Basic Environmental Plans to emphasize this concern. By passing the 1998 Law Concerning Promotion of Measures to Cope with Global Warming, Japan made policy specifically to combat global warming. The law provides a legal basis to combat climate change with initiatives for a range of stakeholders including the national government, local authorities, businesses, and citizens. The law does not set any quantitative reduction targets, but it does urge the government (both national and local) and industry to take measures to reduce their emissions of the six main GHGs and to make their action plans and periodic progress reviews available to the public. To encourage public participation the law provides for the establishment of Centers for the Promotion of Activities to Prevent Global Warming in each prefecture. According to the OECD

> Japan has significantly expanded its *legislative framework with the aim of lowering the GHG emission intensity of energy production and use.* From the early 1990s, the GHG reduction strategy for the energy sector aimed to strengthen regulations on energy efficiency, increase nuclear power generation capacity and expand the use of "clean" energy sources (*e.g.*, natural gas and renewables). The 1979 Law Concerning the Rational Use of Energy was revised in 1998 to strengthen regulations on the energy efficiency of consumer products. The 1997 Law Concerning Special Measures For Utilization of New Energy Sources prioritizes the development of "new" energy technologies, including solar and wind power, low-emission vehicles (LEVs) and fuel cells. The 2000 Second Basic Environmental Plan calls for GHG reduction measures aimed at both energy supply (*e.g.*, increasing use of renewables) and energy conservation (OECD 2002).

The focus on mitigating the negative consequences of energy use is a step in the right direction, but the most effective policy will be achieving a change in public and industrial attitudes about the value of the environment.

Japanese Environmental Institutions

The Global Environment Bureau of the Ministry of Environment (MoE) is responsible for administrative coordination and implementation of climate change policy in Japan. The Global Warming Prevention Headquarters coordinates climate change policy at the national level, promoting and overseeing comprehensive measures. Other ministries with environmental management responsibilities include:

- Ministry of Foreign Affairs (MOFA) for diplomatic policy and negotiations relating to global environmental issues;

- Ministry of Agriculture, Forestry and Fisheries (MAFF) for management of natural forests, conservation of fishery resources, promotion of sustainable agriculture, and the regulation of agricultural chemicals;
- Ministry of Economy, Trade and Industry (METI) for promotion of energy conservation, development of technology for industrial pollution prevention and control, and the recycling of industrial waste; and
- Ministry of Land, Infrastructure and Transport (MLIT) for control of pollution from road vehicles, development of public works (*e.g.*, sewage, urban parks, and roads), restoration of rivers, and the prevention of coastal zone pollution.

Responsibility for the implementation and enforcement of national environmental laws lies mainly with prefectural authorities. Prefectural and municipal governments can set local emission standards that are more stringent than those in national legislation. All forty-seven prefectures and numerous municipal governments have exercised this option, putting in place stricter emission standards for certain pollutants or in certain physical locations, on an "as needed" basis. In contrast, non-governmental organization involvement in the development and implementation of climate protection policy in Japan has been rather limited at both the national and local levels so far (OECD 2002).

Japan has a system of regulation enforcement that allows impromptu inspections of polluting facilities by prefectural or municipal authorities. Such inspections are numerous and regular, with administrative follow-up ensuing for almost eleven percent of water inspections and about one percent of air inspections (OECD 2002). The most common type of follow-up is the issuing of administrative guidance or of administrative warnings, although penalties can also be assigned.

Japan's ambient environment monitoring networks are highly developed. Governmental agencies in prefectures and large cities operated about 1, 700 general air pollution monitoring stations and about 400 roadside air pollution monitoring stations as of 1999. The national air quality monitoring network, consisting of fifteen stations, compliments these local efforts.

Japan has improved access to information regarding compliance with environmental regulations by making data from ambient monitoring networks available free upon request and posting it on the internet. The national total of releases and transfers of listed chemicals is made public annually and data on these issues concerning a specific company can also be disclosed upon request. Japan relies on active participation of community organizations and concerned citizen groups at the local level to ensure regulatory compliance, environmental monitoring, and accountability.

Carbon Dioxide Emissions and Removal in Japan

Carbon dioxide comprises 94% of Japan's national GHG emissions and has increased 8.9% from 1990 to 1999. Combustion of fuel for transport, industry,

residential/commercial, and other uses is the largest source of GHG emissions, generating over 90% of carbon dioxide emissions. Industry, construction, and agriculture are responsible for 45% of carbon dioxide emissions and the residential/commercial sector for 25%. Household consumption of manufactured goods and energy is a major driving force behind rising carbon dioxide emissions according to the MoE. Japan projects that sequestration of carbon dioxide through land use changes and forestry will continue to be sizable, accounting for a 3.7% reduction in national GHG emissions between 1990 and 2008-2012 (OECD 2002). 6% of Japan's national GHG emissions take the form of CH4 (2.1% of total emissions, weighted by global warming potential in 1999), HFCs (1.5%), PFCs (0.8%), and SF6 (0.6%).

Table 5. Projected Carbon Dioxide Removal and Emissions Due to Forest Change in Japan: 1990-2010 (kt)

Removal and Emissions	**1990**	**1994**	**2000**	**2005**	**2010**
Removal: Caused by forest growth	146, 056	142, 120	128, 337	123, 620	119, 834
Emissions: Caused by deforestation	-61, 665	-47, 758	-59, 092	-62, 113	-63, 221
Emissions: Caused by forest land use change	-579	-929	--	--	--
Emissions: From forest soil	-471	-2, 599	-2, 093	-1, 744	-802
Net removal	83, 341	90, 834	67, 192	59, 762	55, 811

Source: OECD 2002

Specific Climate Change Policy Measures in Japan

Japan's early climate protection measures focused on improving the efficiency of energy production and use to reduce carbon dioxide emissions. These measures have led to large efficiency gains in industry, but have had less impact in the transport and residential/commercial sectors. The Japanese government has also made extensive use of voluntary initiatives, often accompanied by financial assistance such as tax breaks, reduced-interest loans, and investment subsidies to reduce GHG emissions from industry. To date, economic instruments such as emission charges, tradable permits, or eco-taxes have not been widely used in Japan (OECD 2002). Since the 1970's Japanese domestic climate change policy has been a mix of specific regulatory instruments, economic instruments, procedural measures and voluntary initiatives.

Table 6. Examples of Japanese Climate Change Policy Measures

General Measures	**Specific Initiatives**	**Components of specific initiatives**
Regulatory Measures	1970's Energy efficiency regulation	• Energy efficiency standards for 3,500 energy-intensive manufacturing industries • Energy efficiency standards set for some consumer products and gasoline vehicles • Energy efficiency of certain technical equipment indicated to consumers on special labels
	1998 Expansion of energy conservation program	• Energy efficiency standards set for less energy-intensive industries • Energy efficiency standards strengthened for consumer products • "Top-Runner Program" standards for a given product class set at a level equal to the best energy efficiency of products currently on the market

		• Energy efficiency standards for housing and buildings strengthened with overall aim of reducing consumption of energy for heating and cooling 20% for housing and 10% for offices • Energy efficiency standards aimed at reducing energy intensity by 7% for railways and 3% for ships between 1995 and 2010 • The Diet introduced mandatory recovery system for HFCs used as refrigerants to limit emissions
Economic Measures	1970's Financial assistance measures	• Private consumers can receive financial assistance for investing in energy efficiency improvements that change energy consumption behavior • Construction of homes and buildings that incorporate energy-conservation measures warrants loans from The Housing Loan Corporation and Japan Development Bank at preferential interest rates • Farmers implementing agri-environmental measures to decrease GHG emissions from fertilizers and manure management also warrant a range of financial assistance measures • Research and development of CFC substitutes with low global warming and ozone depleting potentials warrant government subsidies • Businesses making investments in facilities for the recovery and destruction of fluorocarbons can

		benefit from accelerated depreciation allowances, property tax breaks, and low interest loans
	1998-2002 Promotion of the development of renewable energy sources	• Government subsidies to industries that utilize wind energy, waste and cogeneration for electricity generation • Federal subsidies provided to municipal governments for the construction of 120 waste-to-energy power plants • Governments subsidies offered to households for the purchase of home-operating photovoltaic systems (to date, over 8,200 applications have been processed)
	2001 Reassessment of the role of taxes with environmental effects	• Tax Commission reconsidered earmarking vehicle-related taxes for road construction and maintenance instead of redressing the negative environmental effects of road transport • Tax Commission created opportunities for the "greening" of tax provisions
Procedural Measures	1997 Keidanren Voluntary Action Program on the Environment	• Set guidelines for participating industries with the overall goal to return CO2 emissions from industry and energy production to 1990 levels by 2010 which is assessed in annual follow-up surveys published and reviewed by national councils
	Guidelines issued by METI	• 19 business associations in ten industrial branches have made voluntary action plans concerning the

		reduction of HFC, PFC, and SF6 emissions following METI guidelines with progress reviewed by the Industrial Structural Council
Other Measures	1996 Funds to establish the Asia-Pacific Network for Global Change Research	• Japan provided funding for research concerning global warming to the APNGC to help develop observation methods, promote the use and dissemination of observation and monitoring data, and to encourage international exchanges of information
	1991-1997 Budget increase for education and public awareness concerning climate	• Budget increased from JPY 340 million in 1991 to JPY 3.2 billion in 1997 for public education programs aimed at various social stakeholders

Source: OECD 2002

Japan's Energy Outlook

Climate protection policy has been a priority in Japan longer than in most other developed and industrialized countries. Japan's Action Program to Halt Global Warming, instituted in 1990, formulated a strategy to reduce GHG emissions between 1990 and 2010. The program was replaced by the Guidelines on Measures to Prevent Global Warming when Japan adopted the Kyoto Protocol. The guidelines are ambitious and highly detailed for climate protection and are reviewed at the cabinet level. In 1997 Japan hosted the third UNFCCC Conference of Parties (COP3) in Kyoto. According to the OECD, although the rate of increase in CO2 emissions has slowed, overall Japan has failed to "sever the link between GHG emissions and economic growth" for the sake of sustainability (OECD 2002). With respect to all six GHG's (measured in CO2 equivalents) emissions from Japan have risen almost 7% between 1990 and 1999 (OECD 2002). Japan must reduce emissions by almost 13% to reach national emissions reduction targets.

Japan is responsible for 5% of global CO2 emissions and is therefore the fourth largest emitter of CO2. Japan's "business-as-usual" scenario forecasts a 20% increase in CO2 emissions by 2010 and by 2008-2012 Japan would need to reduce its GHG emissions by an estimated 26% from "business-as-usual" levels to meet its Kyoto target. This will not be possible using only present domestic policy measures. Therefore, Japan is planning additional domestic policy measures to reduce CO2 emissions from fuel combustion, namely:

- *applying* energy efficiency regulations to additional energy uses like space and water heating;
- *accelerating* the timeline for implementation of fuel economy standards for motor vehicles;
- *implementing* new measures to reduce emissions from electricity production like launching quota systems with tradable certificates; and
- *increasing* the use of renewable energy resources like photovoltaics for private households and low emissions vehicles in the public sector (OECD 2002).

Rapid growth of energy demand is expected to continue in the residential, commercial, and transport sectors. The supply of non-fossil-fuel energy, like

nuclear and renewable energy, in Japan is projected to be lower than expected as well. The primary measures used to achieve the reduction in GHG emissions will most likely be through energy conservation, greater use of renewables, and further fuel switching. The viability of these options will rest on the need for *energy security*, *environmental protection*, and *economic efficiency*. The OECD reports that "while new energy forms such as photovoltaic, wind, and waste power tend to be expensive and are affected by natural conditions, the 2001 outlook prioritizes them for their advantage of being 'indigenous and non-CO2 emitting'" (OECD 2002).

The following important lessons for structuring domestic climate change policies in light of the UNFCCC and the Kyoto Protocol can be taken from Japanese environmental regulation:

- Allow flexibility in timing cumulative emissions reduction to decrease overall costs.
- Incorporate economic incentives into emissions reductions policy.
- Build knowledge and improve technology through government funded development and research on global climate change impacts (regional and other).
- Encourage public education about, and participation in, global climate change policy.

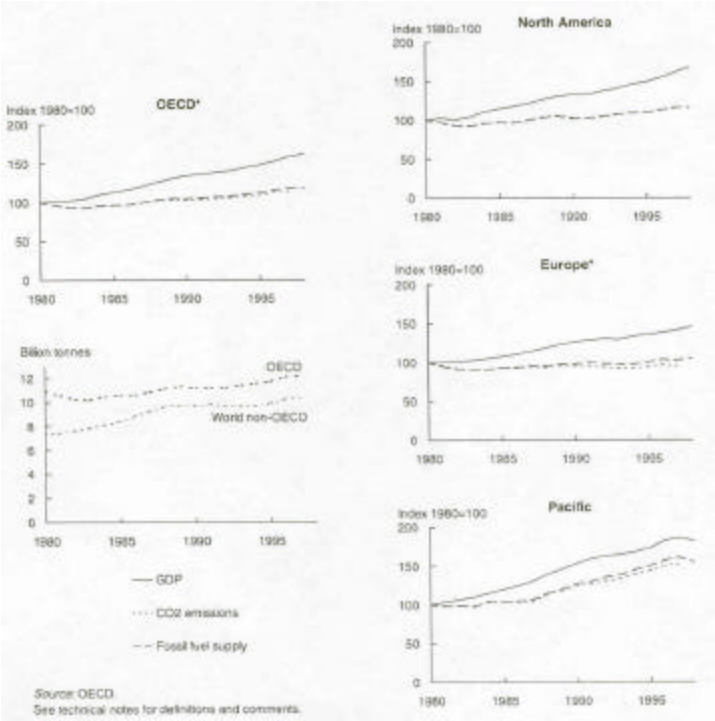
Conclusions

Climate Change Policy: Review

Global warming due to anthropogenic GHG emissions is causing an *unsustainable* rate of environmental and societal change. Lack of long-term information on this issue cannot be confused with negligible risk. Participation in the UNFCCC shows a commitment to protect the environment, to sustainable development practices, and to the future of energy security. In the context of this international agreement it is important for individual countries, following Japan, to be consistent, yet flexible, with domestic climate change policies in order to increase economic efficiency and adhere to international agreements. To achieve these goals policy-makers should think comprehensively about the costs and benefits of GHG emissions reduction (see Graph 1 for carbon dioxide emission trends by global region). Officials must carefully consider the impacts of global climate change on the future of the following: the market, human health and welfare, natural resources,

and overall quality of life. Policy-makers must think long-term and understand that scientific knowledge and policy responses will necessarily change over time with regard to global climate change and its effects. Therefore, all countries must have a flexible climate change framework for adaptation, sustainable development, and GHG emission reductions. Michael Toman makes a wonderful point when he says that, "In many cases, the best climate policy may have little to do with greenhouse gases or climate change *per se*, and much more to do with developing better basic social infrastructures for natural resource conservation and use for public health protection" (Toman 1997).

Graph 1. Current Growth of Carbon Dioxide Emissions By Global Region (OECD 2002).



Governments must also think about climate change as an international issue. This means all countries are fully accountable for their contribution to the maintenance of the global commons. Distributional issues are not only regional, but generational, and an assessment of the costs of global climate change should include those the current generation will bear as well as those that will be borne by future generations. To be fair to all generations, estimations of global climate change mitigation costs should take into account that the future increase in global energy demand, by developing countries and the expanding human population, will increase the costs of longer-term emissions reduction without the development of non-fossil fuel energy alternatives. In the end, to be most effective in helping to develop new energy sources and to mitigate other causes of global climate change, governments must work to change public attitudes about the value of the environment.

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