Climate Change: National Interests Or a Global Regime?

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SUMMARY

This chapter addresses the ultimate global environmental governance challenge: climate change. It explores four key questions: 1) Who is responsible for climate change? 2) Who is affected by its consequences? 3) Who should act in response? and 4) What is to be done?

Climate change is profoundly different from most other environmental problems humanity has faced. The atmosphere's planetary scale and scope make it a "global public good," prone to overexploitation and underregulation. The multiplicity of causes of climate change, the uncertainty of timing and effects, and substantial economic costs make global agreement difficult to attain and maintain. Along with a challenge to material wellbeing, however, the climate change problem poses an ethical dilemma stemming from the large physical, social, and even temporal distances between emitters and victims of climate change.

Climate change requires a global response, encompassing the North and the South, local and global communities, and the public and private sectors. Ranging from global negotiations to individual choices, a diversity of actors with different resource endowments, and diverging values and aspirations, need to be involved.

Success will depend on the substance and equity of national commitments and on the process developed for promoting global-scale cooperation. Four conditions need to be emphasized in building a global climate regime: 1) adequate information, 2) issue linkage and bargaining, 3) technological potential, and 4) a shift in values.

CLIMATE CHANGE AND GLOBAL GOVERNANCE

All social structures humanity has ever built have required some form of management. As societies evolved from tribes to kingdoms and from kingdoms to nation-states, they were governed both at an increasingly larger scale, and with increasing levels of complexity. Tribes were managed as relatively simple top-down structures, where the center of influence was the tribe itself, and the circumference of interdependence was the geographically surrounding tribes. Nation-states developed more complex systems of governance, and pushed the circumference of interdependence beyond neighboring states. In the era of globalization, however, governance issues have moved to a global level in response to a growing recognition of planetary interdependence.

Climate change is one of the first truly global environmental challenges. Several key features distinguish it from other environmental problems:

- The atmosphere is a classic example of a global public good – greenhouse gas emissions in one country affect the entire planet; conversely, emission controls in any country benefit all, encouraging "free riding" on the efforts of others;
- The impact of climate change is not likely to be evenly distributed among regions and countries. Developing countries tend to be more vulnerable and, at the same time, less able to respond and to adapt;
- A multitude of human activities result in greenhouse gas emissions, so that efforts at reducing emissions are needed at many levels – from global to national to local to individual;
- Uncertainties as to the timing, scope, and impacts of climate change reinforce reluctance to alter economic behavior.

The scale of climate change requires global collective action, yet the costs and complexity make many countries hesitant to participate. A functioning climate change regime has thus been difficult to construct. This chapter examines the tension between national interests and the creation of a global climate regime by asking four questions:

- Who is responsible?
- Who is affected?
- Who should act?
- What is to be done?

Were the answers to the first three questions one and the same, devising solutions to the problem of climate change would be a relatively simple task – the countries responsible for climate change would tackle the issue themselves, because it would be in their own interest to do so. The fact that the answers vary takes us into a perplexing ethical arena where many of the countries most affected are least able to act, and many of those most able to act are least willing. We will emerge from this quandary to the degree that countries are able to shift from narrowly defined national interests to an internalized notion of global interdependence. Such a shift will need to encompass both a technological revolution and an ethical evolution supported by a new approach to problem solving at the global scale.

Who Is Responsible?

Major components of our biosphere (including the air, the oceans, the range of animal and plant species, and the climate system itself) have been altered by the intensity of human exploitation of the earth's resources in the twentieth century.[1] Responsibility is lodged in the North as well as in the South and must be understood in terms of two major global trends that lead to increased greenhouse gas emissions and reduced "sinks" for carbon dioxide – population growth and increasing consumption (especially of fossil fuels). Population growth is a problem mainly in developing countries while increasing consumption is a problem mostly in the industrialized world.

Global population has doubled since 1960, reaching 6.1 billion by 2001 (UNFPA, 2001). Increasing population entails increasing pressure on the land. Arable land per capita has been rapidly dwindling since the 1950s. The average then was 1.2 acres per capita. The average today is less than half that. In developing countries, pressure on the land has been "eased" by clearing forests and converting them to (poorly

1 For information and data on changes in climate and other consequences of global warming, see IPCC (2001a) and UNEP (2002).

performing) agricultural land. Deforestation, however, contributes significantly to carbon dioxide emissions (UNEP, 2002).

Twenty-three percent of global greenhouse gas emissions are due to deforestation, and most of this comes from developing countries. In Latin America alone, well over two thirds of total emissions are due to deforestation. There is clear climate change responsibility here.

The second macro trend is increasing consumption. The rate of environmental degradation is affected not simply by population growth but by the pressure people exert on natural systems through consumption, especially of non-renewable resources, most notably coal, oil, and natural gas. While world population has doubled over the past fifty years, total energy consumption has increased fivefold in the same period of time (Energy Information Administration, 2002). We have relied mainly on fossil fuels for that energy generation, and the growth in consumption has brought on parallel increases in greenhouse gas emissions. Carbon dioxide (CO_2) concentrations in the atmosphere have increased from 280 parts per million (ppm), before the industrial revolution to 370 ppm today, reaching a level that has not been exceeded during the past 420,000 years, and in all likelihood, not during the past twenty million years (IPCC, 2001a).

The United States alone accounts for as much as twenty-one percent of total world emissions while being home to only four percent of the world's population. In contrast, 136 developing countries are collectively responsible for twenty-four percent of global emissions (Marland, Boden, and Andres, 2000). This situation, however, will shift in or about the year 2020, when population growth and increased energy consumption in developing countries will contribute half the total world emissions. It is therefore imperative that both developed and developing countries make a substantial commitment to action and that the requisite governance structures are created to facilitate agreement, to allow bargaining and trade-offs, and to assist in the implementation of the necessary measures.

Who Is Affected?

It has been universally accepted that countries have "common but differentiated responsibilities"[2] with regard to environmental degradation. Sophisticated climate models and scenarios point out that countries have also common but differentiated vulnerabilities. The comparative susceptibility to adverse climate impacts lies also along a North-South axis, but in an inverse relation to historical responsibility. Recent studies of the likely impact of climate change on regional agricultural production predict positive impacts for the United States, Japan, and parts of Europe (Mendelsohn and Nordhaus, 1996; Mendelsohn, 2001; Reuters, 2002)[3] and considerable negative consequences to sub-Saharan Africa and the Indian subcontinent (IPCC, 2001b; Fischer et al., 2001).[4] Some of the most significant potential effects for the developing world include:

- Exacerbated desertification in Africa due to reductions in average rainfall, runoff, and soil moisture;
- Significant increases in the geographic incidence of insect-borne diseases, such as malaria and dengue, particularly in the tropics and subtropics, due to rising temperatures;
- Increased risk of hunger and famine for many of the world's poorest people as a result of a change in the volume and distribution of water;

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2 Principle 7 of the Rio Declaration adopted at the 1992 Earth Summit states that "In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command." The full text of the Rio Declaration is available at: http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm

3 Even within the United States, where some studies forecast positive impacts, there is likely to be significant regional differentiation. Southern states are likely to experience substantial negative consequences from higher temperatures, including decreased agricultural productivity, increased unemployment, and increased energy use for cooling that would far outstrip the savings from heating (Mendelsohn, 2001).

4 A warmer climate is also likely to adversely affect far Northern latitudes where permafrost would melt, leading to the collapse of the topsoil and the loss of large forested areas. This would be particularly devastating for Russia, where large parts of the country (rich in natural resources) are covered in permafrost. The global impacts would also be significant as Siberian forests are currently an important natural sink for excess carbon.

- Undermined food security, human health, and infrastructure, and constrained development due to increases in droughts, floods, and other extreme events;
- Food production losses of as much as twenty-five percent in forty of the world's poorest nations, including India, Bangladesh, Brazil, and many countries in sub-Saharan Africa. These countries have a current combined population of about 2 billion, of which some 450 million are already undernourished;
- Displacement of tens of millions of people in the low-lying coastal areas of Asia due to rising sea levels and increasingly intense tropical cyclones.

These adverse impacts will be most severely felt in the poorest countries where vulnerability is greater due to geographic and climatic conditions, and where the ability to respond is very limited. Successful adaptation depends on technological advances, institutional capacity, knowledge and education, and availability of financing.

Overall, developing countries have less favorable economic circumstances, weaker institutions, more limited access to capital, and more restricted information exchange. The nations most vulnerable to global change are often the ones least prepared to respond or to adapt to it.

Who Should Act?

The divergence between the countries most responsible for, and the countries most affected by, climate change creates a profound ethical dilemma. Developed countries have the capacity to act, yet some of them (notably the United States) are unwilling to do so without the assurance of substantial emission reductions on the part of developing nations. Facing pressing domestic concerns, however, countries in the South resent the imposition of economic costs for the amelioration of what they perceive to be a Northern-caused environmental problem.

Currently, the United States emits twenty metric tons of CO_2 per capita annually, while per capita CO_2 emissions in India are 1.05 metric tons. (World Bank, 2002). One is reminded of the famous cartoon of the tall white man who drives up in his gas-guzzling SUV and asks the bushman to put out his campfire in order to reduce global emissions. It is not surprising that Indian negotiators contend that their people should not be limited to a few "survival emissions" while industrial countries are not even willing to accept modest cutbacks in their "luxury emissions."

Finger pointing about past responsibility for or future contributions to the problem will not help countries reach a solution. Constructing a global climate regime without the United States may be possible, but it is certainly not optimal. The Kyoto Protocol target of a 5.2 percent reduction in CO_2 emissions from 1990 levels by industrialized countries cannot be met without the United States. But even if it could be reached, the estimated sixty to seventy percent decrease required to stabilize greenhouse gas concentrations in the atmosphere (Mapes, 2001; Gelbspan, 2001) demands the participation of *all*.

One-sided measures will not be sufficient. Industrialized countries cannot, by themselves, reduce global carbon emissions to levels likely to fall within relatively harmless concentrations; indeed, even a total ban of fossil fuels by all industrialized nations would not be sufficient if developing countries continue to increase their emissions (Jacoby, Prinn, and Schmalensee, 1998).

Many developing countries have shown a willingness and capability to voluntarily participate in global climate protection. The most recent ratification of the Kyoto Protocol comes from Brazil, which – with a unanimous vote from its Senate on June 18, 2002 – joined seventy-five other countries in committing to a global climate regime.[5] Several developing countries are making significant efforts

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5 Developing countries, however, are not required to reduce greenhouse gas emissions under the Kyoto Protocol. They can participate in the flexible mechanisms of the Kyoto agreement, such as emissions trading and the Clean Development Mechanism.

to reduce emissions, primarily for economic reasons. China, Brazil, India, and Mexico have cut fossil fuel subsidies, reducing consumption by twenty-five million tons of carbon.[6] South Korea, China, Mexico, and Thailand have adopted efficiency standards as well as tax incentives for energy efficiency. China's efforts at restricting carbon emissions are especially impressive. It has reduced carbon emissions substantially, even while its economy has grown steadily, with the help of subsidy phase-outs for coal,[7] market pricing for fuel, and energy conservation initiatives. The World Bank estimates that

THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THE KYOTO PROTOCOL

The United Nations Framework Convention on Climate Change (UNFCCC), which was opened for signature during the 1992 United Nations Conference on the Environment and Development in Rio, was designed as a first attempt to deal with the threat of global climate change. The main objective of the Convention is to stabilize atmospheric greenhouse gas concentrations at levels that would prevent dangerous consequences for the climate system (UNFCCC, 1992: Note 1, Article 2). Although the existence of the Convention attests to an international consensus that serious steps must be taken to reduce greenhouse gas emissions, the Convention does not set any specific targets, leaving that step to subsequent protocols.

The Kyoto Protocol differentiates Annex B countries, mainly industrialized countries and countries with economies in transition, from non-Annex B countries, the developing nations. The Kyoto agreement provides legally binding emissions targets for Annex B countries, which will be required, by 2012, to reduce their combined emissions of greenhouse gases to below the levels measured in 1990. Different countries have different targets, which range from an eight percent decrease from the base level for the European Union to a ten percent increase for Iceland (UNFCCC, 1992: Annex B).

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6 Between 1990-91 and 1995-96, total fossil fuel subsidies in fourteen developing countries that account for twenty-five percent of global carbon emissions from industrial sources declined forty-five percent, from $60 billion to about $33 billion. Reduced subsidies are desirable because they lead to higher fuel prices and reduced taxes of growth in carbon emissions (Reid and Goldemberg, 1997).

7 China has reduced its coal use by forty percent since 1996 (BP, 2001: 33).

further efficiency gains in China have the potential of yielding savings of 1,000 to 1,700 million tons of coal equivalents per year by 2020 – an amount greater than China's total energy consumption in 1990 (Johnson et al., 1996).

So far, developed countries have done little to reduce their emissions. The commitment of the 1992 United Nations Framework Convention on Climate Change has gone largely unfulfilled. Inaction is justified by the presumption of prohibitive economic costs.[8] However, a growing body of data and results from progressive corporate and local government practices tell a different, more encouraging story (Hawken, Lovins, and Lovins, 1999). While national governments have been reluctant to respond to the challenge, innovative solutions have sprung up at the company and local levels across the world.

Aware that – with or without the Kyoto Protocol – the future trend is toward less carbon intensive economies, multinational corporations are putting in place efficient energy systems to reduce emissions. BP, for example, has established a voluntary plan with the target of reducing emissions of greenhouse gases by ten percent from a 1990 baseline by the year 2010 (Browne, 2002). A consortium of corporations led by Shell Hydrogen and DaimlerChrysler reached an agreement in 1999 with the government of Iceland to make that country the world's first hydrogen-powered economy. Shell expects to develop its hydrogen capacity and DaimlerChrysler expects to have the first fuel cell-powered automobile on the market. Shell plans to open its first chain of hydrogen stations in Iceland (Brown, 2001).

In developing countries, where access to a central power utility and an electricity grid is limited, local entrepreneurs are investing in solar cell generating facilities and selling power to village households. By the end of 2000, one million households were receiving their electricity from solar cells. About 700,000 of those households were in villages in developing countries.

Similarly, local governments have responded to new information about environmental realities. In the United States, many state governments and local communities have embarked on new energy ini-

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8 An intensive advertising campaign in the United States by a coal-led industrial lobby with the environmentally friendly name of "Global Climate Coalition" has contributed significantly to the perception by the press and politicians that any climate-related mitigation measures would be prohibitively costly. The United States has large sources of cheap coal and a transition to less carbon-intensive fuels would adversely affect the powerful coal mining industry.

tiatives encompassing energy efficiency and emission reductions programs as well as a shift toward new generation capacities. Advances in wind turbine technology have lowered the cost of wind power dramatically and wind farms have sprung up in Colorado, Iowa, Minnesota, Oregon, Pennsylvania, Texas, and Wyoming. Lester Brown calls the U.S. Great Plains "the Saudi Arabia of wind power" as the steady breezes in this region have the potential to generate enough electricity to meet a significant portion of U.S. needs. In Europe, wind power covers fifteen percent of the electricity demand of Denmark, nineteen percent of Schleswig-Holstein, the northernmost state of Germany, and twenty-two percent of Spain's industrial state of Navarra. China could double its current generation capacity by wind alone (Brown, 2001).

Corporate and governmental action will be fundamental to ensuring greenhouse reduction. However, unlike other environmental problems where blame is easily assigned to industrial pollution or governmental failure, individual decisions are a critical factor in global climate change. In Bangkok, Thailand, the city government decided that at 9:00 pm on a given weekday evening, all major television stations would show a big dial with the city's use of electricity at the time. Once the dial appeared on the screen, viewers were requested to turn off unnecessary lights and appliances. As people watched, the dial showed a reduction of 735 megawatts, enough to close two coal-fired power plants (Brown, 2001). This experiment served as a reminder of the power of individual decisions to make a collective difference.

At the individual level, seemingly insignificant investment decisions of shareholders could also exercise enormous pressure. The Dow Jones Sustainability Index[9] tracks the performance of leading companies worldwide and addresses increasing investor interest in companies committed to innovative technology, industrial leadership, and social wellbeing. There is mounting evidence that the management of these particular factors is directly related to superior financial performance (EPA, 2000).

Global climate change requires a response encompassing the North and the South, local communities, and the global community of nations. Ranging from global negotiations to individual choices, a diverse set of actors with different resource endowments and diverging values and aspirations would need to be involved. Concerns for

9 For information on the Dow Jones Sustainability Index, see http://www.sustainability-index.com

equity and justice, however, are central to effective responses to global climate change (Paterson, 2001; Wiegandt, 2001). Differences in the perceptions of developed and developing countries as to what is fair and equitable have presented enormous difficulties in constructing governance mechanisms for addressing climate change. Developing countries emphasize the need for a historical view of responsibility as well as present-day distributive justice. An historical perspective entails not only the widely accepted "polluter pays" principle but also the principle of "common but differentiated responsibility." However, absent a supranational body vested with the requisite judicial authority, the application of these concepts is, at best, difficult. Distributive justice entails a fair distribution of costs or benefits. Some commentators argue that this translates into equal per capita emissions (Grubb, 1990; Agarwal and Narain, 1990; Bertram, 1992). Given the political infeasibility of this approach, its defenders have emphasized the critical importance of financial resources and technology transfers to assist developing countries in minimizing their impact while allowing economic growth.[10]

Developed countries have formally acknowledged the need for fairness, but they have shown little interest in operationalizing this commitment to equity on a basis that satisfies the South. The absence of governance structures that allow for matching interests, facilitating bargains, and overseeing the completion of contracts hampers effective responses to many global issues. In the case of climate change, an equitable agreement could come about if the genuine interests of all parties involved are duly considered and accounted for. This would entail the creation of a more agile and multi-layered institutional structure.

What Is To Be Done?

Climate is an extraordinarily complex system with many delicately interrelated components. We lack knowledge about thresholds that might trigger climatic changes for which we are unprepared. Estimates of global carrying capacity for CO_2 emissions range from 500 billion tons to two trillion tons (Schelling, 2002). Climate change modeling continually grows more sophisticated, but the complexity of

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10 Grubb (1990: 287) estimates that necessary North-South transfers would amount to $100 billion per year.

the systems modeled and current limitations in technology leave predictions of future changes in the realm of the hypothetical. And yet, in the face of uncertainty that is likely to continue into the future, policy decisions must be made regarding possible ways to advance human development while diminishing its impact on nature. As illustrated by the analysis thus far, action is necessary at the local and the global levels, by private and public actors, in the North and in the South. To this end, an interest-based approach is critical. Interests are shaped by changes in information on vulnerability or abatement costs. Drawing on the analysis of Esty and Ivanova in this volume, we see functioning governance mechanisms for information and technology as critical and a forum for issue linkage and bargaining as imperative for a successful climate change regime that incorporates yet transcends national interests.

Information Provision

Given the distance, scope, and relatively hard-to-see nature of the problem, and the scientific ambiguity and magnitude of the costs involved, climate change decisions are predicated upon a complex array of data on emissions, likely impacts of human activities on the environment, and costs and benefits of abatement strategies. Measurement and indicators can make obscure phenomena such as greenhouse gas emissions seem more tangible. The "electricity meter on TV" in Bangkok provides a vivid example of this effect.

Data and information can expose uncertainties, reveal risks, and demonstrate alternatives (Esty, 2002). As new information emerges, the utility calculus of countries can shift, leading to an altered perception of interests and more optimal strategies. For example, if countries receive new evidence that their ecological vulnerability is higher or that abatement costs are lower than previously estimated, their propensity to support stronger international commitments may increase (Sprinz and Weiß, 2001).

The climate regime has developed considerable data and information capacity, drawing on research institutes around the world. It has built a sophisticated network of experts through the assessment process of the Intergovernmental Panel on Climate Change (IPCC), demonstrating the value of collaborative research and analysis across

a variety of disciplines.[11] The climate data and information initiative is an important building block for a more comprehensive environmental information initiative at the global level.

Comparative cross-country data and benchmarking on energy efficiency indicators could be developed to reveal true economic potential, identify best practices, and increase awareness and peer pressure. Greater information availability could also promote a more effective issue linkage and bargaining strategy and more efficient and equitable technology transfer.

Issue Linkage and Bargaining

Recognizing the importance of institutional incentives and flexible arrangements, the Kyoto Protocol features new mechanisms that seek to facilitate greater participation and alter incentives, including Joint Implementation, emissions trading, and the Clean Development Mechanism. These mechanisms provide flexibility in achieving emission reduction targets through the potential for contracts between countries with high and low abatement costs. As Whalley and Zissimos emphasize in this volume, a bargaining forum that allows linkage among various issues could further develop these mechanisms and provide for matching of interests and "give and take" on a series of issues of global impact and significance.

One way to breach the North-South gap might be to establish a place where environmental bargains could be struck. Many developing countries, for example, still manufacture and use chemicals known as persistent organic pollutants. These substances include pesticides such as DDT, deldrin, and endrin, industrial chemicals such as PCBs, and unintentional byproducts of industrial and combustion processes such as dioxins and furans. Persistent organic pollutants pose a serious threat to human and ecosystem health and their effects may span the globe, since they travel great distances, persist in the environment, and bioaccumulate through the food chain. A global forum for negotiation and bargaining across issues might provide a breakthrough in global

11 The IPCC was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988 to assess scientific, technical, and socioeconomic information about human-induced climate change.

governance. The United States, for example, could agree to reduce CO_2 emissions in exchange for a phase-out of persistent organic pollutants, more stringent controls for preventing influx of non-native species, forest preservation, or other issues of concern to the United States and its citizens. Developing countries would hold powerful bargaining chips in the form of natural resources of global significance. Biodiversity, tropical forests, coral reefs, and pristine ecosystems could be preserved in exchange for market access, debt relief, or immediate financial transfers.[12]

An issue linkage strategy might provide for a more egalitarian approach than current governance structures.

Emission reductions could be linked with minimizing the costs to the North of meeting reduction targets, and would also facilitate North-South financial and technological transfers based on genuine interest-based contracts rather than altruistic promises. Moreover, a bargaining approach, with a light institutional structure to oversee contract completion, could ensure efficiency in implementing obligations.

Technological Potential for a New Growth Imperative

The economic paradigm of the last hundred years of rapid growth was based on the presumption that the environment should be understood as a subset of the economy rather than the economy being a subset of the ecosystem on which it depends. Further, the supply of natural resources was assumed to be infinite and the capacity to absorb waste unlimited. Environmental services such as the ability of plants to convert carbon dioxide to oxygen, of wetlands to cleanse water, or of forests to stabilize aquifers are not assigned any economic value despite their importance to continued economic growth.[13] It was not until it became obvious that economic development and popula-

12 For a full analysis of the rationale for and the functioning of a global bargaining body, see Whalley and Zissimos, this volume.

13 Many of the ecosystem services that life on Earth depends upon have no substitute at any price. This was demonstrated memorably in 1991-93 when the scientists operating the $200 million Biosphere 2 experiment in Arizona discovered that it was unable to maintain life-supporting oxygen levels for the eight people living inside. The Earth performs this task daily at no charge for 6 billion people (Hawken, Lovins, and Lovins, 1999).

tion growth were affecting the carrying capacities of natural systems that an alternative was put forward – the vision of sustainable development.

A shift from the traditional fossil fuel-based economy to carbon-free energy systems would be the cornerstone of an environmentally sustainable economy. Indeed, as Seth Dunn of Worldwatch Institute points out, an information-age economy cannot conceivably be powered by a primitive, industrial-age energy system (cited in Brown, 2001). Technological breakthroughs can already be identified. Advanced new technologies such as hydrogen fuel cells, film-thin solar cells applicable to facades and windows, and wind turbines with long-term energy storage capacity are being developed and could dramatically alter energy needs. The transition from fossil fuels to an energy economy based on wind, solar, and hydrogen power is taking hold (see Table 1). Moreover, energy restructuring is not only feasible, it could be economically profitable.[14]

Table 1 Trends in Energy Use, by Source, 1990-2000

Energy Source	Annual Growth Rate (percent)	
	1990–2000	2000
Wind power	25	32
Solar cells	20	43
Geothermal power	4	N/A
Hydroelectric power	2	N/A
Natural gas	2	2
Oil	1	1
Nuclear power	0.8	0.8
Coal	-1	-4

Source: Brown, Lester. 2001. *Eco-Economy: Building an Economy for the Earth*. New York: W. W. Norton, available from http://www.earth-policy.org/Books/Eco_contents.htm

14 The United States, for example, could cut its annual energy bills by $300 billion by using existing, more energy efficient technologies (Hawken, Lovins, and Lovins, 1999: 243).

Technological progress is likely to play a key role in a transition toward sustainability. Technological innovation represents a double opportunity, offering prospects for improvement in both developed and developing countries. In the North, new technologies could be gradually introduced as capital stocks turn over. In the South, new, more energy efficient technologies would allow countries to bypass the carbon intensive growth typical of the North, and advance directly into cleaner energy matrices. However, new technologies often represent incremental costs and take time to develop and disseminate. Financing mechanisms for technology transfer from the North to the South would therefore be critical to meeting the rapidly growing energy needs of developing countries, while also facilitating their participation in global efforts to reduce greenhouse gas emissions.

New Ethical Imperative

The pace of progress will be determined by the most important shift that the international community still needs to make – a shift in values. As Speth argues in the opening chapter of this volume, we now find ourselves in a radically different ethical position, one that demands "active management of the planet." We need to extend our value system over space, relinquish our self-centered attitudes, and think beyond the confines of our immediate surroundings. We need to give up our village behavior as we realize that our wellbeing has become intricately tied to the wellbeing of others. We need to also extend our value system over time and overcome our propensity for short-term thinking. Global environmental challenges require long-term commitment and investment. The effects of today's environmental degradation are likely to be experienced most intensely by future generations. At the end of our lives, we must return to our children the planet we have ultimately borrowed from them.

CONCLUSION

Climate change presents the ultimate challenge to global environmental governance. The inherently global nature of the problem mandates a truly global response. The atmosphere is indivisible and greenhouse gas concentrations have a global effect. However, the multiplicity of

causes, uncertainty of timing and effects, and significant economic costs are strong deterrents of collective action. Moreover, vulnerability to climate change varies across regions, with the greatest negative impacts likely to be concentrated in the tropics and sub-tropics. While historical responsibility for climate change is undoubtedly lodged with the North, development trajectories are shifting this burden to the South. Climate change thus brings forth deep-seated North-South divisions that demand resolution. Historical fairness would have the North pay a large share of the initial climate change bill, but the existing international institutional arrangements have no authority to impose such a tab. Distributive justice entails an ability to pay approach, but even this version of fairness seems politically infeasible.

An innovative governance architecture is necessary to facilitate a leap from narrowly defined national interests to a global regime. Accurate, comprehensive, and reliable information can reveal preferences, confer negotiating power, and alter interests. Bargaining across issues holds the promise of reaching otherwise impossible agreements and directly addressing preferences for resource transfer or policy changes. A system of international mechanisms to promote changes in behavior across sectors and jurisdictions in an efficient and equitable manner will be critical to the success of a climate change regime.

Despite all the debate, the confrontations, and the frustration, we have begun to move in the right direction. The issue now is the pace at which we are moving. The longer we wait before taking serious action, the more difficult and costly it will be to mitigate global warming. Global governance, whether for climate change or for any of the myriad issues affecting the world as a whole, can only be built on the recognition of planetary interdependence. Anything short of that will keep us paralyzed while the planet's challenges grow far beyond our reach.

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