iGES

International Review for Environmental Strategies
Vol.1, No.1, pp. 17 – 23, 2000

Special Contribution

Climate Change Policy and the Sustainable Future

Dr. Hoesung Lee

President, Council on Energy and Environment Korea, and Former Co-Chairman, Intergovernmental Panel on Climate Change Working Group III

1. Introduction

One of the major challenges for sustainable development is the determination of what constitutes dangerous anthropogenic interference with the climate system as referred to in Article 2 of the Framework Convention on Climate Change. At the same time, developing countries need to find means to rescue their populations from poverty and environmental degradation. This must be done in a world where people at poverty level, living on less than U.S.$ 1 per day, number more than 1.3 billion, and where 2 billion people live without access to electricity. As the world's population doubles in the coming decades, pressures on world's resources ranging from food, energy, water and forests to the natural environment, including Earth's atmosphere, are bound to increase.

2. Challenges

2.1. GHG emissions reduction profiles

The world community does not know the acceptable concentration level of CO_2 in the atmosphere required to stabilize the climate system. But it knows through various scientific studies that regardless of the level of concentration targets, a business-as-usual future will not be tolerable and thus the GHG emissions will have to diverge from business-as-usual trends and eventually fall below the current emissions level of 6 Gtc per year. The questions are when such a departure will take place and what would it take to break away from the business-as-usual trend.

Concentration targets determine the timing of departure from and peaking in emissions. The higher the stabilization targets, the later the deviation and peak will be. IPCC studies report that to achieve stabilization at 750 ppm, global emissions must begin to leave the business-as-usual trend in 2023 and then peak in 2062. For 550 ppm, double the CO_2 level of the pre-industrial era, the required deviation will occur ten years sooner in 2013 and the peak in 2033. In both cases, emissions will have to decline eventually to between 2 and 3 Gtc per year, much lower than the current emissions of 6 Gtc per year. This is a very different world from what we know now. And divergence from the current emissions path involves costs.

The cost of stabilizing CO_2 concentrations depends upon concentration targets. As the cost reflects the difference between the business-as-usual trend and the emissions profile corresponding to a particular concentration target, stabilization at a lower concentration level will entail a higher cost than otherwise. The adjustments in economic, social, and technological infrastructure will have to begin earlier if a tighter goal of stabilization is sought. These earlier adjustments are costly. Offsetting the high cost is the prospect of reduced risk from lower levels of CO_2 concentrations in the atmosphere. The balance between the cost and risk from target CO_2 concentrations will determine the stabilization goal.

For a given stabilization target level, the cost of stabilization varies with emissions reduction profiles. A number of studies report that a more gradual reduction will be less costly because a more gradual reduction would entail less pressure for infrastructure adjustments, such as premature retirement of existing capital stocks to accommodate new technologies for lower CO_2 emissions. On the other hand, earlier action, though involving higher costs, would reduce the risk of rapid climate disturbances and increase the demand for technological improvements. The IPCC Second Assessment Report finds that "earlier mitigation action may increase flexibility in moving towards stabilization of atmospheric concentrations of GHGs; the choice of abatement paths involves balancing the economic risks of rapid abatement now against the corresponding risk of delay."

The price of delay—a piece of critical information in determining the timing of emissions reduction—is not known; climate is not traded in the market. However, the Kyoto Protocol, through limits on future emissions, has the effect of creating a de facto market for climate stabilization. To succeed in market creation, the Kyoto Protocol should be anchored to a specific stabilization target for CO_2 concentrations. Then the price of the risk of delay would be revealed and the choice of abatement path would be determined. However, the Kyoto commitments were agreed upon without any consideration of links to the stabilization targets. Thus, the cost of Kyoto commitments can be estimated, but not in the context of climate stabilization.

Nevertheless, a break away from the business-as-usual trend is rational even if a market for climate is nonexistent. Individuals and societies are risk-averse in the face of large risks and are willing to incur costs to reduce the likelihood of large risks. The cost of emissions reduction, a precautionary investment, is the risk premium—the extra amount that society is willing to pay to reduce a climate change risk. Precautionary investments may take several forms, including mitigation, adaptation, research and development to reduce future abatement costs, and continued research to reduce uncertainties about climate change and its impacts. The amount of precautionary investment for climate change that society will be willing to undertake depends upon the size of the stakes—the loss from the climate change. The precautionary investment is reflected by the divergence of the emissions path from the business-as-usual trend.

2.2. Near-term challenge: Promoting synergy between development and mitigation

Climate change is not an isolated, independent problem. It is closely related to the structure and functioning of ecological systems, affecting biodiversity loss, ozone depletion, forest loss, desertification and fresh water availability. And its implications involve global as well as local/regional environmental issues.

Thus, climate change mitigation actions provide benefits that extend beyond climate stabilization. Positive relationships between GHG policies and reduction in local/regional air pollution are well documented. For instance, improved health from reduced air pollution is expected to be substantial in many developing countries. In addition, the social costs of transportation, land use practices and energy utilization are favorably influenced by GHG policies. Also important is the fact that these related benefits are realizable in the near-term, involving less uncertainty than climate stabilization, and are local/region specific, involving less leakage than climate stabilization efforts.

This phenomenon of double dividends has been well reported. Its magnitude will depend upon the existing tax structure and types of particular tax cuts. Studies found markedly different impacts between payroll tax cuts and reduced taxes on capital.

The ancillary benefits are within the scope of no-regrets options. The existence of significant no-regrets potential has been well recognized, ranging from removal of distortional measures to establishing energy efficiency standards. Recognizing the interdependency of climate change issues with local/regional economic and ecological priorities gives policymakers a powerful opportunity to improve local/regional environmental quality as well as to address global climate concerns in a cost-effective manner.

However, implementing no-regrets actions requires changes in policy and institutional arrangements, which involve costs that may prove prohibitive due to social-political constraints. The implementation cost can be insurmountable for some countries. And there is powerful inertia in the socioeconomic systems that underwrite continued near-term increases in emissions. Energy infrastructure is fossil fuel dominant, while energy efficiency is price sensitive and energy prices are low.

During the 1990s, since the agreement of the FCCC, CO_2 emissions in OECD countries increased by 1% per year. And in the absence of the Kyoto Protocol, the OECD emissions during the commitment period are expected to rise 20 to 30% more than in 1990.

Inflexibility for taking near-term action is also visible for developing countries. In the next two decades, emissions from developing countries is expected to surpass those from developed countries. When must developing countries begin to depart from the business-as-usual trend to satisfy global requirements for stabilizing CO_2 concentrations? Studies report that for 550 ppm stabilization, developing countries would have to reduce their emissions relative to the IPCC BAU scenario around 2030 to 2035, assuming that Annex 1 countries reduce their emissions at a rate between 2.5% and 7.5% per decade, a steeper rate than required under the Kyoto Protocol (Watson 1999).

Given the large potential for ancillary benefits from reducing CO_2 emissions, synergy between economic development and mitigation would be possible even for developing countries. The immediate challenge for developing countries is to improve their standards of living—more income and healthier environments. Although CO_2 mitigation is not among the immediate tasks facing developing countries, recent evidence provides grounds for positive expectations.

The analysis of the relationship between development and environment led some researchers to claim the existence of an environmental Kuznets Curve—predicting the environmental impact of development turns positive after some level of income around U.S.$ 5,000 to $10,000 per capita. However, recent evidence shows that the turning points occur at much lower per capita incomes (World Bank 1999). This shift in turning points is a hopeful sign for future policy responses of developing countries to climate change. The factors contributing to shifts can also work towards CO_2 mitigation in the future. Studies show that two factors were attributable to the decline in the pollution intensity in developing countries: structural shifts of the economy towards less polluting industries and stricter environmental regulations corresponding to increases in per capita income and environmental awareness. Developing countries have begun to recognize that the benefits of pollution control outweigh the costs. India, for instance, reports that the annual loss from environmental degradation amounts to 10% of its GDP (TERI 2000).

The clean development mechanism (CDM) under the Kyoto Protocol can facilitate this shift and work towards generating synergy between development and mitigation. Developing countries have large pent-up demands for infrastructure investment. Such investments will be an economic opportunity for incorporation of climate change concerns into resource-use and development decisions. Currently, many operational details for CDM need to be specified. The challenge is to identify projects that contribute to economic development as well as mitigation, fulfilling the operational specifics of the CDM.

In industrialized countries, mitigation costs can be reduced significantly through the use of CDM, Joint Implementation and international emissions trading. Research results show that restrictions in the use of the Kyoto mechanisms would lead to reductions in the cost savings for industrialized countries. The cost of meeting the Kyoto Protocol commitment would rise to 2% of GDP in the absence of the flexible mechanisms. The cost would fall to 0.5% of GDP if global trading in emissions were allowed (Weyant 1999).

2.2. Long-term challenge: Development and diffusion of technologies for stabilization

There is a hundred-years trend of decarbonization in the industrialized countries. This was due to the autonomous declines in energy and CO_2 intensity. The intensity declines are expected to continue in the future due to technological advances in energy and material efficiencies and to increasing use of non-fossil energy sources. In the longer term, new technology such as carbon sequestration technologies will enhance the capacity to lower CO_2 concentrations in the atmosphere.

Running against these potentials are volume impacts and behavioral effects that tend to stimulate increases in CO_2 emissions. Volume impacts include population increases and rapid economic expansions. Behavioral effects include higher demand for larger cars, more spacious residential units, and more electrical appliances. The recent trend towards energy market liberalization leads to an increasing tendency to focus on short-term outcomes. Part of the impact can be seen in the reduction in energy R&D

in both public and private sectors in industrialized countries. This decline will lead to retreat in the frontiers of climate-related knowledge expansion required for future mitigation.

The stabilization of CO_2 concentrations requires a deliberate shifting of the world's energy system to non-carbon-emitting technologies. The Protocol is a short-term measure attempting to limit emissions. This will not stabilize global CO_2 concentrations. However, as indicated before, the emissions must decline if concentration is to be stabilized.

The influence of conventional energy technologies in the context of stabilizing concentrations is severely limited. The climate-related conventional technologies are biomass, solar, nuclear and end-use technology improvements. At most, these technologies can only fill half of the gap expected between the business-as-usual emissions trend and the emissions profile corresponding to 550 ppm—twice the pre-industrial level (Edmonds 1999). The remaining 50% gap would have to be filled by non-conventional technologies such as carbon sequestration. The new entrant technologies, conventional or not, face barriers erected by the lock-in effect of existing technologies imbedded in the infrastructure. Major global changes in technology have taken decades. Achieving a significant shift in technology base for GHG stabilization in the short-term requires more than price reductions for new technologies. A deliberate policy to initiate and promote the shift is necessary. The market alone will not achieve this outcome because climate has no market price.

The climate problem is unique. And its uniqueness makes technology even more important as well as vulnerable to failure. Its uniqueness is not limited to problems arising from the public goods characteristics of climate stabilization. The extremely long-term nature of the climate change problem generates serious intergenerational transfer issues. Any solution requires collective global action for current and future generations. However, decisionmakers must be multiplicitous in order to form global agreements, implement them on a local-level and consider future generations. This multiplicity renders climate policy development a formidable task, beyond the experiences that countries have encountered in addressing conventional environmental problems. While technology is the key, the complexity of the problem also requires innovations in the socioeconomic framework under which technology is to be developed and assimilated. Narrowly defined technological solutions will not work. And technology transfer mechanisms, a crucial instrument to meet UNFCCC objectives, will also need new configurations.

Most conventional technologies are transferred through established institutions and networks comprised of government agencies, industries and intermediaries that include consulting firms and financial institutions. This transfer system usually depends on "top-down" decisionmaking with information flows restricted to direct participants. While these attributes may lower transaction costs, they pose problems for the rapid transfer and diffusion processes needed to meet UNFCCC objectives.

The development of environmentally sound technologies on the international scale anticipated by the UNFCCC will likely be better served by a "bottom-up" approach. These technologies tend to be employed at smaller scales than conventional technologies, and require collaboration and information exchange involving a wider range of stakeholders than those who are directly engaged in the transfer of the technology. For example, energy efficiency improvements among industrial users in developed and developing countries have been identified as offering substantial GHG emissions reduction potentials at low costs. To realize these potentials, successful technology transfer will need to meet the specific requirements of a diffuse number and type of industries. The transferred technologies will often represent many small-scale changes to individual industrial operations. And collaboration will need to occur among energy producers and industrial consumers, international and local financial institutions, central and local governments, and NGOs. This can be contrasted with the transfer of cleaner burning electric power plant technology which, while technically and financially complex, involves fewer transactions and decisionmakers and the development of a small number of large-scale projects. Currently, the international technology transfer regime favors development of large-scale technologies such as cleaner burning power plants at the expense of projects improving end-use efficiencies, which may have equally far reaching impacts on environment and climate.

Successful transfer of technologies will depend upon host and donor countries having compatible organizational, technical and policy capacities. Traditional models of capacity building have focused on enhancing the technical skills of host country experts through donor-organized training and education. This one-way model needs to be supplemented by two-way approaches in which a host country communicates its needs and the context for the successful fulfillment of its needs. “One way” models are inadequate for the transfer of environmentally sound technologies because their application in developing countries usually requires significant adaptation and redesign to reflect local conditions and infrastructure.

The role of technology in meeting the long-term challenge becomes clearer when considering the decisionmaking process for climate change. Because of uncertainty and lack of information, climate change decisionmaking is a continuum of strategic decisions utilizing new and better information along decision paths. “Act, then learn, then act again” best summarizes decisionmaking strategies related to climate change. Research and development provide linkages in the sequential process that allow mid-course corrections based upon new information and knowledge. The fundamental contributions of research and development in the climate decisionmaking process are to create options for responses to uncertain climate changes and to reduce uncertainties about climate change.

2.3. Fundamental challenge: Sustainability

Sustainability is at the heart of the climate issues. The resolve, described in the FCCC, to stabilize the atmospheric concentration of GHGs at a level to prevent “dangerous” anthropogenic interference with the climate system reflects the world consensus for pursuing sustainable development. The question of sustainability depends upon resource substitutability. If resources are perfect substitutes for one another in the production process, sustainability should not matter. The implication is that as long as environmental degradation or use of non-renewable natural resources could be offset by increases in capital stock sufficient to ensure future generations the same standard of living, development would be sustainable (Solow 1992). The question is: can man-made capital substitute for all types of natural capital? This must be answered for all current and future requirements.

There are, in reality, limits to the ability of man-made capital to substitute for natural resources, although technology may expand to some extent the ability for substitution. For many of the goods and services produced by ecosystems, including "regulation of climate, purification of air and water, detoxification and decomposition of wastes, generation and renewal of soils, protection of coastlines, pollination, control of pests, seed dispersal, creation of biodiversity, provision of cultural, religious and aesthetic values, eco-tourism, it is not possible to provide human substitutes" (Yohe 1999).

With limits on substitution, sustainable development requires that restrictions on the use of natural resources be restricted to some "safe standards". Then, the central question is what constitutes and how to determine the minimum threshold levels for each component of the natural resource system. This question remains to be answered. Unbiased scientific research and social consensus, built upon science-based information, will be required to understand and determine thresholds. In the climate context, this threshold is the level at which there is dangerous anthropogenic interference with the climate system.

Research needs are enormous as important gaps in knowledge exist regarding climate change and sustainability: socioeconomic constraints and opportunities facing developing countries in climate change mitigation; climate-related technology diffusion in a globalized market economy and alternative development patterns. Policymakers face significant scientific uncertainties in assessing the balance between taking precautionary measures and delaying responses to climate change risks. Research can provide policymakers with more information and options for addressing climate change with a view to attaining sustainable development.

References

Edmonds, J. 1999. Toward a technology greenhouse strategy. *Consequences* 5, no. 1:17-28.

IPCC. 1996. *Climate change 1995: Economic and social dimensions of climate change,* edited by James P. Bruce, Hoesung Lee and Erik F. Haites. Cambridge: Cambridge University Press.

Tata Energy Research Institute. 2000. *The Green India Project.*

Watson, R. 1999. Key policy issues after COP 4. *The sustainable future of the global system proceedings.* United Nations University/Institute of Advanced Studies, 23-24 February 1999, Tokyo, Japan.

Weyant, J. 1999. The cost of the Kyoto Protocol: A multi-model evaluation. *The Energy Journal, Special Issue.*

World Bank. 2000. *Greening industry: New roles for communities, markets, and governments.* New York: Oxford University Press.

Yohe, G. 1999. Economic sustainability, indicators and climate change. *Climate change and its linkages with development, equity, and sustainability, proceedings of the IPCC expert meeting,* 27-29 April 1999, Colombo, Sri Lanka.