A Credible Commitment

Frank Loy and Bruce Smart

Consider these three propositions: The scientific case for action on man-made greenhouse gas emissions is clear. Voluntary actions to limit emissions alone are an insufficient response. The U.S. economy needs an early credible signal from government that there will be a cost to carbon emissions in the future.

Each of these conclusions would have been disputed ten or even five years ago, and the papers in this volume and the discussion that they engendered would have been very different. A diverse group of business leaders,scientists, environmentalists, and present and former government officials, meeting for two and a half days at the Aspen Environmental Policy Forum to discuss United States climate change policy, in large part, albeit not always unanimously, accepted these conclusions.

They were aided by important real world experience gathered during the past decade.

- The science of climate change has become clearer and more persuasive – the result of extensive research by many of the world's top experts, reviewed and made accessible by the Intergovernmental Panel on Climate Change.

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- An array of voluntary actions has been undertaken for at least the past ten years, and their effectiveness can now be judged by examining actual results.
- A real international agreement to reduce greenhouse gas emissions now exists, one that we can study and evaluate.

While the Aspen group was not of one view on some difficult issues presented, they were generally in agreement – and persuaded us as co-chairs – on several important points:

- The science is quite clear that the earth is warming because of increased concentrations of greenhouse gases (GHGs), caused principally by human action such as the burning of fossil fuels and deforestation.

- The potential consequences to the earth are likely to be serious – possibly disastrous – and require taking measures now to curb GHG emissions.

- The 1992 Rio Framework Convention on Climate Change ("the Rio Convention") sets a suitable goal: *stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.*

- It is too difficult and perhaps premature now to convert that general goal to a widely-accepted specific concentration level. However, there is agreement that in order to meet the Rio goal, we must begin soon to bend downward dramatically the present rising curve of annual emissions. Achieving even modest results will require more than modest efforts.

- Technology is critical – both to upgrade and more widely deploy current best practices, and to develop and diffuse innovations in fuel and efficient production and use of energy. Better ways to use sinks also need to be developed. Government support of energy and climate R & D has fallen in recent years. This trend must be reversed, and incentives for more rapid adoption of newer technologies provided.

- It is important to signal reductions soon. Delay may effectively foreclose our ability to meet whatever targets we later decide are necessary.

- Ten years of U.S. experience with voluntary measures to reduce GHG emissions demonstrates that, while these measures have some effect, and are good laboratories for new approaches, they are insufficient to meet the challenge. (See Gardiner, this volume.) Throughout the '90s, when many voluntary programs were in effect, emissions rose by over 13%.

- If U.S. businesses and consumers are to take meaningful steps to reduce emissions, they need a "signal" that carbon emissions are not free. An early strong signal – a credible commitment by government – is essential. Certainty that the future cost of carbon emissions will rise steadily is more important than the initial cost imposed.

- Finding the right signal requires balancing economic effectiveness with political realities. Using market forces is preferable to prescriptive regulation. In theory a tax on carbon would be both the fairest kind of signal and the most efficient one. But politics make it unlikely to be accepted soon.

- The most efficient and effective of the politically viable options would be a "cap-and-trade" system, under which the government would set a cap on emissions from the entire U.S. economy, declining each year, while giving emitters an opportunity to minimize the cost of staying under the cap by a system of emission trading. An alternative but less comprehensive way to start would be a cap-and-trade system only for the electric power generation sector (one third of U.S. emissions). However, any such sector specific plan must be designed to facilitate a transition to an economy-wide approach.

- Biological sequestration of carbon dioxide (CO_2) is an inexpensive and currently available way to withdraw carbon from the atmosphere. The problems of measuring and accounting for the use of such "sinks", although not yet adequately resolved, seem manageable. There is also exciting potential in research into "capturing" CO_2 and subsequently sequestering it in sub-surface geologic formations.

It is useful to explore these propositions more closely.

The Scientific Background

To address the problems that GHG emissions pose for the earth's climate, one should understand the underlying science.

The presence of naturally occurring gases in the earth's atmosphere, such as water vapor, carbon dioxide,methane,and nitrous oxide among others, creates a natural "greenhouse effect". It permits sunlight to reach the earth's surface, but restricts radiation of heat back into space. Some emissions are cycled back into natural "sinks" – growing forests, the soil and the oceans. This heat capture system raises the earth's temperature to a level sufficient to force heat out through the greenhouse gas shield to balance that coming in from the sun. Over many millennia the result has been a relatively stable range of surface temperatures that has fostered and sustained life on earth.

However, since the beginning of the industrial age, human activities have increased the concentrations of important greenhouse gases including CO_2, methane,nitrous oxide, and a variety of manufactured gases such as chlorofluorocarbons. For example, since 1800 the atmospheric concentration of CO_2 has increased from 280 parts per million (ppm) to 370 ppm. This rate of increase is without precedent, attributed principally to anthropogenic GHG emissions, primarily from burning of carbon-based fuels,and secondarily from the removal of forests. Growing emissions have outrun the balancing uptake by natural "sinks". And, because these emissions have long atmospheric lifetimes, on the order of decades to centuries, they have led to sharp increases in atmospheric concentrations of the gases. Greater concentrations have caused a rise in average global temperature,unevenly distributed, of about 0.67 degrees Centigrade since the late 19th century.

Increases in GHG *emissions* will not be immediately reflected in corresponding temperature and climate changes. These changes stem from increases in GHG *concentrations*, and occur more slowly; a lag of decades as natural sinks absorb CO_2, and water in the oceans warms gradually. Even if anthropogenic emissions were now eliminated, it would be many years before global warming peaked.

While the scientific principles above are almost universally accepted, and the potential severity of the consequences were taken as a given at the Aspen Forum, there remain uncertainties on the timing, location,and extent of eventual climate changes. It is not known whether climate will react in linear fashion to greater warming (think of a rheostat) or by sudden extreme events (think of a light switch). Despite these uncertainties, the need to take action was not questioned by the Aspen participants. This fact is a newsworthy and encouraging outcome of our session.

Setting a GHG Concentration Goal

There are two reasons to set a numeric goal for the concentrations of GHGs. First, we need to establish the concentration that will meet the Rio Convention goal to "stabilize GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system". The issue is discussed by Wigley (this volume). The best answer is not certain, but the numbers revolve around 550 ppm of equivalent CO_2 concentration, a doubling of the pre-industrial age levels. (Equivalent CO_2 concentration is a measure of all the GHGs, expressed in terms of the amount of CO_2 that would have the same impact. See Wigley, pages 16-17.) Krupp (page 76) suggests that stabilization at 450 ppm CO_2 equivalent may be essential, while others suggest goals of 750 ppm or higher.

Second, without a specific, quantified goal it is tough to energize a nation to tackle the problem seriously. How do we know at any stage whether we are being successful or unsuccessful? How can we tell whether a particular effort is significant enough to be a meaningful step toward our goal?

Yet we concur in the Aspen group's general agreement that it may be too early to identify a precise target for eventual maximum CO_2 equivalent concentration. What cannot wait, however, since at some point GHG concentration must stabilize, is the urgent task of deflecting emissions from an increasing to a decreasing trajectory. The beginning target of a return to 1990 emission levels (also a part of the Rio Convention), while not sufficient, is an interim waypoint toward which to aim. The task is daunting: to maintain any given level of concentration, net global CO_2 emissions must decline indefinitely over the centuries ahead toward virtually zero. (See Edmonds, page 47.) For concentrations, and

thus global temperatures, to remain stable,it appears that emissions to the atmosphere cannot exceed the amount that is absorbed by sinks.

The Role of Technology

One cannot achieve the necessary level of reductions of carbon emissions without extraordinary advances in technology. Advances must come in a variety of fields: new energy efficiency technologies; much broader use of currently available sources of energy – such as wind, solar and the burning of biomass – which are not broadly used because of cost or other reasons; safer and more economical nuclear power production and waste storage; the development of totally new forms of energy, specifically hydrogen; and improved or new methods of sequestering carbon.

What steps will bring about such technological advances? At present, we have a striking disconnect between a traditional American enthusiasm for, and reliance on, new technology, and the absence of incentives for the businessman, the homebuilder, or the car manufacturer to develop and deploy new technology. The most important way to overcome this disconnect is for government to give a signal – to make a credible commitment – that carbon emissions have a cost. A higher price for energy, a government-mandated cap-and-trade system, or specific regulations to reduce emissions could all constitute such a signal.

Concurrently, we also need government to increase financial support of research and development in the areas described above. Unfortunately, both globally and in the U.S., recently the reverse has been the case. As Edmonds shows (pages 54-55), except in Japan, public expenditures dropped rather than rose during the period 1985-1995.

Timing is critical. Technology that totally transforms a system takes decades to invent, perfect and install. If we are to deflect emissions from the current path, we first need to improve systems with methods already understood. It would be folly to place all our bets on technology innovations, and not take steps that can bend our emissions curve downward much sooner.

We also need to develop the holy grail of the transport sector – an automobile that runs on pure hydrogen,and to develop the new infrastructure needed to

provide that hydrogen to motorists. No single technological advance would do more to reduce our emissions levels. Yet we know that such a development is many years in the future. With equal urgency we need technological (and institutional) improvements that will decarbonize the electric utility sector.

The Timing of a Response

How quickly to introduce signals or regimes that will reduce emissions is of huge importance, and quite controversial. We examined the argument that, while a technological response is clearly required, new technologies will be developed over the next decades for reasons unrelated to climate change, and that waiting until they are available would mean significantly lower costs to reach whatever reduction objectives are eventually set. Furthermore, this argument goes, any premature retirement of economically useful plant and equipment will be unacceptably costly.

The answer to this line of reasoning lies in the unforgiving mathematics of global warming: emissions are cumulative, remaining in the atmosphere for hundreds of years. What we emit now adds to that accumulation. If later we determine that a tough concentration target is necessary, delay in starting reductions may foreclose our ability to meet that target. And it surely will increase the cost of meeting any given concentration target unless a serious, and successful, effort to develop new technology is undertaken.

The growing demand for energy means that much of our long-term energy infrastructure will be fixed in the near future. China and other countries in the developing world could add enough new electricity generation in the next decade to almost double their entire existing capacity.

The demand for automobiles is similarly growing. If new cars are oil-fueled, (as most will be for at least a decade), if their average life is over fifteen years, and if they are no more efficient than current models, it will be nearly impossible to significantly reduce emissions from transportation in the next two decades, and the investment required in other sectors to make up for this failure would be impossibly large.

As one participant noted: "The developing countries' schedule for investing in energy systems is front-end loaded, so the time to affect that footprint is now. If we miss this window, that's a big problem."

The Need for a Strong Signal

Reductions in emissions require changes in the way we design, produce, and use the goods and services of our society. This calls for new technologies, new ways of doing business, and new systems – as well as broader deployment of technologies that are already available but not widely used.

What incentives can we provide to stimulate these changes? Absent a signal from government – a credible commitment that carbon costs will increase steadily over time – most players will respond only to current economic forces, which exclude the economic and social cost of the carbon emissions. In such a business-as-usual scenario, emissions will continue to rise as population and economic activity increase. (See Edmonds, page 48.)

Most European countries and Japan have available a wide array of initial signals – both currently employed and planned. These include high energy prices (including taxes) and some specific regulations designed to increase energy efficiency. More recently, both the EU and the UK have accepted the concept of a cap-and-trade system for GHG emissions, something they resisted for years in the negotiations leading to the Kyoto Protocol.

While other nations employ these signals, the political environment in the U.S. resists many of them. Many see our traditionally low energy prices as an entitlement. Numerous energy-inefficient regulations and subsidies have developed powerful constituencies. Attempts to increase corporate average fuel economy (CAFE) standards for automobiles have met with labor and industry opposition, claiming high costs of reductions, safety concerns, consumer preferences, competitive disadvantage, and job loss.

But we do have an array of signals at our disposal: both positive and negative. Negative signals – below full-cost energy prices, energy subsidies, and reliance on drilling as the answer to rising oil imports – suggest to business and the public that emissions and environmental damage do not matter. As such, they discourage progress towards lower emissions.

Positive signals can have varying degrees of strength. What would be most useful is a credible governmental commitment that carbon costs will rise steadily. The road to such a commitment can take several forms, and even the gentler ones can be helpful in getting started. Some that appear useful, roughly in ascending order of impact, are:

- Mandatory reporting of GHG emissions, with public disclosure.
- Strong government support for R & D for energy efficiency and conservation.
- Use of government purchasing power and incentives to accelerate the introduction of more efficient vehicles, appliances, and other energy consuming devices and activities.
- Multi-pollutant legislation for electric power plants including a limitation on CO_2 emissions.
- Significant increases in CAFE requirements for autos and light trucks.
- Mandatory retirement of inefficient old power plants,needed particularly if there is no legislation limiting CO_2 emissions.
- Joining an international regime, such as the Kyoto Protocol.
- An economy-wide cap-and-trade program or a carbon tax.

In the latter options on this list,the signal can and should be given early and adequate lead time allowed.

An International Signal: The Kyoto Protocol

The U.S. rejection of Kyoto sent a negative signal, but for those countries that have accepted it, Kyoto provides a strong positive signal. International efforts to reduce global emissions began with the Rio Convention adopted in 1992. But it soon became clear that the Rio Convention's failure to provide legally binding targets and timetables, and an incentive-based framework to govern the reduction

effort, made it a noble but ineffective charter. The Kyoto Protocol of 1997 was an effort to overcome these defects. It, too, was something of a skeleton agreement, lacking specifics that would make it workable, signable and ratifiable. These shortcomings were addressed in a series of Conferences of the Parties to the Protocol, ending with the agreement reached at Marrakech in late 2001.

The Protocol contemplates a long-term regime where each nation is limited in specific commitment periods to a diminishing level of annual emissions. In the first of these, each industrialized-country party has taken on a legally binding total emissions target, expressed in a percentage of 1990 emissions. In this period the actual aggregate reductions by virtue of the Protocol are likely to be modest. However, the parties to the Protocol clearly have undertaken a "credible commitment" to give carbon emissions a cost. The establishment of the architecture for more significant future progress, including the participation of developing countries, is significant.

It is particularly disappointing that the U.S. dropped out of the Kyoto process, for the mechanisms to achieve the required reductions finally agreed to have exactly the flexibility the U.S. had sought. These include coverage of all GHGs, not just CO_2, and the ability to trade among them; the ability to bank and trade credits, allowing market forces rather than governments to determine where reductions should be made; the ability to gain credits by investing in other countries, including developing countries, where emission reductions may be less expensive; and the ability to meet a portion of the obligations by offsetting emissions with the sequestration of carbon.

Kyoto addresses the issue of fairness. While developing countries were not required to take on quantified targets in the first commitment period (2008-2012), it does impose upon them requirements to measure and report their emissions. More fundamentally, it constitutes the beginnings of a worldwide system, to match the worldwide nature of the problem. At the Aspen Forum it was thought by most that, at an appropriate time, we should reconsider our decision not to participate in the Kyoto process. But there was also agreement that is not going to happen soon, and thus we need strong signals domestically.

A Domestic Cap and Trade System

If political reality in the U.S. precludes a carbon tax,the most credible, effective and fair government commitment is a domestic cap-and-trade system. This approach, as President Bush noted recently, has been used with huge success to reduce sulfur dioxide emissions to prevent acid rain.

In a CO_2 or GHG cap-and-trade program, the government would set a ceiling on total emissions and establish a flexible trading system that uses the market to find least cost ways to reduce emissions. We were able at the Aspen Forum to review a particular version of such a system (Morgenstern, this volume) that offers solutions to most of the problems such a concept raises. For example, by requiring energy producers rather than end-users to obtain the emission permits (i.e. at the mine mouth for coal, at the refinery gate for crude oil, and at the initial point of distribution for natural gas) the system greatly simplifies administration and reduces transaction costs. Virtually all domestic emissions would be covered by about 2,000 permits.

A number of politically charged questions need to be answered in shaping the optimum system:

- Is such a system politically achievable? Many oxen would be gored,and one can imagine substantial efforts to carve out exceptions that would destroy its fairness and raise the cost of GHG reductions.

- Should the system cover the entire U.S. economy, or only one of its sectors? A system that covers the entire economy is clearly the most economically efficient; its cost to the economy would be less because it would find the cheapest sources of emissions reductions from the widest spectrum of options. It would also be the fairest. But it may be politically easier and quicker to enact a system covering only the electricity sector (see Cassidy, this volume). Of course, it is important that no sector-specific initiative impede the possible transition to an economy-wide system.

- How would emission permits be distributed? Should we give away permits on the basis of past emission levels, which would tend to discriminate against those who have already taken steps to reduce emissions, or auction

permits to the highest bidders? We concur with those at Aspen who favored auctions to distribute at least a portion of the permits. The auctions would be revenue neutral, with revenues matched by reductions in other taxes, or used to compensate sectors that would be particularly harmed by the regime.

- How can the level of the cap be established, since estimates of the cost of cutting emissions vary so enormously, depending on the assumptions used (see Weyant, this volume). High costs and damage to the economy are often cited as a reason for inaction. On the other hand, models predicting low costs and even benefits to the economy are cited by proponents of strong early action. A proposal to include a limit on cost, a "safety valve" (see Morgenstern, this volume),was discussed at Aspen. While such a provision would remove the certainty of achieving a desired level of reductions, it does provide a ceiling on the cost of reductions. Thus, it seems worth consideration if it holds the key to removing a central political argument against action.

Conclusion

Shortly after the Aspen Environmental Policy Forum, President Bush said in his State of the Union address that he was determined to combat terrorism, from whatever source it may come. "We will be deliberate," he said,"yet time is not on our side. I will not wait on events, while dangers gather."

The threat of climate change, while less visible, is similarly dangerous, and one could apply the same words of urgency to it. In a subsequent February speech on the environment the President endorsed the international conclusion that greenhouse gas concentrations in the atmosphere must be stabilized. For this he is to be commended. But that goal can be realized only by establishing some regime that assures that we will begin soon actually to decrease GHG emissions (as other industrialized countries have done). The program he has proposed takes no meaningful steps in that direction, instead deferring any action until 2012.

This position needs to be rethought, for without early and responsible action to reduce the emissions of GHGs we risk burdening succeeding generations with more and more violent storms, rising sea levels, mass migrations of people displaced by

flooding or crop failures, the spread of tropical diseases, and increasing extinction of plant and animal species.

Because most shifts in climate will occur gradually over many decades, there will never be a single, world-changing event like the attacks of September 11 to glue Americans to their televisions and cause them to call for government action to repel threats to their climate.

And yet, as we noted at the beginning of this article, even in the absence of such a transforming event, the participants at Aspen found areas of agreement that would have been disputed as recently as five years ago.

It is precisely this that creates the opportunity and the need for leadership. Our political leaders – in both the Administration and the Congress – must provide that leadership. When they do, we believe they will find a surprisingly unified country ready to follow.