CLIMATE CHANGE: ACTIONS, NOT TARGETS

Chris Green

As the Harper government searches for an effective climate policy it should focus on actions, not targets. Avoiding commitments to greenhouse gas (GHG) emission targets should apply not only to the government's domestic agenda, but to the position Canada takes at international gatherings such as the one to be held in Bali to consider post-Kyoto targets. Chris Green of McGill University explains why commitments to emission reduction targets are not credible and stand in the way of the energy technology revolution/race needed to stabilize the climate. He also explains why global carbon dioxide emissions have tripled since 2000, relative to the 1990s, and sets out actions that Canada could take to slow, then begin to reduce, its emissions.

Pour se doter d'une politique climatique efficace, le gouvernement Harper devrait privilégier l'action plutôt que les cibles. Et il devrait éviter les engagements relativement à la réduction des émissions de gaz à effet de serre non seulement dans le cadre canadien, mais également dans les rencontres internationales comme celle de Bali, qui examinera les cibles de l'après-Kyoto. Chris Green, de l'Université McGill, explique en quoi les engagements de réduction n'ont rien de crédible et pourquoi ils freinent l'avancée de la révolution des technologies énergétiques indispensables à la stabilisation du climat. Il explique aussi pourquoi le taux des émissions de dioxyde de carbone a triplé dans le monde par rapport aux années 1990 et propose des mesures qui permettraient au Canada de modérer, puis de réduire ses émissions.

As the Harper government searches for an effective climate policy, it faces domestic and international pressure to have Canada sign on again to emission reduction targets. Canada should refuse to do so. Climate change is too serious a problem to justify another round of emission target setting. Kyoto, it seems, was one round too many.

If Canada wants to make a *real* contribution to climate stabilization, it should avoid commitments (domestic or international) to emission reduction targets, whether of the near-term (Kyoto) variety or the much-longer-term type (such as those proposed by the G8 for 2050, or those being considered by the Canadian government). Instead, the government should set out a list of doable actions that could make a significant contribution to energy system transformation, which will be essential if there is to be any hope of stabilizing the atmospheric concentration of greenhouse gases (GHGs). Then it should follow through. The issue here is not "voluntarism," but what Canada should commit to. Commitments to targets lack credibility, as indicated below, but commitments to actions, including but not limited to a carbon price policy, can be credible.

It is not difficult to set forth the outlines of a potentially effective climate policy. Unfortunately, what may be effective is not necessarily politically acceptable. In fact, it now seems that the main barrier to an effective climate policy is the obsession with emission targets — a legacy of the Kyoto Protocol.

Emission targets stand in the way of concentrating on actions whose payoff is mainly beyond the targeted time frame. Worse, because of an effective effort by climate change "campaigners" to portray the Kyoto Protocol as the (last?) best hope of humankind (at least on the climate change front), emission targets have now taken on a life of their own, particularly in political arenas susceptible to grandstanding behaviour. The evidence is all around us.

Currently, political pressures are mounting for agreements on post-Kyoto emission-reduction mandates. Canada (and hopefully some other nations too) should resist these pressures. Canada should push for commitments to actions that reduce emissions, but *not* to emission targets. Canada should emphasize that mandated emission reduction targets put the focus on *ends* rather than on the technological *means* of achieving those ends. Because targets are assessed only rarely in terms of what is doable but usually in terms of what pressure groups think ought to be done, target-based policies lack credibility in virtually the same proportion in which they are politically popular. The Conference of the Parties (COP)

meeting in Bali in December will indicate whether there is a sufficient number of countries prepared to say that the target-setting emperor "has no clothes," and are ready to bring to at least a temporary end this failed approach to climate policy.

In what follows, I want to address two issues. First, are long-term (40-to-50 year) targets any better than shorter-term ones? I tackle this issue by considering the case of the G8 proposal that global carbon dioxide (CO_2) emissions be cut to one-half the global current level by 2050. (The G8 proposal also has implications for the achievability of Canada's proposed 2050 emission reduction targets of 45 percent, or 65 percent below 2003 levels.) Second, what actions could Canada take that would be effective and doable? What I have to say on each of these two points should make doubly clear why I think it is a bad idea to support another round of Kyoto-type emission reduction targets.

It is not difficult to set forth the outlines of a potentially effective climate policy. Unfortunately, what may be effective is not necessarily politically acceptable. In fact, it now seems that the main barrier to an effective climate policy is the obsession with emission targets — a legacy of the Kyoto Protocol.

The potential harm done by setting long-term targets is illustrated by discussions that took place at the G8 meeting last June. The host of the meeting was Germany, and Chancellor Merkel wanted the G8 to sign onto an agreement to aim for a 50 percent reduction in global emissions from 1990 levels. President Bush refused to go along, but under pressure appeared to agree that a 50 percent reduction from current levels could be seriously considered. The final communiqué emphasized the apparent agreement on the target of 50 percent by 2050.

As is usual when discussions of targets come up, at the G8 meeting the emphasis was on what *ought* to be done rather than on what *can* be done. Had the appropriate arithmetic been done, it would have been clear that a reduction of global CO_2 emissions from 8 gigatonnes of carbon (GtC) in 2007 (emissions were 6 GtC in 1990) to 4 GtC in 2050 is for all intents and purposes out of the question. Why? Because it is tantamount to requiring a transformation of energy systems and economies sufficiently great that, on average, the world as a whole would in 2050 have the same carbon intensity (carbon emissions divided by GDP, expressed as C/GDP) as Switzerland had in 2004. And, moreover, that transformation would have to occur by 2050, while the world is limited to a GDP growth rate averaging 2 percent. A 2 percent GDP growth rate is about half the present world GDP growth rate, measured in purchasing power parity (PPP) terms.

Let me put the implications of the G8 proposal in perspective. Switzerland's economy, with its emphasis on high-value, low-energy-using industries such as manufacturing watches and banking and finance, could not be more unrepresentative of the world's economies, especially the more rapidly growing and populous ones. Moreover, because Switzerland purchases (imports) most of its electricity from abroad (France), it uses even less energy, making it even more unrepresentative of world economies. Not surprisingly, Switzerland has the lowest carbon intensity of output in the world.

But even if the required energy and economic transformations were possible, they could not happen by 2050. Energy and economic structural transformation is slow. Only 43 years remain between now and 2050. Much energy capital equipment and infrastructure has a life of 50 years or more. Moreover, the replacement of fossil-based energy systems by carbon-emission-free system to any significant degree awaits science- and engineering-based technological breakthroughs. And waiting in the wings (or just beginning to appear on stage) is the long-awaited economic development of the most populous parts of the world. These are proving to be huge consumers of energy — and necessarily so. The evidence of this can be seen in Asia. A comparison of global emission numbers in the 1990s and in the first several years of the present decade will illustrate this.

Whereas in the 1990s carbon dioxide emissions from the combustion and flaring of fossil fuels grew at an average annual rate of 1.0 percent, in the first six years of the 21st century they have grown at a rate of 3.1 percent. Although it may be coincidental that the three-fold increase in the rate growth of emissions has occurred during "Kyoto years," the rising rate testifies to the essential irrelevance of emission target setting in general. It behooves us, therefore, to consider why the world is moving rapidly in the "wrong" direction so far as CO_2 emissions are concerned.

The answer does not lie with the US, as some would have us think. True, the US did not ratify the Kyoto Protocol, and it was until very recently the world's largest emitter. But from 2000 to 2005, US emissions grew at an average annual rate of less than 0.5 percent, compared with 1.0 percent for Europe as a whole, and 2.5 percent for Canada. Rather, the answer lies in the rapidly developing world, especially Asia. But the point here is not to shift the blame. On the contrary, it is time to recognize that the developmental success story comes with a huge shift in the location and relative importance of the most energy intensive industries.

The best example is China, which now accounts for 48 percent of the world's production of cement, 49 percent of the world's production of flat glass, 35 percent of its steel and 28 percent of its aluminum. The list could go on, but suffice it to say that these are among the world's most energy-inten-

sive industries, with energy-to-output ratios (energy intensities) about 10 times higher than those of most other manufacturing industries.

The important point is that as development proceeds, rural populations move to cities, but to an increasing extent not to shanties and slums but to high-rise buildings on broad streets that are very energy-intensive. This process will continue for decades, not only in China, but all over Southeast and South Asia and eventually in Africa, until well after the middle of the century.

As a result, we have only begun to see the surge in global energy use that the transformational development process now involves. And with that development process and energy surge will come a GHG emissions surge that will terminate only with a transformation of the world's energy systems. Not only will that transformation be a slow process, but the necessary energy technologies are not, for the most part, ready yet. And they will not be ready if we focus on emission targets rather than on the energy technology race needed to bring to fruition technologies capable of large future emission cuts — cuts that could eventually bring about a stabilization of the climate.

In sum, by targeting a 50 percent global emission cut by 2050, the G8 is creating expectations that almost certainly cannot be met. Worse still, it has whetted climate policy appetites for equally unachievable nearer-term emission reduction targets. An example is the 2020 target of a 25 to 40 percent cut from 1990 emission levels for developed countries that came out of a recent climate conference held in Vienna. Another example is the proposed 2050 targets for Canada. A 65 percent reduction from 2003 emission levels would commit Canada to achieving, by 2050, a carbon intensity half that of Switzerland in 2004. A 45 percent cut would imply Canadian carbon intensity in 2050 slightly higher than that of Switzerland in 2004. Models that suggest that these targets are achievable, and with relatively little cost and using existing technologies, are, in my view, simply not credible. At the very least they should be subjected to reality checks.

Talk is cheap, but it does not reduce emissions. Time spent on negotiating essentially ersatz emission reduction targets to please various pressure groups is time wasted. We have wasted the last decade and we will waste another one if commitments to specified emission reductions/levels (targets) are considered the centrepiece of climate policy.

The preceding discussion makes clear why I think international agreements to reduce global emissions make little or no sense. That still leaves open whether certain countries might usefully commit to meeting specified emission targets. By setting out what Canada can do, I make clear why I think emission targets are at the least unnecessary, and will probably harm the possibility of eventually making substantial emission reductions. Here then is a short list of some things Canada can usefully do.

- Undertake major carbon capture and storage (CCS) projects in Alberta and Saskatchewan. Electricity generated by coal-fired plants and particularly from the facilities used to mine and process the oil sands is an important source of emissions growth in Canada. A number of leading companies have shown a willingness to tackle this problem. It will be expensive. The Alberta government has already indicated a willingness to put up some funds. The federal government should also do so, on behalf of all Canadians. (We are all in this together!) While the companies will have to foot the bill for the retrofits that make carbon capture possible, the federal and provincial governments should foot a substantial portion of the cost of the pipelines and readying the storage areas. If such an undertaking were successful, Canada would provide a real example to the world of the potential of CCS to cut emissions from fossil-fuel facilities. Globally we cannot even think about emission reductions unless some of the emissions from coal-fired electricity generating plants can be captured and safely and securely stored. In my view, this one project, if it succeeds, would be worth many times more than any Kyoto-type agreement.
- Make greater use of nuclear power, especially in eastern Canada. Nuclear power is not the "silver bullet" that some of its proponents make it out to be, but as with CCS, it is hard to see how the climate can be stabilized in the 21st century without an important contribution from power generated by nuclear fission. All the forecasts suggest that the global demand for electric power will grow rapidly, even with big improvements in energy efficiency. The world now seems on the verge of a nuclear power comeback. Atomic Energy of Canada was a contributor to the earlier development of nuclear power. There is no reason why Canada should not be part of a global resurgence of nuclear power, built on much improved plant design and

Switzerland's economy, with its emphasis on high-valued, low energy-using industries such as watches, banking and finance, could not be more unrepresentative of the world's economies, especially the more rapidly growing and populous ones. Moreover, because Switzerland purchases (imports) most of its electricity from abroad (France), it uses even less energy, making it even more unrepresentative of world economies. Not surprisingly, Switzerland has the lowest carbon intensity of output in the world.

waste storage arrangements.

- Raise energy efficiency standards. Canada should set energy efficiency standards for new buildings and appliances and, with the cooperation of the US, for automobiles too. While most economists do not like efficiency standards, especially for automobiles, the present approach of relying on biofuels, especially ethanol, does not appear to reduce energy usage (or emissions) when one analyzes it on a life-cycle basis.
- Require the installation of geothermal energy for new buildings. Geothermal energy is a potentially useful means of providing space conditioning (heating and cooling) for buildings. As part of new building standards, Canada should consider introducing a requirement that the piping required for accessing geothermal energy be included in the original construction.
- Develop storage for wind and solar energy. Wind and storage energies are increasingly popular forms of "alternative" energy. But their growing popularity will soon outstrip their usefulness unless economical and large-scale storage, suitable for utilities is developed — and sooner rather than later. Wind and sun are intermittent and variable sources of energy, and sun is useless at night. Without storage they will necessarily play a niche role. Electricity utility administrators can handle only a small amount of variability in the supply of energy (production); it is already quite a task to meet variability on the demand (consumption) side. But developing good storage (other than "pumped" and big dam hydro storage) has proven a very difficult basic science nut to crack. Canada should join up with the US and a few other countries to undertake a crash program to develop utility-scale as well as small-scale means of storing electric energy (or energy that can almost immediately be converted to electricity). Incidentally, if utility-scale storage could be developed, nuclear plants, which are most efficient when run constantly, could store power that is generated overnight for use the next day, thereby economizing on the amount of nuclear capacity required to meet specified loads over the diurnal cycle.
- Introduce a price for carbon. The best way to do this is to institute a carbon tax — one that starts low, say at $10 per tonne of CO_2, and then rises slowly but automatically over time. The carbon tax would send a useful price signal to those considering future investments in carbon-intensive energy equipment and projects. The tax would be rebated if the carbon is captured and then safely stored in geologic deposits. A carbon tax is far superior to a tradable emission permit system — the so-called "cap and trade" (CAT) system. CAT programs are administrative monstrosities, are prone to price variability that only the financial (hedge fund) industry would welcome and can lead to both unwanted redistributions of wealth as well as the scams such redistributions are all too likely to attract. Finally, tradable permits are a tax in disguise — and a very bad one on most criteria. If we want to price carbon, the appropriate method is a carbon tax. It also has the added benefit that it would raise revenues that could be used to reduce other taxes, contribute to financing emission-reducing energy infrastructure, and fund basic, science-driven R&D in new energy technologies. Because current governments cannot tie the hands of future governments, the only way to provide some confidence that a rising carbon tax (price) will not be reversed or rescinded at a later date is to start with a low tax and then raise it slowly. (The same, of course, would apply to quantitative controls, such as CAT.)

It is clear why these projects are inherently incompatible with commitments to reduce emissions to a specific level (the target) by a specific date. There is no way to predict with any degree of certainty by how much, at a specific date, any of the projects will reduce emissions. The effect on emissions, at any specified future date, of each of the suggested undertakings set out above is impossible to know in advance: It depends on such things as how quickly projects come onstream; the turnover rate of existing capital stocks; energy technology breakthroughs; and the behavioural response to carbon prices.

There is another problem. Even if emission reductions could be predicted with a degree of accuracy, we could not say what the level of emissions will be without knowing what the level of emissions would have been at the future date in the absence of the emission reductions. If the projects are successful, they will reduce emissions. But when policy targets call, for example, for a 30 percent cut in emissions from current or past levels, these might imply a 45 to 50 percent cut from a future level. Thus, projects that would reduce emissions by

The best example is China, which now accounts for 48 percent of the world's production of cement, 49 percent of the world's production of flat glass, 35 percent of its steel and 28 percent of its aluminum. The list could go on, but suffice it to say that these are among the world's most energy-intensive industries, with energy-to-output ratios (energy intensities) about 10 times higher than those of most other manufacturing industries.

30 percent at some future date would not, in general, achieve a 30 percent reduction from current levels. That is one reason (but certainly not the only one) why it is so unlikely that emission reduction commitments from past or current levels of emissions will be met. We need to consider where emissions would be in the future if we had not acted, and that too is difficult to know in advance.

To deal with this problem, analysts have developed emission baselines or scenarios. It turns out, however, that these can be misleading when it comes to assessing the amount of technological change needed to stabilize climate (that is, stabilize the atmospheric concentration of GHGs). The problem is that most emission scenarios have built into them very large amounts of energy technology change. In general, these "built-ins" have been ignored by analysts, who assess the technology challenge by looking at what it takes to move from an emission scenario to a stabilization path. It turns out, however, that making the technology assessment this way leads to a large understatement of the technology challenge posed by stabilization. In fact, when measured in terms of emission reduction, much more technology change is built into the emission scenarios themselves than is needed to move from the scenario to stabilization.

Pacala and Socolow (2004) illustrated this. They introduced the wedge concept and estimated it would take 7 one-GtC "wedges" to maintain global emissions constant for the next 50 years. But they utilized an emission path (scenario) that already had 11 built-in wedges. The true number of wedges needed to maintain emission level constancy was 18 (7 + 11). The Intergovernmental Panel on Climate Change (IPCC) carried out a similar analysis in its Special Report on Emissions Scenarios and found even larger numbers of built-in wedges, with built-ins ranging from 1 to 20 times those that ostensibly are needed for stabilization.

To get around the problem of technology understatement, one can use a "frozen technology" baseline. Two such "baselines" are illustrated in figure 1, for the IPCC's B2 and A1B scenarios. The built-in technology is, in each case, the grey area. The grey areas dwarf the "stabilization scenario" component. That is, it dwarfs the move from the emission scenario pathway (the B2 and A1B lines in the figure below) to the 550-parts-per-million stabilization pathway (B2 550 and A1B 550 in the figure).

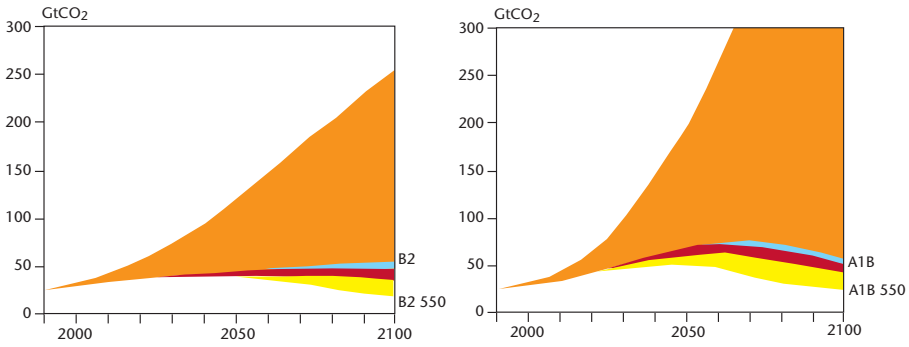
There is an important message here. Analyses based on emission scenarios may give a misleading impression about the magnitude of the energy technology challenge ahead. The challenge is really very large — and climate policy-making has yet to level with the public on this score. Moreover, using emission scenarios as a baseline to estimate the cost of climate stabilization can lead to large understatements of that cost. Further, using emission scenarios to assess what available technologies can do runs the risk of double-counting the contributions of technology: one time in the baseline and one time in the move from emission scenario baseline toward the stabilization pathway. This is just one more reason why setting a long term emission reduction target is fraught with difficulty and error.

In short, what may seem achievable based on emission scenario baselines may not be even remotely achievable — certainly not without energy technology breakthroughs about which there can be no current certainty. The message is clear: The notion of credible commitments to date-specific emission level targets is made even more implausible, while the need for an energy technology race appears all the more pressing.

Someone has to lead. Another round of climate policy-making that ignores the analysis set out above would be a prescription for another decade wasted. While it may be politically difficult to chart a new course, there is no alternative if we wish to effectively cope with the climate change problem.

Canada could at least get out in front with projects and policies that have a strong possibility of substantially reducing GHG emissions, even if by how much and when is inherently uncertain. While Canada cannot ignore the debate over whether these reductions meet any particular person or group's view of what a future emission level *ought* to be, it should be prepared to defend its approach as an effective means of beginning to seriously tackle the climate change problem

FIGURE 1. THE IMPACT OF TECHNOLOGY ON GLOBAL CARBON EMISSIONS IN REFERENCE AND CLIMATE MITIGATION SCENARIOS, 2000-2100[1]



Source: Adapted from: Intergovernmental Panel on Climate Change, *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA., 2007, chap.3, figure 3.33.

[1] While the IPCC acknowledges the importance of "built-ins" in this chapter, they do not appear to play a role in the rest of the report, nor in its *Summary for Policy Makers*.

Chris Green is professor of economics and former chair of economics at McGill University. He researches and teaches on the subject of climate change and climate policy. He was consulted by Environment Canada in the spring of 2007 regarding the economic consequences of attempting to meet Canada's commitments under the Kyoto Protocol.