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The Case for Intensity Targets

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Introduction

In December 1997, more than 150 countries negotiated a landmark agreement on global climate change, the Kyoto Protocol. Signed by 84 countries, including the United States, the treaty would commit industrialized countries to legally binding limits on their emissions of greenhouse gases, which in turn threaten global climate change. These limits are expressed as reductions (or, in a few cases, increases) in absolute emissions levels relative to a 1990 baseline.

Kyoto detractors have put forth a range of arguments, often focused on the Protocol's significant economic cost and its treatment of developing countries. Arguably, these concerns are a consequence of the underlying architecture and the setting of absolute emission limits. That is, absolute emission limits in the face of economic growth quickly lead to high and escalating costs until new, carbon-free, technologies are fully developed and adopted—something that remains decades in the future. For developing countries, the architecture has the added disadvantage of appearing to codify existing disparities in economic development, making their participation unlikely.

Partly in response to these concerns, in February 2002 the Bush administration announced its new climate policy based on a domestic goal to reduce emissions intensity—emissions per

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dollar of real gross domestic product (GDP)—by 18% over the decade 2002-2012.[1] The response from the environmental community as well as many U.S. allies was skeptical at best. Critics emphasized the lack of policies beyond voluntary programs and limited tax incentives, as well as the lack of an improvement beyond what was achieved over 1992-2002 (Bush Climate Plan 2002; Pianin 2002). Sometimes, but not always, this criticism extended to the more general idea of an intensity-based emission limit as alternative to the absolute emission limits embedded in the Kyoto Protocol (and in U.S. domestic programs for sulfur dioxide and nitrogen oxides as well).[2]

Regardless of one's beliefs about the numerical limits or the lack of mandatory mitigation in the Bush plan, the question remains whether intensity-based emission limits offer a useful alternative to absolute emission limits. Do intensity targets better accommodate growth and make targets for developing countries more likely?

The point of this essay is the make the case that they do. Importantly, intensity targets are valuable in terms of how emission targets are *framed*. That is, the advantage to intensity targets is not so much in their annual indexation to economic activity, but in terms of the short- and long-term process of setting and resetting multi-year emission goals. Indeed, it is probably *undesirable* to use intensity goals to adjust to unexpected deviations from forecast economic growth.

These conclusions follow from four observations:

1. For at least the next two decades, greenhouse gas emissions will rise across industrialized countries, even with reasonable mitigation efforts.
2. Absolute targets emphasize zero or declining emissions growth while intensity targets do not, making intensity targets particularly sensible in the near term.
3. The case for intensity targets is even stronger for developing countries, where economic development is integrally tied to emissions growth for the foreseeable future.

[1] This was not the first time intensity targets have been proposed; see Argentine Republic (1999).

[2] See Burtraw and Palmer (2003) and Burtraw and Evans (2003) for descriptions of the sulfur dioxide and nitrogen oxides trading programs.

4. In contrast to secular growth, fluctuations in emissions are not consistently related to economic activity, making it unnecessary (and undesirable) to adjust intensity-based emission limits on an annual basis.

After discussing the role for the L20, the remainder of this essay discusses these points in more detail.

L20 Call for Action

Accepting the arguments that there is a strong, practical case for using emission intensity as a basis for negotiating and setting national targets for at least the near term, objections will likely arise from environmental advocates who see it as a weaker negotiating position for current and future emission limits. Specifically, the intensity approach requires accepting that emissions in industrialized countries will continue to rise. These advocates have tended to be influential in international negotiations where environmental ministries wield more authority.

With a broader agenda and domestic constituencies, an L20 initiative offers a potentially unique opportunity to advance this and other practical approaches. While climate change is an environmental problem, it requires a balance with competing economic and security concerns. The acceptance of emissions growth, for example, as a trade-off to achieve broader engagement in the face of these concerns would be more palatable as an L20 initiative than a strictly environmental negotiation. The L20 is also the right forum to simultaneously address the trade and competitiveness concerns that arise as countries embrace the higher energy costs associated with climate change mitigation.

While this memorandum documents the case for intensity targets, there are a number of practical questions the L20 will need to address to put them into practice. Do all countries need intensity targets, or is a mix of absolute and intensity targets okay? What are the bounds of "reasonable" targets? Arguably the real advantages of intensity targets come from, first, all countries denoting their efforts in terms of intensity, and, second, the flexibility to negotiate national targets without constraints. Allowing some countries to take absolute caps, rather than translating those caps into intensity measures, risks creating the same kind of qualitative, good/bad country distinctions that this approach is designed to avoid. Similarly, historic and forecast rates of improvement should be a guide but not an obstacle. Nonetheless, the very purpose of the L20 initiative is to seek practical compromise on these kinds of issues, and these questions ought to be on the table.

Emissions will continue to grow

The underlying motivation for an intensity approach is the need to accommodate emissions growth even as policies are enacted to reduce that growth. Without additional action, global emissions of carbon dioxide are forecast to grow more than 50% by 2025, with growth of 34% among industrialized countries alone.[3] Forecasts for the six largest industrialized country emitters, the United States, Germany, the United Kingdom, France, Canada, and Japan, are shown in Figure 1 (along with historical emissions back to 1990). Together these six countries account for 80% of industrialized country emissions and 40% of global emissions. Looking across these countries, Canada and the United States are forecast to grow more than 40%, Germany, Japan and the U.K. about 20%, and France less than 5%. The increases in Germany and the U.K. are forecast to occur despite significant declines over the preceding decade in both of these countries.

What explains the variation across time and countries? Well-known events in the U.K. (ending coal subsidies) and Germany (re-unification) are believed to explain at least part—if not the majority—of the historic decline in those countries. These events, however, are not expected to generate sustained reductions as both countries are expected grow in terms of economic activity and energy use. Looking forward, much of the variation among national trends can be explained by a few distinct features. Population in the United States and Canada is forecast to grow at annual rates of 0.8% and 0.6%, respectively, while population growth in France and the U.K. is only 0.3%, Germany is flat, and Japan is expected to decline by 0.1%. It makes sense that, other things equal, countries with higher population growth will need more energy resources—and more carbon emissions—to support those extra people. In these forecasts, Canada and the

[3] These and all data concerning international carbon dioxide emissions, energy use, and emissions intensity come from EIA (2004a; 2004b).

United States not only have the highest population growth by a factor of two, they also have the fastest emissions growth by a factor of two.[4]

Another key trend is power generation, specifically nuclear. While Germany's nuclear share is forecast to decline from 10% to zero over the next two decades, France's share is expected to rise from 35% to 43%. Therefore, even as France's energy use rises by 20% compared to Germany's 10%, the increased use of nuclear power implies that France's carbon emissions will remain roughly constant as German emissions rise by 20%.

Can these trends be altered? On the one hand, the Kyoto Protocol stipulates a fixed emission limit for participating countries, including all of these countries except the United States, over the period 2008-2012. Certainly there is an expectation among many that future targets must do even more, given that the Kyoto limits themselves—even if extended forever—only marginally change the trajectory of forecast climate change. On the other hand, studies of the cost of the Kyoto targets for these countries suggest that the necessary 25% reduction in emissions, implemented with a decade of lead time, would cost around \$70 per ton of carbon dioxide at the margin, or around \$90 billion annually for 2.6 billion tons of CO_2 reductions.[5] Including capital and labor market impacts, the GDP impacts might be twice as much, while a more rapid introduction of the same emission limits could lead to even larger business cycle effects.[6,7]

Are these industrialized countries willing to spend more than \$90 billion per year, almost 0.3% of their collective economic output, to arrest their emissions growth for twenty years?[8] Recognizing that this is a collective burden whose individual elements must be either negotiated or voluntarily embraced, that these costs will be born even as emissions rise in (and likely shift

[4] The distinct influence of population growth, per capita income growth, energy intensity declines, and changes in carbon per unit of energy is often referred to as the Kaya identity (Hoffert et al. 1998).

[5] Data on the cost of emission reductions is drawn from Weyant and Hill (1999). Cost estimates are based on a simple calculation of ½ x (price) x (reductions) by country.

[6] In competitive markets, real wages and returns to capital will fall by the added value of emission allowances as well as direct reduction costs—or roughly seven times the approximate cost of a 25% reduction. Assuming compensated supply elasticities of 0.3, the net effect on GDP would be a doubling of the direct cost. This would translate into higher welfare costs if there are, in turn, tax distortions in factor markets.

[7] EIA (1998) found that the business cycle (actual minus potential GDP) impacts of the Kyoto targets were four times larger than the real productivity (potential GDP) costs.

to) key developing countries, that only a fraction of this effort will go into development of the zero-emission technologies necessary in the future, and that the main benefits remain even further in the future, the challenge is that much greater. Meanwhile, simple economic analysis argues that a more prudent course is to first slow emissions growth, then stop and reverse it (Wigley et al. 1996). For all of these reasons, it seems likely that emissions will continue to rise among industrialized countries for at least the next two decades.

Intensity targets better accommodate growth

If emissions need to rise, absolute emission limits can still be used to slow growth. One can stipulate a growing, or "growth", target that rises each year based on a fixed or formulaic amount. Many labor contracts, for example, automatically increase wages based on inflation indicators such as the CPI.[9] Businesses, in general, target growth rather than fixed levels of performance (Torres 2004). The academic literature on climate change considers a variety of emission limits paying no attention to whether emission caps rise or fall.[10]

On the other hand, all of the real world examples of pollution cap-and-trade programs involve either constant or declining caps. Federal sulfur dioxide and nitrogen oxide programs, regional caps in various states (such as the RECLAIM program in California), U.S. phase-out of lead in gasoline, and international limits on ozone-depleting substances, all focus on constant or declining caps. At the same time, the critics' rhetoric regarding emission caps for greenhouse gases is clear. "…through the Climate Stewardship Act [the recent proposal for an emissions cap by Senators McCain and Lieberman], our government will require sharply higher efficiencies to be realized, or else we'll just have to stop producing" (Spencer 2004). "In its current form, the Kyoto Protocol places significant limitations on the economic growth of Russia."[11]

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[8] Technology optimists are quick to argue that costs could be considerably lower than these rough calculations suggest. Such arguments are based on technology expectations or assumptions about existing inefficiencies. While there may be some truth to these arguments, it certainly seems *likely* or at least *possible* that emissions will continue to grow absent a significant expenditure.

[9] See U.S. Department of Labor (2004).

[10] Nordhaus (1994) considers various emission paths that increase over time; Bradford (2002) specifies a business as usual emission path that rises over time (at least initially). Jacoby and Ellerman (2002) suggest a phased approach that, while declining, might involve an initial cap substantially above current emission levels.

[11] Statement by Andrei Illarionov, economic adviser to Prime Minister Putin, reported by Reuters (2003).

At the heart of our experience and the critics' rhetoric is fact that absolute emission limits focus attention on the current emission level or target. Current emissions become the benchmark for measuring progress as well as adjusting policy—increases are bad, decreases are good. Our preternatural association with 1990 emission levels in the climate change arena (enshrined in both the UNFCCC and the Kyoto Protocol) is one example. Even the word "cap" suggests the absence of growth.

Intensity targets, in contrast, have no natural focal point. Except in the poorest countries shifting from agriculture to industry, intensity naturally declines. Accelerating this natural decline can slow, stop, or reverse emission growth depending on whether the decline in intensity falls below, equals, or exceeds the rate of economic growth. Because different countries grow at different rates, and the differences are small, it is hard to label particular intensity goals as good or bad without a bit of work.[12] Intensity targets can also be described as performance standards, which not only avoids the suggestion of limiting growth but even has a positive ring to it.

Summarizing, given the proposition that mitigation policy needs to sequentially slow, stop, and reverse emissions growth—and that the slow phase is likely to go on for decades—practical concerns argue in favor of intensity targets. Typically, if not pervasively, caps are used to reduce emission, and critics often associate caps on carbon dioxide emissions with limits to growth. Absolute caps by their nature draw attention to stopping emissions growth. Meanwhile, intensity targets are easily adjusted to levels that slow, stop, or reverse emissions growth without drawing attention to the particular choice.[13]

Intensity Targets Favor Developing Countries

Despite the fact that developing countries are at greatest risk from global climate change, they continue to avoid binding commitments to reduce emissions. Arguably this is based on three persuasive views. First, the problem threatening the world now was caused by industrial

[12] Arguably the Bush administration's 18% intensity suggested the same reductions as other international and national targets—but it was not immediately obvious.

[13] Interesting, environmental advocates who worry that intensity targets allow emissions growth to slip by unnoticed might, in the long run, appreciate that increasingly strict limits could similarly avoid notice.

country emissions—so industrialized countries should be the first ones to start dealing with it. Second, developing countries should be afforded the same development opportunities as industrialized countries, including the use of cheap fossil fuels. Third, and perhaps most important, developing countries face a host of more immediate and threatening problems that make concern over climate change appear to be a luxury of wealthy countries.

In addition to these general arguments against developing country mitigation effort, all of the specific concerns about absolute targets are amplified in the developing country context. While evidence suggests that emissions growth is related to economic growth primarily through population among industrialized countries, emissions growth is inextricably linked to economic *development* among poorer countries.[14] Absolute emission limits are then synonymous with limits to development. Even with a generous emission limit that might allow profitable emissions trading in the near term, developing countries are rightly concerned about an architecture that emphasizes emission levels.

In contrast, a focus on intensity gives many developing countries an *advantage*. Consider the case of China, illustrated alongside the United States in Figure 2. Since 1990, Chinese emissions intensity has been declining considerably faster than the United States and is forecast to continue to do so for the foreseeable future. Although a common currency comparison of intensity levels (rather than intensity declines) would make China look worse than the U.S., such comparisons are conveniently problematic due to the challenges of real currency conversion.[15]

Little can be done to assuage the initial barrage of factors that limit developing country engagement on the issue in general. Nonetheless, intensity targets simultaneously remove the concern that industrialized countries are attempting to lock in their economic advantage through absolute emission limits and utilize a metric that tends to favor developing country performance. The hope is that this combination might be enough to secure at least voluntary commitments.

[14] See recent work by Schmalensee et al(1998).

[15] This would seem to raise the issue of how to define real economic activity for purposes of computing intensity. However, the economic forecast could be set forth at the same time as the intensity target by stipulating that this bundled economic forecast (rather than some other economic information) is used to translate the intensity target into a series of emission allocations. Much as Kyoto negotiations turned to sinks and McCain-Lieberman focused on offsets as ways to keep the same nominal target while adjusting the real consequences, intensity negotiations could focus on subtly adjusting economic forecasts rather than changing intensity targets.

Annual emission adjustments are a bad idea

So far, the main argument for intensity targets has been that it avoids many pitfalls associated with using absolute emission targets to describe a growth path for emissions. With this motivation, we could use an intensity target coupled with a given economic forecast to define a growth path for emissions over the horizon of the policy and then implement an otherwise ordinary cap and trade program.

However, this idea that intensity targets better accommodate growth over time suggests that intensity targets might also accommodate *unexpected* growth in an advantageous way. That is, if economic activity is unexpectedly higher than forecast, should we not similarly allow an increase in emissions? Or if growth is lower than expected, should we not seek lower emissions? Instead of determining emissions over the entire policy horizon with some initial economic forecast coupled with the intensity target, we could use updated estimates of economic activity to determine the emission level in future years.

Despite the seeming appeal of this idea, it turns out to be a bad one. The underlying premise is that emission fluctuations are tied to economic fluctuations, and that intensity behaves more predictably over time than emissions. Therefore, targeting intensity leads to more consistent effort in the face of uncertainty events; an absolute emissions target would be too hard in the face of unexpectedly higher growth and too easy in the face of unexpectedly lower growth. As Table 1 shows, however, intensity and emissions exhibit similar fluctuations from year to year —with the interesting exception of the United States, where intensity fluctuations are smaller. Otherwise, just as an absolute target could end up requiring an additional 5% reduction in the face of an adverse shock, so might an intensity target.

Not only does an intensity target fail to provide a more stable target, it also flips the relationship between adverse economic shocks and the prospect of easier or harder targets. An intensity target becomes harder in the face of lower growth and easier in the face of higher growth. Statistically, declines tend to proceed faster when growth proceeds faster, reflected in the negative correlation between economic growth and intensity shown in the last column of Table 1.

In other words, even though intensity is a constructive way to frame an emission target that accommodates growth, annual emission adjustments are not a great way to address *uncertainty* about economic growth. In contrast to a fixed emission target where harder targets occur in the face of unexpectedly high growth, annual emission adjustments lead to harder targets when economic growth is unexpectedly low—sort of a statistically regressive outcome. Concern about uncertainty, and the cost of uncertainty, must be addressed through other mechanisms.

Conclusions

For more than a decade, international climate negotiations have focused on absolute emission targets and timetables. The result is a system that is biased toward halting and reversing emission growth, even as evidence suggests that emissions will continue to grow for decades in industrialized countries and much longer in the developing world. This bias arises because progress viewed in terms of emissions inevitably means emission reductions—not slowing growth. Such a bias is arguably an obstacle to progress within many countries as well as internationally.

Shifting the focus toward intensity targets opens the door to easier negotiations where a range of progress—including slowing, stopping, and reversing emission growth—can be discussed without prejudice. Intensity targets are easily interpreted as a performance standard for the whole economy. Conveniently, intensity levels are difficult to compare across countries, promoting an emphasis on progress rather than status. Also conveniently, key developing countries appear favorably with larger natural declines in intensity arising from modernization. Alternative approaches are possible, though none appear to have these advantages while remaining parsimonious.

Intensity targets are not a particularly useful way—indeed, are a bad way—to deal with economic shocks that make the cost of any emission limit uncertain. Other mechanisms, such as a safety valve where additional, above target emissions are allowed at a fixed price, make much more sense. With that said, one could use a safety valve mechanism to accommodate emission growth even if the nominal target did not (Pizer 2002). As technology develops, mitigation costs fall, and perhaps the safety valve price rises, emissions growth should eventually stop and reverse. Although this safety valve approach can solve the domestic problems associated with absolute caps, the international dilemma remains. Developing countries may still view a system of national caps—even with a safety valve—as a way to justify the existing pattern of economic development. And, even the domestic problems may not entirely disappear if critics believe the safety valve could be phased out or eliminated.

An intensity target should be used to frame a sequence of emission targets, not to establish a more complex system with annual revisions to the emission limit. This highlights one of several disadvantages of intensity targets: even translating the intensity targets into a otherwise ordinary cap-and-trade program, those targets are necessarily harder to convey to stakeholders and the public than a simple emission cap. Discussion and debate over emission intensity also loses some of the resonance associated with a focus on emissions themselves. Finally, the intensity target's main advantage—that it does not draw attention to zero growth as a benchmark for progress—will be seen as a disadvantage by advocates that seek such a benchmark.

The assumptions underlying the argument for intensity targets are also subject to criticism. The observation that near-term targets in industrialized countries will slow growth and not stop it (based on cost and politics) may be wrong. While experience and rhetoric suggest that absolute targets cannot easily accommodate growth, there is no tangible impediment. And, in the end, all of these concerns are only one part of a much larger puzzle of stakeholder and national self-interest, as well as competing and complementary policy issues, that must be pieced together in order to break the current logjam. Nonetheless, as individual nations and the international community move forward, it makes sense to give greater consideration to intensity targets as one piece of the policy mix.

Tables

Table 1: Annual Variation in Emissions and Intensity

[Frame1]

Figures

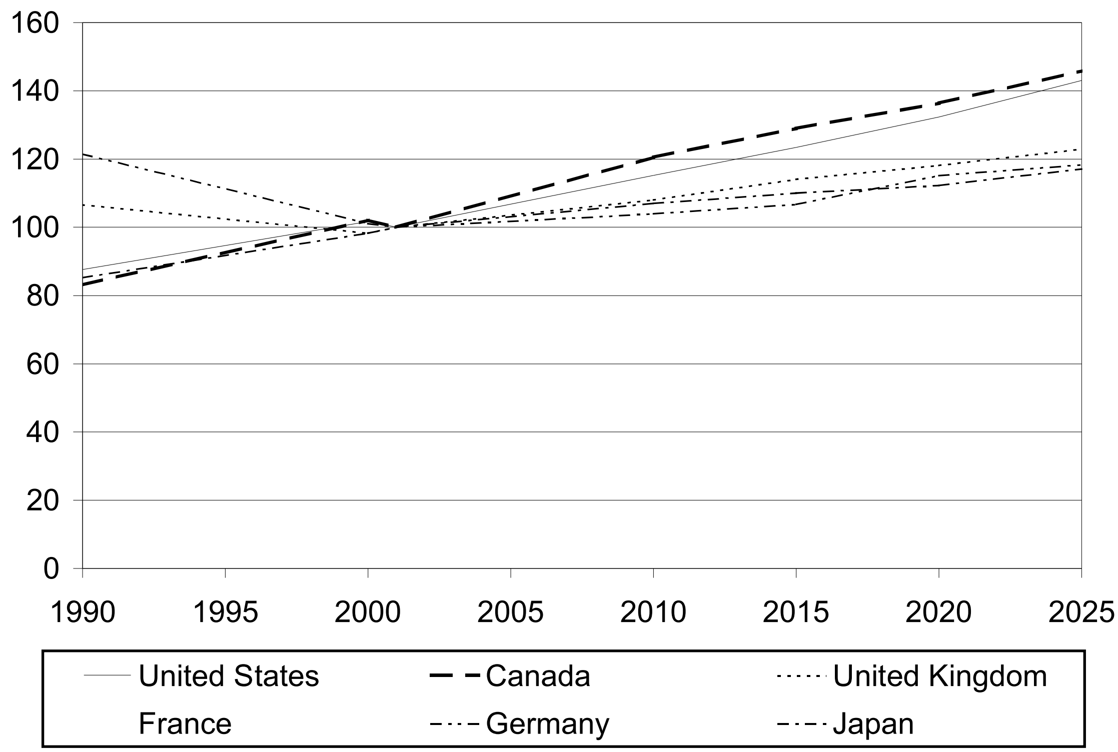

Figure 1: Forecast emissions growth to 2025 relative to 2001 levels (= 100)

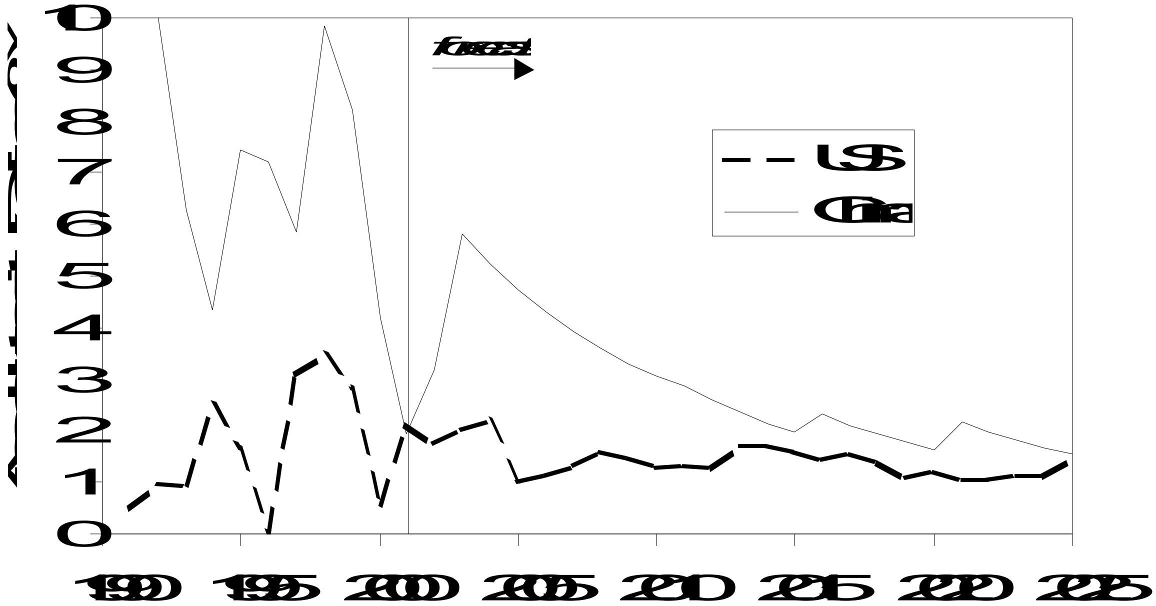

Figure 2: U.S. & China Annual Decline in Emissions Intensity (historical and forecast)

References