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TRADABLE EMISSIONS RIGHTS AND JOINT IMPLEMENTATION FOR GREENHOUSE GAS ABATEMENT: A LOOK UNDER THE HOOD

PAPER

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DRAFT

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TRADABLE EMISSIONS RIGHTS AND JOINT IMPLEMENTATION FOR GREENHOUSE GAS ABATEMENT: A LOOK UNDER THE HOOD

Richard Schmalensee*

[Draft of September 19, 1997]

This December, the second conference of the Parties to the Framework Convention on Climate Change will meet in Kyoto, Japan. Since the first such conference was held in Berlin in 1995, diplomats from many nations have been attempting to produce an agreement that will impose national limits on greenhouse gas emissions for the early years of the next century. Even though the Parties remain divided along several important dimensions, the pressure to reach some sort of agreement somehow is already intense and continues to increase. When an issue is well-understood, this sort of pressure can sometimes force productive resolution of minor differences. When, as here, there are important uncertainties, pressure to reach agreement may cause major issues to be ignored and mishandled in a hastily-drafted agreement, to the long-term detriment of all concerned.

As involved Europeans seem to delight in pointing out, the Clinton Administration has not yet put forward a complete proposal for the world's venture into abatement of emissions of carbon dioxide (CO₂) or of other greenhouse gases.¹ However, the Administration has made clear, particularly in a "Draft Protocol Framework" circulated early this year,² the sort of vehicle in which it would like to make this journey. That vehicle is the focus of this paper. I will pay particular attention to its use of tradable emissions rights, both internationally (where I will use the term "quota") and, domestically (where I will use the term "allowance"), and of joint implementation.

A commonly-posed, threshold question is whether the Administration's proposal is workable: can its vehicle go anywhere? I believe the answer is "Yes" – and the question is not very interesting, because workability is a weak test. After all, past Administrations devised more or less workable systems for wellhead regulation of natural gas prices and regulation of interstate trucking rates and airline fares. Because those who created these programs ignored important economic issues, of course, these regulatory regimes were long-lived, costly mistakes. Similarly, while the economic impact of the Administration's proposal would depend on design parameters not yet announced – particularly the level of emissions allowed – and on details of implementation, that proposal, too, shows neglect of important issues. Even if one takes the possibility of climate change seriously, as I do, I believe one must conclude that the Administration's vehicle, despite a number of very attractive features, has the potential to take us for a bumpy ride in the wrong direction. (If, on the other hand, you are absolutely convinced that there is no chance we will ever learn that climate change is a real problem, you should care only about the bumps, not about going in the wrong direction.)

I. THE ADMINISTRATION'S VEHICLE

The so-called "Berlin Mandate," adopted at the first conference of Parties two years ago, decreed that the current round of climate negotiations was to be about limiting the emissions only of the so-called Annex 1 nations: the OECD circa 1990 (Western Europe, the U.S., Canada, Australia, New Zealand, and Japan) and the "economies in transition" (Eastern Europe and most of the Former Soviet Union). So far, the Administration has not departed from these instructions, though its proposal would allow other nations to opt-in to the Annex 1 regime. The Berlin Mandate and the Administration proposal focus on national limits on

greenhouse gas emissions for the early years of the next century, though the Administration's proposal seems to envision a deliberative process (not specified) that would lead to changes in national limits over time.

To my knowledge, the Administration has not yet said anything official about what sorts of emissions limits it has in mind, but it has presented an interagency analysis of the costs of reducing U.S. CO₂ emissions from fossil fuel combustion to 1990 levels by the year 2010 and maintaining that level through 2020.³ The European Union (EU), in contrast, has proposed reducing Annex 1 emissions to 15% below 1990 levels by 2010. Whatever approach to emissions limitation is chosen, costs will clearly vary directly with stringency, and they will be particularly burdensome in any case if the EU's proposal is implemented.

The Administration proposes that Annex 1 nations be given quotas for periods of several years at a time rather than for a single year. (Characteristically, the number of years is left blank, but I believe it would be useful to think of five-year periods.) Nations would be permitted to bank unused portions of their quotas for future use and (to a limited extent and at a cost) to borrow from future quotas. These provisions are clearly intended to provide some flexibility; the year-to-year fluctuations in emissions they would permit would have no discernible climate effect. Perhaps more importantly, the Administration would allow quotas to be transferred between nations. The ability to trade emissions rights internationally can in principle reduce total world costs, though most studies find that trading involving only Annex 1 nations has relatively little cost-reducing potential.⁴

Though I have not seen this stated officially, all indications are that the Administration plans to ensure that the constraint on U.S. emissions is met by using tradable emission allowances domestically. That is, the U.S. quota would be divided (somehow, see below) among (most likely) a set of domestic firms, and these firms would be free to trade emission

rights (allowances) among themselves. In theory, such a system could ensure that whatever abatement the U.S. achieves is accomplished at minimum cost.⁵ Moreover, such a system could in principle allow private parties, rather than or in addition to governments, to trade emission rights internationally.

The Administration continues to argue that non-Annex 1 nations should be encouraged to participate in greenhouse gas abatement via “joint implementation.” Using this mechanism, the U.S. government (or a U.S. firm) could, for instance, gain credit for some number of tons of reduced CO₂ emissions by investing in reducing emissions from Chinese electricity generation. Of course, if this were to be counted toward meeting U.S. international obligations, some international organization would have to verify that the investment actually reduced emissions by the amount claimed, compared to a world in which the investment had not been made.

Finally, the Administration’s “Draft Protocol Framework” clearly envisions coverage of multiple greenhouse gases, not just carbon dioxide. Since other human-caused emissions are, in aggregate, of roughly equal importance to CO₂, this makes sense in principle. Given the real difficulties (discussed briefly below) associated with measuring the emissions of other gases, however, it seems highly unlikely that any agreement signed in Kyoto will extend beyond CO₂ emissions from fossil fuels.

II. GOING IN THE RIGHT DIRECTION?⁶

It is important to acknowledge that there is much in the Administration proposal to applaud – particularly when it is compared to the alternatives on the table. The EU tends to stress the use of “common policies and measures,” which is best translated as “similar

command and control regulations for all,” and to oppose most approaches that will lower total costs. Developing nations tend to resist playing any role at all in reducing global greenhouse gas emissions and, in particular, tend to be suspicious of joint implementation. The U.S. appears to be the only Party to think beyond the next few decades and to address the need to employ market mechanisms to provide flexibility and reduce costs. For all this it deserves much applause. On the other hand, largely because of its adherence to the Berlin Mandate, the Administration’s vehicle cannot without substantial modifications move the world toward a strategically sensible response to the risk of potential climate change. It could easily make such a response harder, not easier, to implement.

A. The Terrain

Perhaps the most important features of the climate change issue are the long time-scales and high uncertainty involved. We know that emissions of CO₂ remain in the atmosphere for something like a hundred years and that both emissions and atmospheric concentrations of greenhouse gases have increased substantially over the last century. Even if emissions were stabilized at today’s levels, atmospheric concentrations would rise substantially for decades.

Stabilizing atmospheric concentrations at levels that have been discussed in international negotiations would require substantial cuts in CO₂ emissions over the course of the next century.⁷ (The Framework Convention on Climate Change makes stabilizing atmospheric concentrations of greenhouse gases its ultimate goal, but it is effectively silent on the level at which they are to be stabilized.) In contrast, most long-run forecasts show substantial global emissions growth in the absence of stringent controls, with the bulk of the growth (and thus a rising fraction of global emissions) occurring in the developing world.⁸ It

will very likely be impossible to attain stabilization at widely discussed concentration levels without significant abatement by developing nations. In most long-term scenarios, setting Annex 1 emissions to zero is, by itself, insufficient.⁹

It is also generally accepted that higher atmospheric concentrations of greenhouse gases, *all else equal*, will increase the amount of solar energy retained by the Earth system and tend to raise temperatures at the Earth's surface. But all else is not equal: some poorly understood climate processes amplify this warming effect, while others, no better understood, tend to counteract or delay it. Work in the MIT Joint Program indicates that temperature increases in the year 2100 as small as two degrees Fahrenheit or as large as nine degrees Fahrenheit can easily be defended as plausible. (This range reflects uncertainty about future emissions as well as about climate processes.) Moreover, we know even less about the likely impacts on society of climate change or about the costs of adaptation than about the likely amount of warming. Clearly, though, a temperature increase of nine degrees over the course of the next century would pose significant risks to a variety of important natural processes (including ocean circulation and unmanaged ecosystems) as well as to agriculture and other human activity.

Given all this, it is plainly important to invest in research on the climate system (including determinants of emissions and analysis of effects of climate change), and the U.S. has long been a leader in this important endeavor. Because of ongoing research we may someday learn that substantial climate change is in prospect, that it poses a serious threat to human civilization, and that substantial reductions in greenhouse gas emissions are required to respond to it. It is also possible, of course, that we will learn that even with no attempt to limit emissions, there will be little or no warming and, on balance, no adverse impacts. But even

with continuing heavy investments in research, it appears unlikely that either possibility will be definitively ruled out for years to come.

In this situation, the obvious near-term task, before this profound uncertainty is resolved, is to identify and make productive investments aimed at reducing the costs of mitigating climate change and of adapting to its effects, the costs that would be incurred if the news turns out to be bad. Such investments almost certainly include research on new energy technologies with low CO₂ emissions,¹⁰ as well as on agricultural techniques with reduced emissions of such greenhouse gases as methane (CH₄) and nitrous oxide (N₂O). Similarly, development of new crop varieties and cultivation techniques could substantially lower costs of adapting to climate change in poor nations, and there may be other “adaptation technologies” that could profitably be developed.

Because the developing world’s emissions must be controlled if global emissions are to be reduced and because it appears that the cheapest abatement possibilities are to be found in the developing world,¹¹ investments in making such control possible appear particularly attractive from a strategic perspective. These investments would be largely in designing and developing international institutions. Since it seems that we have several decades, at least, before global participation in emissions limitation could become vital, and since voters in even the richest nations do not appear interested in spending appreciable sums today to deal with climate change, it is good that institutional development tends to be time-intensive but relatively cheap. On the other hand, the task of developing useful international institutions is complicated by the need to respect national sovereignty, a need that has no counterpart in the domestic policy environment. Imagine the process of making U.S. environmental policy if the federal government had to rely on voluntary compliance by state governments – and then recall how homogeneous the states are as compared to the nations of the world!

A first institutional issue is financial. Today's developing nations are unlikely to spend their own resources to control greenhouse gas emissions, at least until their incomes have risen substantially. Thus if, say, China, is to be induced to control its emissions significantly any time during the next few decades, methods will need to be found to transfer resources to China for this purpose. If tight controls on global emissions are required, substantial resource transfers will also likely be necessary: in plausible scenarios more than two percent of OECD GDP will need to be transferred in some years to achieve widely discussed stabilization goals.¹² It is almost impossible to imagine transfers of this magnitude being made directly by rich nations to individual poor nations. It thus seems that some sort of respected, objective international institution (on the model, perhaps, of the IMF and the World Bank) will be required to act as an intermediary.

Large resource transfers will not be forthcoming, of course, unless the donors can be assured that the recipients will meet their obligations. This suggests the importance of developing the ability to monitor emissions with confidence, particularly in the developing world. Doing so will require both advances in knowledge and the transfer of technology and expertise to developing nations. The standard data on CO₂ emissions from fossil fuels are computed by combining unverified national reports of imports, exports, production, and inventory change of various fuel types with assumptions regarding the carbon content of each.¹³ This will surely not be adequate when the financial stakes are large and incentives to misrepresent become impossible to ignore.¹⁴ Moreover, we have even less ability to monitor emissions of CO₂ associated with land use changes and cement production or emissions of other greenhouse gases. Because it is hard to imagine that global emissions of greenhouse gases could be reduced on balance with only controls on CO₂ emissions from fossil fuels, there would appear to be a large potential return to investments in developing the capability of

monitoring emissions from these other sources. In addition, it is not entirely straightforward to design an efficient international mitigation regime that covers multiple gases with very different sources, chemical properties, and atmospheric lifetimes.

Finally, while the carrot of resource transfers may be necessary to induce nations to meet their obligations, the international community may also need to employ the stick of sanctions. While explicit sanctions do not play a large role in inducing compliance with most international agreements,¹⁵ no international agreements currently in force (except, arguably, in the defense area) involve economic stakes nearly as high as those potentially at issue in the climate context, and few require governments to impose significant costs on their own citizens. At the very least, the question of sanctions deserves serious study and the serious attention of climate negotiators.¹⁶ The complexity of this question argues that it should be addressed sooner rather than later.

B. The Wrong Direction

Strategically, the Administration's proposal concentrates on short-run reductions in rich country emissions of CO₂ from fossil fuels, not on taking steps to reduce the cost of (or, indeed, to render feasible) the substantial long-run global reductions in overall greenhouse gas emissions that may be necessary to deal with the threat of climate change. The Administration proposal does not deal in any serious way with development of new technologies that could lower costs of reducing emissions or of adapting to climate change, even though Administration rhetoric tends to stress the value of research and development. The proposal does not even address the problem of moving from a regime focused on CO₂ from fossil fuels to a more comprehensive approach; the "Draft Protocol Framework" is written as if the problem were solved.

More importantly, the Administration proposal has little to say about the development of international climate policy institutions, largely because it follows the Berlin Mandate and does not aim to induce participation by non-Annex 1 nations. The Administration proposal simply obliges each party to put in place a system for monitoring emissions, and it merely notes that the parties might wish, sometime in the future, to consider what to do about non-compliance. It does not deal with international transfers of financial or technical resources. On a positive note, its proposed requirement that an international secretariat review national policies and emissions projections is a good idea; it would both develop useful expertise and serve to provide some advance warning of non-compliance.

The proposal's main device to involve non-Annex 1 nations is Joint Implementation (JI). Unfortunately, it seems painfully obvious that JI will do very little to advance this objective. Indeed, by ratifying the principle that developing nations have no emissions control obligations and by providing no mechanism for their transition to Annex 1 status, the Administration Proposal may actually retard the achievement of effective global participation. Developing nations are generally hostile toward JI, fearing (among other things), that it will threaten their sovereignty, reduce flows of foreign aid, and saddle them with de facto emissions control obligations. But even if they were enthusiastic, the need to reach international agreement on project-specific emissions reductions will guarantee that transactions costs are high. Note that this is not a problem of monitoring, and it does not even in principle have a technical solution. The problem is not to measure actual emissions (though this must be done) but to estimate what emissions would have been in the unobservable, "but for" world without the project in question. Such estimates are inevitably project-specific, and the process of constructing them is inevitably controversial and detail-intensive. The

disappointing U.S. experience with this sort of credit system should make clear the serious difficulties involved.¹⁷

One final point on JI deserves mention. Inevitably in the evaluation of any JI project, errors will be made in estimating what “but for” emissions. Positive errors make the project less attractive to the parties involved by reducing the credits it generates; negative errors make the project more attractive. Because more attractive projects are more likely to be implemented, on average the projected benefits of JI projects will tend to be over-stated, and JI will contribute less to reducing emissions than will be claimed.¹⁸

Taken as a whole, the Administration proposal or, indeed, any proposal strictly consistent with the Berlin Mandate, would work against eventual inclusion of developing nations in a serious greenhouse emission abatement regime. By explicitly or implicitly raising the prices of fossil fuels in Annex 1 countries, the Administration proposal would encourage investment in energy-intensive industries outside Annex 1. This sort of “leakage” increases non-Annex 1 emissions and means that the reduction in Annex 1 emissions will exceed the real reduction in global emissions.¹⁹ More important, a country that has just invested heavily in energy-intensive industry will clearly be less eager than otherwise to reduce the value of that investment by explicitly or implicitly increasing energy prices. The inevitable process of “leakage” will make it harder to persuade additional nations to assume abatement obligations.

The Berlin Mandate aims at a “deep, then broad” approach to global control of greenhouse gas emissions: first have rich countries control their emissions, then, if necessary, induce others to play along.²⁰ Unfortunately, as I have just argued, the first of these steps makes the second more difficult. The obvious alternative is a “broad, then deep” approach: involve most nations in a relatively low-cost regime, then, if necessary, tighten controls globally. Implementing such an approach would obviously require heavy, early investment in

institutional development – just the sort of investment that is missing from the Administration proposal.

III. A BUMPY RIDE?

Though it is mis-directed from a strategic perspective, it must be acknowledged that the Administration's vehicle can reduce U.S. CO₂ emissions somewhat without wrecking the nation's economy, though, as many studies have found, substantial reductions will inevitably entail substantial costs.²¹ The use of tradable allowances within the U.S. can limit emissions at lower cost than most command and control regimes. As I now discuss, however, the Administration design has a number of features and defects that seem likely to produce implementation problems and to inflate compliance costs relative to feasible alternatives.

A. Can We Trade?

A system of domestically tradable quotas poses the same basic administrative challenges as a carbon tax. Just as most carbon tax discussions conclude that the tax should be levied on primary energy production and imports, with rebates granted for exports and non-energy uses of fossil fuels (e.g., in chemical manufacturing), so it probably makes sense to issue "allowances" that permit emission of specified quantities of carbon to firms that produce and import fossil fuels. Measurement of the carbon content of fuel sold would be the same in the two systems, and enforcement problems would be similar. While there are some tricky problems in the details, I do not believe they are insoluble.²² Moreover, the experience since 1990 with the U.S. acid rain program gives one every reason to expect that efficient markets for carbon allowances would develop in a timely fashion.²³

The equity issues raised by a domestic system of carbon allowances are also similar to those raised by a carbon tax. Like a carbon tax, a carbon allowance system would hit (domestic) coal noticeably harder than (domestic and imported) oil. These impacts would be concentrated in regions that produce coal and in regions that burn coal to generate electricity. There would be pressures to depart from efficient policies to offset these impacts, just as the costs of reducing U.S. emissions of sulfur dioxide has long been increased by policies designed to aid high-sulfur coal interests.²⁴ Pressures to depart from efficiency in the interest of fairness are ubiquitous and seem to guarantee that mitigation policies actually adopted will be noticeably less efficient than those that have been analyzed to date.

There are, however, some important implementation issues that are unique to the tradable allowance regime. While it is possible to imagine a regime in which carbon allowances will be auctioned instead of given away, there are good political reasons why such regimes exist only in economics textbooks. There is no environmental difference, the benefits of auction revenue would be dispersed, and the costs would be concentrated on the regulated entities.²⁵ If, as thus seems highly likely, carbon allowances are to be given away under the Administration proposal, who is to get them? This is the domestic analog of the diplomatic problem of determining national emissions quotas. The acid rain program would seem to demonstrate that this problem can be solved – and that solving it will involve messy political dealing, not comparisons among competing abstract principles.²⁶ (Indeed, one can argue that this “problem” is really an advantage of the tradable allowance approach; the ability to distribute valuable allowances without compromising efficiency provides a useful tool for building political coalitions.)

A second problem relates to changes in national quotas. As we learn more about the issue and as national fortunes ebb and flow, unexpected changes will occur in appropriate

global emissions and in national quotas. Implementing such changes would create capital gains or losses for those who held allowances. It is never easy to change tax rates, though in practice they change often in the U.S., or command-and-control regulations, but I fear that the prospect of capital gains or losses may well act to make it even harder to change national CO₂ emission quotas.

A final set of problems relate to the implementation of international emissions trading, which is critical to hold down world-wide and domestic costs, with a domestic tradable allowance regime. In order to make allowances issued to private U.S. parties effectively tradable internationally, foreign governments would need either to implement compatible tradable allowance programs or to stand ready to buy and sell allowances to and from private U.S. parties on a businesslike basis. The first of these raises issues of sovereignty, while the second raises issues of plausibility. If allowances issued to U.S. private parties were not tradable internationally, however, the only way to expand U.S. use of fossil fuels would be for Congress to appropriate funds to buy emission rights from other sovereign governments. It is a little difficult to imagine this Congress, at least, paying billions to the Chinese for the right to compete with Chinese energy-intensive exports.

B. Should We Trade?

If one is concerned about the total cost of CO₂ abatement, the obvious domestic alternative to a tradable allowance regime is a carbon tax. In the very simplest textbook situations, these policies are equivalent. I have argued above that in real life trading remains feasible but, in context, encounters some implementation problems. In addition, a serious greenhouse gas abatement program, one that significantly reduced consumption of fossil fuels from what it would otherwise have been, would have non-negligible economy-wide effects

that could not be neglected. I now want to argue that a consideration of those economy-wide effects reinforces the relative desirability of the carbon tax approach.

A good deal of recent economic research has compared the net static welfare effects of various sorts of environmental policies in economies in which tax systems distort the allocation of resources, as all real tax systems do.²⁷ This is not the occasion, and I am not the person, to summarize that literature in any detail. Its basic thrust, though, is that systems that involve auctioning allowances or taxing emissions are better for the economy as a whole than regimes in which allowances are given away for free, all else (including total emissions) equal. The difference seems to arise mainly because the first two systems generate revenue that can be used to reduce tax-induced distortions elsewhere in the economy, while this cannot occur if allowances are simply given away. In some simple models the difference is so large that it could be highly desirable to control pollution with a tax but undesirable on balance to do anything if the only available instrument were free allowances. We do not know that the real difference of the net costs of allowances and of taxes is that large in the greenhouse context, but we know its sign and I would expect it to be important. At the very least, this issue deserves serious study before a comprehensive abatement scheme is put in place.

A second set of issues relates to unexpected changes in national output (GDP) and other factors affecting energy consumption. With tradable domestic allowances, total emissions are fixed, while the emissions corresponding to any given carbon tax are uncertain. In particular, unexpected increases (decreases) in GDP will raise (lower) fossil fuel use and thus increase (decrease) CO₂ emissions with a fixed tax but will have no effect on aggregate emissions under a fixed national quota. How then can one reconcile domestic use of a carbon tax to meet a binding limit on total national emissions? The Administration's "Draft Protocol Framework" contains the obvious answer: have the limit apply to multi-year periods instead

of to single years, and make some provision for banking and (at a cost) small-scale borrowing from the future. This sort of flexibility should be sufficient to permit nations to employ either carbon taxes or command and control regulation of various sorts to meet their emission quotas..

A first question is whether the Administration's tradable allowance approach could be implemented modified so that it, too could take advantage of this flexibility. If, however, the Administration proposes to announce in advance how many carbon allowances will be issued each year, it would clearly take no advantage of this flexibility. Indeed, because energy is important in at least some major cyclically sensitive industries, there could be significant impacts on the business cycle. If total emissions were absolutely fixed in the short run, national real output would tend to be stabilized. Unexpected increases in aggregate demand would raise energy prices (via raising allowance prices) more rapidly than at present, making purchase of U.S.-produced energy intensive products less attractive relative to imports and to saving. This would tend to choke off booms, and the same mechanism operating in reverse would tend to mitigate recessions. On the other hand, inflation would be de-stabilized. Increases in aggregate demand would cause rapid (and non-transitory) increases in energy prices, while energy prices would fall more rapidly than at present in recessions. I do not believe these effects have been seriously studied or that anyone can say with confidence whether they would be important or whether on balance they would be good for the economy. It would seem prudent to perform a serious study of this issue before going forward with a tradable allowance regime with fixed numbers of allowances.

If, on the other hand, the Administration proposes to vary the number of allowances issued from year to year depending on conditions at the time, it would need to set up something like a Federal Reserve Board for carbon allowances, and it would need to develop

procedures for increasing *and decreasing* the allowances available in any given year. One could not evaluate any system of this sort without knowing a fair bit about these institutions and procedures and thinking through how they would affect the domestic economy. In addition, there might be international affects: trading allowances internationally would certainly be made more complex because relative prices between nations would be affected, at least for a time, by short-run government policy decisions.

This is not a plea for an international regime based on harmonizing carbon taxes. Many authors have noted problems with this approach.²⁸ It is at the very least exceedingly difficult to compare the average net burdens on carbon emissions of alternative complex tax/subsidy/regulatory systems.

But one can use carbon taxes domestically without adopting such a scheme. The Administration's "Draft Protocol Framework" envisions an expert secretariat evaluating national emissions projections in light of national policies. It would be a small step (and one not inconsistent with important aspects of U.S. environmental policy) to specify that as a condition of compliance, national projections (and, of course, the methods employed to make them) be approved in advance. This would provide at least some ability to differentiate between nations that failed to comply because they failed to adopt appropriate policies and those that failed because of unforeseen events. It would move toward a regime based on evaluation of what governments can control, government policies, rather than on what they cannot control, economic activity. It would move away from a regime in which sanctions could only be levied well after the fact, after all emissions data are in and vetted, by which time governments may have changed more than once.

IV. SHOULD WE BUY THE ADMINISTRATION'S VEHICLE?

As I noted at the outset, the Administration's approach to climate change passes the weak test of workability. The Administration has partially designed a vehicle that, despite a range of unanswered questions, will move down the road. But, as I have tried to argue, there are two basic problems that suggest we should not buy that vehicle now.

The first problem is that this vehicle may not move us down the *right* road. By concentrating on near-term reductions in rich-country emissions, it fails to attach adequate importance to investments in technologies for mitigating and adapting to climate change. More importantly, it fails to take any steps at all toward solving what may prove to be the most critical problem of all: inducing developing nations to participate in controlling global emissions. Indeed, by providing incentives for energy-intensive industry to expand in developing nations, the Administration approach (because it follows the Berlin Mandate), will make it more difficult than necessary to induce broad participation.

The second problem is that the Administration's vehicle promises us a bumpy ride or, in ordinary language, non-negligible implementation problems and potentially excessive abatement costs. A system of tradable carbon allowances with fixed annual total emissions would be inflexible and would tend to destabilize the price level. It is hard to see an economic reason for preferring tradable carbon allowances to a carbon tax, though it is clear that energy producers would prefer allowances if they did not have to pay for them.²⁹

I do not intend to suggest that the Administration should trade its vehicle for some other nation's or that I have a fully worked out superior design of my own. I have tried to articulate, here and elsewhere, what I believe is a superior strategic approach to this issue, but going from this approach to an effective international agreement would require an enormous

amount of careful analysis and skillful negotiation. Given what has been done so far, in particular how little systematic attention has been paid to the crucial issue of investing now to reduce long-run mitigation and adaptation costs, there does not appear to be enough time between now and December to finish a good design. Thus, given the power of precedent in domestic policy and international law, any policy regime hastily adopted at Kyoto and hastily implemented at home may prove to be a long-lived mistake.

It is probably unreasonable to hope for a fundamental change in Administration policy at this late date, but it is quite reasonable to expect Congress to review carefully what emerges from Kyoto. In addition, it is reasonable to hope (if not necessarily to expect) that a "Kyoto Mandate" could emerge from December's meeting that would steer the next round of climate negotiations in directions that will be more valuable to us all in the long run.³⁰ We have time to design and adopt realistic strategies to respond to the threat of climate change; we should not be distracted by political pressures to take short-term symbolic actions that may well be counter-productive in the long run.

NOTES

* Gordon Y Billard Professor of Economics and Management, Massachusetts Institute of Technology (MIT), and Director of the MIT Center for Energy and Environmental Policy Research. I am deeply indebted to my colleagues in MIT's Joint Program on the Science and Policy of Global Change [hereafter simply "MIT Joint Program"] for most of what I know about the climate issue, though none of them necessarily agrees with anything that follows.

¹ Roughly, CO₂ accounts for a bit over half of the recent increase in net absorption of solar radiation attributable to human-caused changes in the composition of the atmosphere, and about 80 percent of human-caused CO₂ emissions arise from combustion of fossil fuels. [CITES]

² This is an 11-page typewritten document dated 1/17/97, entitled "U.S. Draft Protocol Framework" and not otherwise identified. Its central elements are discussed in another U.S. government "publication": a document entitled "Climate Change: U.S. Non-Paper" and dated December 1996. I have also relied on conversations with (allegedly) informed parties to characterize the evolving Administration position.

³ [U.S.] Interagency Analytical Team, "Economic Effects of Global Climate Change Policies," draft of May 30, 1997.

⁴ See, generally, Intergovernmental Panel on Climate Change (IPCC), *Climate Change 1995 – Economic and Social Dimensions of Climate Change*. Cambridge: Cambridge University Press, 1996, Section 9.2.

⁵ A good general discussion is provided by T.H. Tietenberg, *Emissions Trading*, Washington: Resources for the Future, 1985.

⁶ This section draws heavily on R. Schmalensee, "Greenhouse Architectures and Institutions," MIT Joint Program Report No. 13, November 1996; and H.D. Jacoby, R.G. Prinn and R. Schmalensee, "Needed: A Realistic Strategy for Global Warming," MIT Joint Program Report No. 21, August 1997.

⁷ [ADD IPCC CITE]

⁸ See, for instance, R. Schmalensee, T.M. Stoker, and R. Judson, "World Energy Consumption and Carbon Dioxide Emissions: 1950-2050," MIT Joint Program Report No. 5, April 1996. The authors note that China and India accounted for about 15 percent of 1990 CO₂ emissions from fossil fuels; they project that these two nations alone will account for at least 27-30 percent of emissions in 2050 and 31-44 percent of emissions growth over the 1990-2050 period.

⁹ See, for instance, H.D. Jacoby, R. Schmalensee, and D.M. Reiner, "What Does Stabilizing Greenhouse Gas Concentrations Mean?" In B.P. Flannery and C.A.B. Grezo, eds., *Critical Issues in the Economics of Climate Change*, London: IPIECA, 1997; and J. Edmonds, J. Dooley, and M. Wise, "Atmospheric Stabilization and the Role of Energy Technology," in C.E. Walker, M.A. Bloomfield, and M. Thorning, eds., *Climate Change Policy, Risk Prioritization, and U.S. Economic Growth*, Washington: American Council for Capital Formation Center for Policy Research, June 1997.

¹⁰ On the potential importance of low-carbon energy technologies, see Edmonds, Dooley, and Wise, "Atmospheric Stabilization." Caution is called for here, however, since the U.S. government has not historically been very good at developing commercial technologies at reasonable cost; see, for instance, R. Schmalensee, "Appropriate Government Policy Toward Commercialization of New Energy Supply Technologies," *Energy Journal*, 1 (1980): 1-40.

¹¹ IPCC, *Climate Change 1995*, Section. 9.2.

¹² This issue is explored by H.D. Jacoby and Z.Y. Yang, [RECENT CONFERENCE PAPER].

¹³ See G. Marland et al, *Estimates of CO₂ from Fossil Fuel Burning and Cement Manufacturing, Based on the United Nations Energy Statistics and the U.S. Bureau of Mines Cement Manufacturing Data*,

ORNL/CDIAC-25, NDP-030. Oak Ridge, TN: U.S. Department of Energy, Oak Ridge National Laboratory, May 1989.

¹⁴ For a discussion of the monitoring problem and a proposed solution, see United Nations Conference on Trade and Development (UNCTAD), *Combating Global Warming: Possible Rules, Regulations and Administrative Arrangements for a Global Market in CO₂ Emission Entitlements*. New York: United Nations, December 1994.

¹⁵ A. Chayes and A.H. Chayes, *The New Sovereignty: Compliance with International Regulatory Agreements*. Cambridge: Harvard University Press, 1995.

¹⁶ Compare R.N. Cooper, "A Treaty on Global Climate Change: Problems and Prospects," Mimeo, October 1996 (arguing that sanctions do not have a substantial potential role in this context) and Environmental Defense Fund, "Emissions Budgets: Building An Effective International Greenhouse Gas Control System," Washington, February 1997 (arguing that automatic sanctions for excess emissions are critical to an effective regime).

¹⁷ See RW. Hahn and G.L. Hester, "Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program," *Yale Journal on Regulation*, 6 (1989): 109-153.

¹⁸ For a theoretical analysis of this point and an empirical study of the relevant portion of the U.S. acid rain program, see J.-P. Montero, *Topics on Market-Based Environmental Policy*, unpublished doctoral dissertation, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, March 1997..

¹⁹ This issue is addressed by H.D. Jacoby, et al, "CO₂ Emissions Limits: Economic Adjustments and the Distribution of Burdens," *Energy Journal*, 18 (1997): 31-58

²⁰ For more on this distinction, see Schmalensee, "Architectures and Institutions."

²¹ For recent studies, see G. Yohe, "Climate Change Policies, the Distribution of Income, and U.S. Living Standards," in C.E. Walker, M.A. Bloomfield, and M. Thorning, eds., *Climate Change Policy, Risk Prioritization, and U.S. Economic Growth*, Washington: American Council for Capital Formation Center for Policy Research, June 1997 and H.D. Jacoby et al, "CO₂ Emissions Limits."

²² See, for instance, J.M. Poterba, "Tax Policy to Combat Global Warming: On Designing a Carbon Tax," in R. Dornbusch and J.M. Poterba, eds., *Global Warming: Economic Policy Response*. Cambridge: MIT Press, 1991.

²³ An analysis of the relevant portion of that experience is provided by P.L. Joskow, R. Schmalensee, and E.M. Bailey, "The Market for Sulfur Dioxide Emissions," MIT, mimeo, February 1997.

²⁴ See, e.g. P.L. Joskow and R. Schmalensee, "The Political Economy of Market-Based Environmental Policy: The U.S. Acid Rain Program," *Journal of Law and Economics*, forthcoming.

²⁵ On the U.S. acid rain experience, see Joskow and Schmalensee, "Political Economy"; for a general discussion, see [STAVINS PAPER]

²⁶ For details on the acid rain experience, see Joskow and Schmalensee, "Political Economy." T.C. Schelling, "Costs and Benefits of Greenhouse Reduction," Mimeo, August 1997, notes that the analogous problem of dividing Marshall Plan aid among European recipient nations was solved by detail-intensive negotiation, not by the application of abstract notions of fairness.

²⁷ The literature on this issue is growing rapidly. Two useful recent contributions are I.W.H. Parry, R.C. Williams III, and L.H. Goulder, "When Can Carbon Abatement Policies Increase Welfare: The Fundamental Role of Distorted Factor Markets," Cambridge, National Bureau of Economic Research,

Working Paper 5967, March 1997; and D. Fullerton and G. Metcalf, "Environmental Controls, Scarcity Rents, and Pre-Existing Distortions," Cambridge, National Bureau of Economic Research, Working Paper 6091, July 1997.

²⁸ See IPCC, *Climate Change 1995*, Section 11.6.

²⁹ This point is sometimes misunderstood, so an attempt at clarification seems in order. Suppose a firm is given the rights to emit 10 tons of CO₂, that the market price of emissions rights is \$10 per ton, and that at that price, the firm plans to emit 10 tons. It pays nothing for allowances, but it must recognize that the cost at the margin of increasing emissions is \$10. Now consider a regime with a carbon tax of \$10 per ton. One would normally expect that the firm would still plan to emit 10 tons, since its cost of emissions at the margin is \$10, as before. The only difference, and it is not likely to be a trivial one from the firm's perspective is that it is out \$100 for taxes in the carbon tax regime.

³⁰ For more on this, see Jacoby, Prinn, and Schmalensee, "Realistic Strategy."