United States Senate

Republican Policy Committee

Jon Kyl, Chairman

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The Economics of Reducing Greenhouse Gases: Can Meaningful Emissions Reductions Come at Acceptable Costs?

Executive Summary and Introduction

By month's end, the Department of Energy, in response to a presidential request, is expected to announce draft recommendations with regard to a current program that allows companies to voluntarily report to the government their "greenhouse gas" emissions. The Energy Department's response is expected to include a recommendation that companies be awarded transferable emissions credits when they demonstrate they have made emissions reductions. For policymakers, this impending recommendation necessarily invites a discussion as to whether policies to reduce greenhouse gases are appropriate – and if so, at what cost.

The appropriateness of any emissions-reduction policy will depend in large part on the scientific basis for global warming, yet the scientific case for catastrophic global warming has not been made. There are significant unknowns which confound scientists' ability to predict the impact of greenhouse gas emissions on the climate and whether, on balance, they are harmful. This vacuum of knowledge leaves policymakers with little guidance. Even those who are convinced that continued unregulated emissions of such greenhouse gases as carbon dioxide and methane would lead to catastrophic climate change must be certain that the policies they advocate would *not do more harm than good*.

The President's request for recommendations on awarding transferable emissions credits presumably stems from the belief that emissions trading could be the most cost-effective means to reduce greenhouse gas emissions. Analysis reveals, however, that this regulatory scheme would prove cost-effective only under certain conditions, which may not exist in the real world. Under this scheme, the government would set a mandatory cap on emissions of certain regulated gases in order to limit emissions nationwide to a pre-set maximum within a given time frame. The government's distribution of allowances

to businesses would permit them to emit a certain amount of the regulated gas. These allowances would be tradeable (or transferable), meaning any business holding surplus allowances could sell them to another business that needed them to comply with its emissions standards – or to someone who valued them as an investment, or to someone who wanted to take them out of play.

This paper will show that under realistic economic assumptions, *emissions trading is significantly more costly* than the more straightforward option of a simple emissions tax. It also will show that so-called voluntary emissions reduction schemes do nothing to change this assessment, and come encumbered with their own set of problems. This paper concludes by suggesting that any emissions-reduction scheme – even the most efficient – is unlikely to meaningfully reduce emissions at an acceptable cost. In other words, *there is no economically defensible action to reduce greenhouse gas emissions.*

The Economics of Emissions Trading

Some scientists believe that manmade emissions of greenhouse gases could lead to dangerous warming of the planet. That hypothesis is still under serious scientific dispute, however.[1] This paper will not re-argue the "shaky science" issue, but will simply explore some of the policy options to reduce greenhouse gas emissions. By so doing, this paper does not endorse in any way the regulation of greenhouse gases. As will be demonstrated, any attempt to reduce greenhouse gases, regardless of policy choice, would likely result in far greater costs than benefits.

The Emissions Trading Theory

Under emissions trading, the government sets a cap on emissions and distributes allowances equal to the amount of the cap to affected entities. At the end of each accounting period, each entity must hold allowances equal to its emissions. Entities holding surplus allowances as the end of the accounting period nears would be able to sell them, and entities that fall short of their compliance obligations would be able to purchase them. In a perfectly functioning market, emissions reductions would occur where abatement costs are lowest.

To see why, consider the actions of two firms in an economy where the government has set a cap on carbon dioxide emissions and employed an emissions trading scheme. Before the mandatory cap was set, each firm had emitted 120 tons of carbon dioxide per year; under the cap, each is awarded 100 allowances (say, for illustration purposes, that one allowance allows for emitting one ton). Suppose that over the course of the following year (the accounting period), the market price of emissions allowances settles at $50 per allowance. Without allowance trading, each firm would have to reduce its emissions by 20 tons. With trading, however, each firm has the option of either reducing its emissions or purchasing emissions allowances on the open market.

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[1]See RPC Policy Paper, "The Shaky Science Behind the Climate Change Sense of the Congress Resolution," June 2, 2003.

Suppose that firm 'A' can reduce its emissions at a cost below $50 per ton until its emissions reach 80 tons.[2] Suppose that firm 'B' cannot reduce its emissions by even one ton at a cost lower than $50 per ton. The result would be that firm 'A' would reduce its emissions to 80 tons and sell the 20 surplus allowances to firm B at $50 per allowance. Firm 'A' would have 80 allowances for its 80 tons of emissions and firm 'B' would have 120 allowances for its 120 tons of emissions. All the reductions would take place at firm 'A' where the costs are lower, but both firms would have helped pay the cost of reducing those emissions. Overall, the cost of meeting the government cap would be lower than it would have been had each firm been forced to reduce its emissions by 20 tons.

This is how an emissions trading scheme would work in a perfect market with perfect information and zero transaction costs. In practice, however, emissions trading is much more complicated than in theory, a point later addressed. Before addressing the practical problems with emissions trading, this paper will turn to the so-called voluntary schemes to show how they will be voluntary only temporarily – that they will lead to mandatory controls.

"Voluntary" Schemes: "Credit For Early Action"

Because many policymakers are rightfully concerned about the harmful consequences of mandatory controls on greenhouse gas emissions, some have proposed so-called "voluntary" emissions reduction schemes. One such proposal is currently being devised by the Department of Energy (DOE). On February 14, 2002, President Bush directed the Secretary of Energy to recommend reforms "to ensure that businesses and individuals that register reductions are not penalized under future climate policy, and to give transferable credits to companies that can show real emission reductions."[3] DOE is set to release its plan later this month.[4]

Under this "voluntary" system, firms can receive credits for reducing emissions even though they are not required to do so. In other words, for each ton of carbon dioxide a firm voluntarily reduces now,

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[2]Economists call these costs "marginal costs." In other words, the cost of reducing each additional (or marginal) ton of carbon dioxide is the marginal cost, or the cost of reducing emissions at the "margin." To understand this concept, suppose the cost to firm 'A' of reducing emissions from 120 tons to 119 tons is $5. Each additional (or marginal) one-ton reduction in emissions is a little more difficult and costs a little more than the previous ton reduced. So reducing from 119 tons to 118 may cost $5.10, and so on until the cost of reducing emissions from 80 to 79 tons is $50. At this point, because the cost to firm 'A' of reducing one more ton of carbon dioxide is equal to the market price of allowances, the firm will stop reducing emissions. The firm will have 20 surplus allowances acquired at a cost below $50 per allowance, which it can then sell. Whenever the term "cost" is used in this paper, it refers to "marginal cost."

[3]White House, "President Announces Clear Skies & Climate Change Initiatives," February 14, 2002, http://www.whitehouse.gov/news/releases/2002/02/20020214.html.

[4]Of course, there would be no reason to be concerned about being penalized unless a mandatory program were being considered.

it earns a credit that would become an emissions allowance under any future mandatory-reduction requirements. Such proposals are often referred to as "credit for early action." But "early" implies before something else – in this case, before mandatory controls. Otherwise, what is gained by a voluntary program, except a political calculation that a two-step move to mandatory controls is easier than going to mandatory immediately?

The problem with these types of schemes is threefold: 1) they create incentives that would inexorably lead to mandatory reduction caps (indeed, they presuppose mandatory controls); 2) they create a zero-sum dynamic where some companies benefit at the expense of everyone else; and 3) they really aren't voluntary at all.

Creating a Business Lobby for Mandatory Caps

The rationale behind the idea of early crediting is simple: it would protect firms that reduce current emissions from being penalized under a future emissions cap. Otherwise, companies that voluntarily reduce emissions for whatever reason[5] would face steeper reduction requirements under a future cap than firms that did nothing. Indeed, firms may well *increase* emissions in the interim in order to raise the baseline from which they would have to make reductions under a future cap.

There is another incentive at work in this calculus, however: *the allowances awarded under an early action credit program would be worthless in the absence of a mandatory cap*. In the absence of a cap, there would be no buyers of allowances, and without demand there is no market. Companies holding allowances potentially worth millions of dollars would have a huge incentive to lobby for mandatory controls in order to realize those gains. The effect of early action crediting, then, would be the creation of a business lobby for mandatory caps. Indeed, *the only rationale for awarding allowances is as a prelude to mandatory caps*.

This consequence was made clear in several comments submitted during the Department of Energy's rulemaking on early action crediting. The following comment by a representative of the Industrial Energy Consumers of America makes the case:

> A transferable credit system is a precursor to emissions trading (cap and trade) and such credits do not have monetary value without an emissions cap at the company level. An emissions cap at the company level would result in energy rationing, distorting energy markets, restraining economic growth, damaging competitiveness of U.S. manufacturing and accelerating the importation of energy-containing products. . . . *If the Administration does not intend to*

[5]Firms might reduce emissions to look "green" or such reductions may occur naturally as firms increase efficiency to lower costs.

implement an emissions trading system (cap and trade), it should not establish a transferable credit system (emphasis added).[6]

A spokesman for the National Association of Manufacturers expressed similar sentiments, stating, "A formalized emission-trading program would create an inappropriate expectation of future credit value by implying that a future Congress will establish emission quotas."[7]

There is nothing inevitable about mandatory caps on greenhouse gas emissions, especially given the significant scientific skepticism about global warming and the efficacy of emissions controls. And so there is no overriding need to protect companies that reduce emissions. Besides, neither Congress nor the administration should be in the business of providing political risk insurance for companies against future regulation. In this instance, the "insurance" would make inevitable the event it is supposed to protect against.

Not Voluntary

Although touted as "voluntary," early action crediting is anything but voluntary. Each credit awarded pre-regulation is a credit that will be subtracted from the total allocation available in the mandatory period. If the recipients of early action credits were allowed to use those credits to exceed a future mandatory cap, it would undermine the environmental objectives of the cap as well as the integrity of the emissions trading market since the existing allowances would lose value. In short, if an emissions trading program is to achieve its objective, there must be strict enforcement of the cap.

Creating Winners and Losers

Given this necessity of a strict cap, any firm that does not "volunteer" to reduce emissions would be forced to make even heavier reductions later, so firms would feel enormous pressure to participate. Of course, the biggest losers would be small businesses who can't afford the necessary investments and do not have the accounting or engineering expertise to reduce emissions in the early-action period. They would suffer from the higher costs of energy rationing that would take place under a mandatory cap, and wouldn't have credits to help offset the costs.

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[6]IECA Comments on the Department of Energy's Greenhouse Gas Reporting Proposal, June 3, 2002. The full public record is available at www.pi.energy.gov/enhancingGHGregistry/; For extensive excerpts from the public record see Marlo Lewis, Jr., "Money for Nothing, Chits for Free: Excerpts from the Experts on The Bush Administration's Greenhouse Gas Crediting Plan," Competitive Enterprise Institute, October 16, 2002.

[7]NAM Comments on the Department of Energy's Greenhouse Gas Reporting Proposal, June 2, 2002, www.pi.energy.gov/enhancingGHGregistry/; Lewis, October 16, 2002.

As an example of how some companies will become losers, assume for simplicity's sake that the economy is made up of just two firms, 'A' and 'B.' Suppose that each firm emits 120 tons of carbon dioxide and that the government sets a nationwide cap on emissions of 200 tons. Absent early action crediting, each firm would receive 100 allowances and each firm would reduce its emissions by 20 tons or meet its target through the emissions trading market as described above.

Now suppose that there was an early action credit program before the imposition of the mandatory cap in which the government had set aside 20 credits for early emissions reductions. As noted, each credit awarded under an early action credit scheme must be subtracted from the future mandatory cap. So awarding early credits reduces the total compliance-period allocation of allowances to 180 rather than 200. If firm 'A' lowered its emissions by 20 tons before the mandatory compliance period, it would have received 20 early action credits. After the setting of a mandatory cap, firm 'A' would also receive 90 allowances as part of its allocation under the cap for a total of 110 allowances. Firm 'B', on the other hand, would only receive a total of 90 allowances.[8]

Instead of having to reduce emissions to just 100 tons, now firm 'B' must reduce emissions to 90 tons or purchase additional allowances from firm 'A'. Firm 'A', on the other hand, now has 110 allowances, but only emits 100 tons of carbon dioxide. It can either increase its emissions or sell the surplus. Either way, one firm gains at the expense of the other.

Early Action Crediting is Simply Mandatory Controls Via the Back Door

Early action crediting schemes are not voluntary at all. They create an expectation of future mandatory caps, and companies that can afford to will have little choice but to reduce emissions to get credits. Moreover, these companies will then constitute a lobby that will demand mandatory controls so that they can turn their credits into cash. Everyone else will be penalized. Since early action crediting inexorably leads to mandatory controls, this paper now turns to an analysis of emissions trading and emissions taxes under a mandatory cap.

Allowances Versus Taxes[9]

If Congress decided to regulate greenhouse gas emissions using market mechanisms, it could choose between an emissions tax (a price instrument) or emissions trading (a quantity instrument). In a world of complete certainty, either instrument will lead to the same outcome. For example, if the government wanted to reduce U.S. carbon dioxide emissions from the present level of 1.6 Gigatons of

[8] 'B' does not reduce emissions in the early action period because of the cost constraints discussed on page 3.

[9] For a more economically rigorous discussion of the costs of emissions trading relative to emissions taxes, the distributional impacts of emissions trading, and of so-called hybrid schemes, see the Appendix.

carbon (GtC) to 1.2 GtC (the Kyoto target), it could either set a tax on emissions (for illustration purposes, assume a $50-per-ton tax would be necessary to meet that target), or it could cap emissions at 1.2 GtC and distribute 1.2 billion tradeable allowances through an auction. The cost of reducing emissions, which would arise from the auction and trading activity in the emissions market, would equilibrate at $50 per ton.

When uncertainty is taken into account, however, the costs of reducing emissions are no longer identical under price and quantity instruments. If the government fixes the per-ton cost of reducing emissions through an emissions tax, this leads to uncertain emissions levels. If the government fixes the level of emissions, then the resulting per-ton costs are uncertain. Uncertainty increases the social costs of both types of instruments, but it turns out that the social costs associated with emissions trading are much higher than those associated with a tax. Indeed, a study by Resources for the Future, which modeled a greenhouse gas emissions trading market under realistic assumptions and compared it to an emissions tax, estimated that emissions trading would be about five times costlier than a simple carbon tax.[10]

Another way to look at this is to think about what businesses face under emissions trading versus a tax. Since the quantity of emissions is fixed under emissions trading, any change, perturbation, or shock affecting the market for emissions allowances would be revealed entirely in the price for emissions allowances, leading to high price volatility. As noted by Yale economist William Nordhaus, with a fixed supply of a good (as would be the case with emissions allowances), the result would be a great deal of price volatility and hundreds of billions of dollars in losses per year.[11]

Price volatility would make it difficult for firms to predict abatement costs, and would disrupt business planning. Under emissions trading, a firm would want to compare the relative costs of different emissions reduction strategies in deciding how to meet its reduction target. If allowance prices are highly volatile, then the firm would be unable to determine relative costs, which in some cases would lead to costly mistakes in business planning. These real-world mistakes would increase the costs of an emissions trading program.

Under a carbon tax, by contrast, the per-ton cost of reducing emissions is fixed at whatever the tax is set at, and businesses would be able to plan for the future based on predictable costs. Of course, the resulting level of emissions would be uncertain, but since the net cost of greenhouse gas emissions appears to be very low (a point addressed later in the paper), that would be preferable to rampant cost uncertainty.

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[10]William A. Pizer, "Prices vs. Quantities Revisited: The Case of Climate Change," Resources for the Future, Discussion Paper 98-02, October 1997; also see Congressional Budget Office, "The Economics of Climate Change: A Primer," April 2003, pp. 36-37.

[11]William Nordhaus, Presentation at a Resources for the Future's "Wednesday Seminar Series," December 18, 1998.

Emissions Trading Under Free Distribution of Allowances

Most emissions trading programs would distribute allowances through "grandfathering" – distributing permits free of charge based on historical emissions – rather than through a competitive auction. This leads to an additional problem with emissions trading programs. The total value of allowances distributed under grandfathering would represent a transfer of wealth from policy winners to policy losers. In the hypothetical example above, that value would be 1.2 billion allowances at $50 per allowance, or $60 billion.

As noted by Ontario economist Ross McKitrick, "If emissions are controlled by tradeable quotas, this creates a new, artificial scarcity in something that hitherto had been free: the right to release carbon dioxide. Because this right is valuable, people are willing to pay to get it. . . . A market will emerge in which [allowances] are traded and priced out."[12] Allowances represent "a new type of asset," said McKitrick, but the value of these new assets does not represent new wealth.

Where does this wealth currently reside? McKitrick explains: "It represents the capitalized value to existing users of fossil fuels of the right to emit carbon dioxide at no charge. This value is already counted into balance sheets, investment portfolios, collateral for loans, etc. all through the economy. Any policy that puts a price on carbon dioxide emissions (including free permit distribution) extracts that money from its current use and hands it over to the beneficiaries of the policy."[13]

In this case, the beneficiaries would be those entities that receive the initial allocation of free permits, or what McKitrick dubs the "Carbon Cartel."[14] Indeed, there has already been a flurry of lobbying by businesses attempting to make sure they are part of the cartel. Utilities that produce nuclear power want credits because their nuclear power plants don't emit greenhouse gases (and never did); the aluminum industry wants credits because it recycles aluminum; waste services companies want credits

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[12]Ross McKitrick, "What's Wrong With Regulating Carbon Dioxide Emissions?" Congressional Briefing Sponsored by the Cooler Heads Coalition, October 11, 2001.

[13]McKitrick, October 11, 2001.

[14]It is relatively easy to determine who would make up the carbon cartel. On June 5, a coalition of electric utilities, investors and environmentalists called for mandatory caps on carbon emissions (http://www.ceres.org/newsroom/press/electricrecs.htm). The Pew Center's Business Environmental Leadership Council, made up of 38 companies, has long advocated "market-based mechanisms" to reduce greenhouse gases. These companies hope to benefit from the massive redistribution of wealth that would occur from an emissions trading program. Enron, a prominent member of the Pew Center's Business Leadership Council, stated in an internal memo that "if implemented, this agreement [Kyoto] will do more to promote Enron's business than will almost any other regulatory initiative outside of restructuring of the energy and natural gas industries in Europe and the United States....The endorsement of emissions trading was another victory for us....I predict business opportunities within 18 months....This agreement will be good for Enron stock (December 1997)."

because they burn garbage; the forest and paper industry wants credits for growing trees, using co-generation and biomass fuels to produce energy, and so on. In many cases, companies want credits for things they would have done *anyway* in the absence of crediting – leading to such credits being dubbed "anyway tons."[15]

The Only Efficient Option: a Carbon Tax (of Zero)

This paper makes clear that, from an economic perspective, if government wants to reduce greenhouse gas emissions, the most efficient means is a carbon tax. So what would the "optimal" carbon tax be? Generally speaking, the tax on a ton of carbon dioxide emitted should be no greater than the benefit to society of reducing that ton of emissions – or else the cost of reducing emissions would be greater than the benefit. But the benefits of reducing greenhouse gas emissions, even by as much as 30 percent as required under the Kyoto Protocol, would be at best tiny – suggesting that the tax should be very small. This is because studies have shown that full compliance with Kyoto would only prevent 0.07 degrees Celsius (0.126 degrees Fahrenheit) of warming over the next 50 years[16], an amount too small to detect. As noted by McKitrick, "The problem with Kyoto-type emission-reduction plans is that the marginal costs rise exponentially and the benefits, if there even are any, rise linearly. So, no matter how you look at it, carbon dioxide restrictions on even a modest scale use up more social resources than any benefits they generate."[17]

Moreover, some recent economic studies have found that a doubling of carbon dioxide in the atmosphere, were it to occur, would actually be slightly beneficial for the United States,[18] in terms of increased GDP – due to increased carbon fertilization, longer growing seasons, increased forest productivity, lower heating costs, and greater recreational opportunities. If true, the carbon tax should be *negative*! Of course, the benefit found was slight (a 0.2 percent increase in GDP), and given the errors intrinsic to such studies, the best anyone can say is that the net impact is unknown.

Since economists aren't even sure whether global warming would be harmful or beneficial, it seems the optimal carbon tax, for the present, would be zero.

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[15]Lewis, October 16, 2002.

[16]Thomas Wigley et al., "The Kyoto Protocol: CO2, CH4, and climate implications," *Geophysical Research Letters*, 25, pp. 2285–2288 (1998).

[17]McKitrick, in correspondence to the author, July 2002.

[18]For a review of the relevant literature see Robert Mendelsohn, "The Greening of Global Warming," American Enterprise Institute for Public Policy Research, 1999.

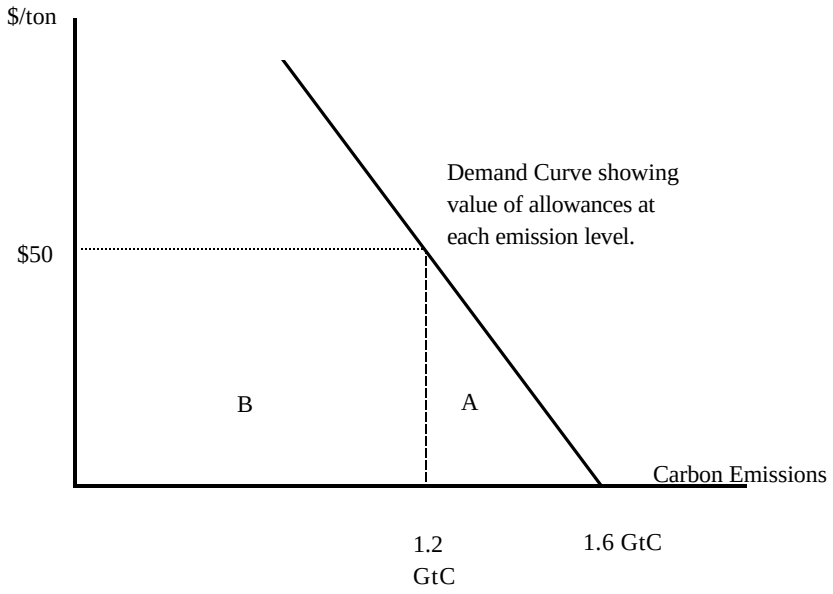
Conclusion

This paper has demonstrated that a policy of emissions taxes is more efficient than emissions trading in reducing greenhouse gases. Emissions trading leads to significant social costs, wasteful lobbying, and significant and damaging wealth transfers. Moreover, given the nature and economics of reducing greenhouse gases – exponentially rising costs and linearly rising benefits – *there is no policy* – whether it be taxes, emissions trading, or other means – *that can achieve meaningful reductions with acceptable costs*.

Appendix

The Economics of Emissions Trading Versus Emissions Taxes

The following is a detailed explanation of the economics of emissions trading versus emissions taxes.



To illustrate the point made earlier in this paper – that emissions trading is more costly than emissions taxes – the above diagram depicts a simple market for the right to emit carbon dioxide. The hypothetical demand curve (labeled) shows the amount firms would be willing to pay for the right to emit each quantity of carbon dioxide.

Currently, the U.S. economy emits about 1.6 gigatons of carbon (GtC). Since there are currently no regulations or taxes on carbon dioxide emissions, the price that emitters have to pay for the right to emit is zero, represented in the diagram where the demand curve meets the horizontal axis. Given the demand curve in the diagram, if the government wanted to reduce emissions from 1.6 GtC to 1.2 GtC (the Kyoto Protocol target), it would have to tax emissions at $50 per ton, or set up a competitive auction in which companies would end up paying $50 per ton for the right to emit carbon dioxide. Either way, the outcome would be the same.

Demand is the Unknown Factor

A difference arises between taxes and trading, however, when uncertainty is taken into account. The uncertainty comes from the fact that the government doesn't know what the demand curve looks like. If it is steeper than depicted here, then it would require a higher tax to achieve the same reduction in

emissions, or the cost of allowances would be higher under emissions trading. If the demand curve is less steep, the opposite would be true.

Because nobody knows what the demand curve in the real world will look like, this leads to mistakes in forecasting the outcome of the policy, regardless of whether a price or a quantity control is chosen. If a price control (i.e., tax) is implemented, there will be errors in forecasting the resulting quantity of emissions. If a quantity control (i.e., cap) is chosen, there will be errors in forecasting the resulting price. These mistakes have social costs, which must be taken into account when determining the best way to reduce emissions.

With Demand Unknown, Emissions Trading Will Be More Costly

It turns out that in cases where the demand curve is relatively steep, meaning that the marginal costs (the cost of reducing an additional ton of carbon dioxide) increase quickly with each ton of carbon dioxide reduced (see footnote 2), and where the marginal benefits (the benefit of reducing an additional ton of carbon dioxide) accumulate relatively slowly, the cost of mistakes associated with choosing an emissions cap is much larger than the cost of mistakes associated with an emissions tax.

This is the case with global warming policies, i.e., marginal costs are increasing quickly compared to marginal benefits, which are essentially flat. The cost of complying with the Kyoto Protocol, for example, has been estimated to be in the range of $100 billion to $400 billion per year.[19] But full compliance with Kyoto, as noted above, would have no discernible effect on global temperatures.

The CBO explains the economics this way:

> "Because climate change will result only from the long-term buildup of gases over many years, incremental benefits are essentially flat in any given year; that is, the incremental benefits of the millionth ton of carbon reduced are essentially the same as those of the billionth. In contrast, the incremental costs of reducing emissions are likely to rise sharply the more emissions are constrained. Thus, choosing to strictly limit the quantity of emissions could prove very expensive compared with the potential benefits, but choosing to impose a tax whose level reflected the expected benefits probably would not."[20]

Distributional Impacts of Emissions Trading

The following discussion describes the distribution impacts of emissions trading under grandfathering.

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[19]Margot Thorning, "A U.S. Perspective on the Economic Impact of Climate Change Policy," Special Report of the American Council for Capital Formation, December, 2000.

[20]Congressional Budget Office, April 2003, pg. 37.

In the emissions-market diagram above, the area under the demand curve, which would extend all the way up to the vertical axis, represents the total value of the right to emit 1.6 GtC for free. If the government sets a cap on emissions at 1.2 GtC or imposes a tax of $50 per ton of emissions, some of that value is lost and some of it is transferred from its current use to other uses. The triangle labeled A represents the economic activity that would be permanently lost under an emissions cap. The rectangle labeled B is the "scarcity rent." This represents the transfer of wealth to policy winners (those who get the initial distribution of allowances) from policy losers (everybody else) that would occur under emissions trading with grandfathering.