

An hourglass-shaped graphic with a globe inside. The top bulb is dark blue, and the bottom bulb is light blue. The globe is centered in the narrow neck of the hourglass. The text is overlaid on the graphic.

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*Global Climate Change: Controlling CO₂ Emissions -
Cost-limiting Safety Valves*

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Abstract. Proposed CO₂ reduction schemes present large uncertainties in terms of the perceived reduction needs and the potential costs of achieving those reductions. Several cost-limiting "safety valves" have been proposed to bound costs of any CO₂ control program, including (1) a straight carbon tax, (2) a contingent reduction scheme, (3) unlimited permit purchases, and (4) cost-based excess emissions penalties. Employing a safety valve shifts much of the emission reduction debate from compliance targets to the specifications of the safety valve, in particular, the level of the tax or fee involved.

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Global Climate Change: Controlling CO₂ Emissions — Cost-Limiting Safety Valves

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Summary

Proposed CO₂ reduction schemes present large uncertainties in terms of the perceived reduction needs and the potential costs of achieving those reductions. Several cost-limiting “safety valves” have been proposed to bound costs of any CO₂ control program, including (1) a straight carbon tax, (2) a contingent reduction scheme, (3) unlimited permit purchases, and (4) cost-based excess emissions penalties. Employing a safety valve shifts much of the emission reduction debate from compliance targets to the specifications of the safety valve, in particular, the level of the tax or fee involved. This report will be updated if events warrant.

The fundamental policy assumption that has changed between the U.S. ratification of the 1992 Framework Convention on Climate Change (FCCC) and the current Bush Administration’s decision to abandon the Kyoto Protocol process concerns costs.¹ The ratification of the FCCC was based at least partially on the premise that significant reductions could be achieved at little or no cost. This assumption helped to reduce concern some had (including those of the former Bush Administration) that the treaty could have deleterious effects on U.S. competitiveness — a significant consideration because developing countries are treated differently from developed countries under the FCCC. Further ameliorating this concern, compliance with the treaty was voluntary. While the United States could “aim” to reduce its emissions in line with the FCCC’s goal, if the effort indeed involved substantial costs, the United States could fail to reach the goal (as has happened) without incurring any penalty under the treaty.

This flexibility would have been eliminated under the Kyoto Protocol with its mandatory reduction requirements. The possibility of failure to comply with a binding commitment intensifies one’s perspective on potential costs: How confident can one be

¹ For a review of U.S. global climate change policy, see CRS Report RL30024, *Global Climate Change Policy: Cost, Competitiveness, and Comprehensiveness*, by Larry Parker.

in the claim that carbon reductions can be achieved at little or no cost?² Compliance cost estimates ranging from \$5.5 billion to \$200 billion annually cause some to pause.³ The current Bush Administration was sufficiently concerned about potential CO₂ control costs to reverse a campaign pledge to seek CO₂ emissions reductions from power plants, in addition to its decision to abandon the Kyoto Protocol process.⁴

Proposed CO₂ reduction schemes present large uncertainties in terms of the perceived reduction needs and the potential costs of achieving those reductions. In an attempt to prevent any CO₂ control program from incurring unacceptable costs, several cost-limiting “safety valves” have been proposed to bound costs. These safety valves are designed to work with market-based CO₂ reduction schemes, similar to the tradeable permit strategy used by the acid rain program,⁵ and would effectively limit the unit (per ton of emissions) control costs sources would pay. This report examines four such safety valves: (1) a straight carbon tax, (2) a contingent reduction scheme, (3) unlimited permit purchases, (4) cost-based excess emissions penalties.

The Dilemma: Price versus Quantity

In general, market-based mechanisms to reduce CO₂ emissions focus on specifying either the acceptable emissions level (quantity), or compliance costs (price), and allowing the marketplace to determine the economically efficient solution for the other variable. For example, a tradeable permit program sets the amount of emissions allowable under the program (i.e., the number of permits available caps allowable emissions), while permitting the marketplace to determine what each permit will be worth. Likewise, a carbon tax sets the maximum unit (per ton of CO₂) cost that one should pay for reducing emissions, while the marketplace determines how much actually gets reduced. In one sense, preference for a carbon tax or a tradeable permit system depends on how one views the uncertainty of costs involved and benefits to be received.

For those confident that achieving a specific level of CO₂ reduction will yield significant benefits — enough so that even the potentially very high end of the marginal cost curve does not bother them — a tradeable permit program may be most appropriate. CO₂ emissions would be reduced to a specific level, and in the case of a tradeable permit program, the cost involved would be handled efficiently, though not controlled at a specific cost level. This efficiency occurs because through the trading of permits, emission reduction efforts concentrate at sources at which controls can be achieved at least cost.

However, if one feels more certain of the potential downside risk of substantial control costs to the economy than of the benefits of a specific level of reduction, then a

² For a further discussion of the foundations for such divergent cost estimates, see CRS Report 98-738, *Global Climate Change: Three Policy Perspectives*, by Larry Parker and John Blodgett.

³ CRS Report RL30024, p. 16.

⁴ President George W. Bush, *Letter to Senators Hagel, Helms, Craig, and Roberts*, Office of the Press Secretary, March 13, 2001.

⁵ For more on market-based strategies to reduce greenhouse gases, see CRS Issue Brief IB97057, *Global Climate Change: Market-Based Strategies to Reduce Greenhouse Gases*, by Larry Parker.

carbon tax may be most appropriate. In this approach, the level of the tax effectively caps the marginal cost of control that affected activities would pay under the reductions scheme, but the precise level of CO₂ achieved is less certain. Emitters of CO₂ would spend money controlling CO₂ emissions up to the level of the tax. However, since the marginal cost of control among millions of emitters is not well known, the overall emissions reductions for a given tax level on CO₂ emissions cannot be accurately forecast.

Hence, a major policy question is whether one is more concerned about the possible economic cost of the program and therefore willing to accept some uncertainty about the amount of reduction received (i.e., carbon taxes); or one is more concerned about achieving a specific emission reduction level with costs handled efficiently, but not capped (i.e., tradeable permits).

A model for a tradeable permit approach is the sulfur dioxide (SO₂) allowance program contained in Title IV of the 1990 Clean Air Act Amendments. Also called the acid rain control program, the tradeable permit system is based on two premises. First, a set amount of SO₂ emitted by human activities can be assimilated by the ecological system without undue harm. Thus the goal of the program is to put a ceiling, or cap, on the total emissions of SO₂ rather than limit ambient concentrations. Second, a market in pollution licenses between polluters is the most cost-effective means of achieving a given reduction. This market in pollution licenses (or allowances, each of which is equal to one ton of SO₂) is designed so that owners of allowances can trade those allowances with other emitters who need them or retain (bank) them for future use or sale. Initially, most allowances were allocated by the federal government to utilities according to statutory formulas related to a given facility's historic fuel use and emissions; other allowances have been reserved by the government for periodic auctions to ensure market liquidity.

There are no existing U.S. models of an emissions tax, although five European countries have carbon-based taxes.⁶

Safety Valves

As a stalemate has continued on strategies to control CO₂ emissions, particularly because of costs fears, attention increasingly focuses on the cost-limiting benefit of a carbon tax, either as the primary strategy or as a component blending a carbon tax with the reduction certainty of the tradeable permit system. The object is to create a *safety valve* to avert unacceptable control costs, particularly in the short term. These safety valves limit unit (per ton) costs of reducing emissions. Four ideas are identified below:

- Carbon taxes: generally conceived as a levy on natural gas, petroleum, and coal according to their carbon content, in the approximate ratio of 0.6 to 0.8 to 1, respectively.⁷ However, proposals have been made to impose

⁶ Finland, the Netherlands, Sweden, Denmark, and Norway. See CRS Issue Brief IB97057, *Global Climate Change: Market-Based Strategies to Reduce Greenhouse Gases*, by Larry Parker.

⁷ Larry Parker, *Carbon Taxes: Cost-Effective Environmental Control or Just Another Tax?* CRS Report 92-623 ENR, August 4, 1992.

the tax downstream of the production process. Several European countries have carbon taxes in varying degrees and forms.

- **Unlimited permits at set price:** generally conceived as part of an auction system where permits are allocated to affected sectors by auction with an unlimited number available at a specific price. The most recent proposal is by the National Commission on Energy Policy, which recommends an initial limiting price of \$7/ton that would increase by 5% annually.⁸ Other variations include the Resources for the Future/Skytrust proposal, which would increase the limiting price (\$25/ton) by 7% above inflation annually, and the Brookings proposal, which would set up a short-term market based on a \$10/ton price, and a long-term market based on market rates.⁹
- **Contingent reduction:** generally conceived as a declining emission cap system where the rate of decline over time is determined by the market price of permits. If permit prices remain under set threshold prices, the next reduction in the emission cap is implemented. If not, the cap is held at the current level until prices decline.¹⁰ Discussions have centered on a 2% annual declining cap subject to a \$5 a permit CO₂ cost cap.
- **Excess emissions penalty:** generally involves a fee on emissions exceeding available permits based on control costs or other economic criteria, rather than criminal or civil considerations. For example, Oregon's CO₂ standard for new energy facilities includes a fee of 57 cents per short ton on CO₂ emissions in excess of the standard (increase to 85 cents proposed).¹¹

Discussion

Table 1 summarizes the key considerations of each of the proposals identified above. As indicated, each safety valve effectively controls cost, but at the price of some uncertainty about the amount of emissions reduced.

⁸ The National Commission on Energy Policy, *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges*, December 2004, p. 21.

⁹ Raymond Kopp, Richard Morgenstern, William Pizer, and Michael Toman, *A Proposal for Credible Early Action in U.S. Climate Policy*, available at [<http://www.weathervane.rff.org/features/feature060/pb66.htm>]; Americans for Equitable Climate Solutions, *Sky Trust Initiative: Economy-Wide Proposal to Reduce U.S. Carbon Emissions*, available at [<http://www.aecs-inc.org/skytrust.htm>]; and Warwick J. McKibbin, *Moving Beyond Kyoto*, Policy Brief #66, October 2000, available at [<http://www.brook.edu/comm/policybriefs/pb066/pb66.htm>].

¹⁰ See Clean Power Group website: [<http://www.eea-inc.com/cleanpower/index.html>].

¹¹ State of Oregon, OAR, Chapter 345, Division 24.

Table 1. Key Considerations of Safety Valves

	Cost-Emission Reduction Balance	Implementation	Enforcement	Other
Carbon Tax	A cost-focused strategy with reductions achieved dependent on the tax imposed.	Strategy can be implemented either upstream or downstream. Can also be implemented across different economic sectors.	Strategy is self-enforcing.	Strategy would generate sizeable revenues that could be recycled or used for other priorities.
Unlimited Permits at a set price	A transitional strategy from cost-focused to reduction-focused. Emission reductions dependent on the price set for excess emissions permits.	Strategy places focus on the excess emissions permit's initial price, and the schedule of any prices increases or excess emissions permit phase-out over time.	Besides requiring the usual monitoring/tracking mechanisms of a tradeable permit system, strategy requires a system to separately track allocations of excess emission permits.	A low price for excess emission permits could have the effect of flooding the permit trading market, discouraging any trading.
Contingent Reductions	An interactive strategy where costs determine reductions and reductions determine costs through a market mechanism. Emission reductions dependent on a freely functioning permit market.	Strategy requires agreement on emission reduction schedules, appropriate permits prices to trigger those schedules, and the specific price determination mechanism (spot vs. long-term prices).	Besides requiring the usual monitoring/tracking mechanisms of a tradeable permit system, strategy requires major oversight of permit market operations.	Potential market manipulation to avoid increased reduction requirements is a serious issue.
Excess emissions penalty	An incremental strategy where reductions achieved are dependent on the penalty imposed.	Strategy places focus on initial penalty and any scheduled increases in that penalty over time.	Requires the usual monitoring/tracking mechanisms of a tradeable permit system only.	Strategy is most similar to existing tradeable permit system.

If one uses the existing Title IV acid rain control program as a baseline, the excess emissions penalty option is the most similar, while the carbon tax option is the most different. The excess emissions penalty option would work in essentially the same fashion as the acid rain program, with the primary difference being the penalty for having insufficient permits at the end of the year. Under Title IV, the penalty is intended to be punitive — to punish the offender for breaking the law. Thus, the offender pays a fine three times the estimated cost of control in addition to forfeiting a future permit. The overriding assumption is that the offender could have reduced his emissions sufficiently, but refused to do so. Under the excess emissions penalty option, there is uncertainty as to whether an offender could have reduced his emissions sufficiently at the estimated price, and that reductions at a cost greater than that price are either socially unacceptable or economically unjustifiable. Hence, the penalty is assessed on the basis of a socially acceptable or economically justifiable price so that the offender pays a cost for his unlawful activity and is encouraged to comply with the law, but is not punished beyond what society has deemed reasonable. Arriving at such an acceptable penalty could be contentious.

The carbon tax is the most radical compared with the Title IV program because it dispenses with the permit system approach to emissions control. All the pressure under a carbon tax scheme is on the timing, pace, and level of the tax, as there is no stigma for not controlling pollution. The strength of this approach is that it is self-enforcing, and considerable revenues will be generated that could be recycled to polluters or used for other priorities. However, U.S. environmental policy has generally opposed any approach suggesting a polluter's right to pollute, which the carbon tax approach does grant.

Depending on how the unlimited permit approach is implemented, it can look and act a lot like a carbon tax. If the initial allocation of permits is by auction and unlimited permits are available at a low price, the auction price will equal the unlimited permit price, resulting in a carbon tax equal to the excess emissions permit price. Thus, without limits on the quantity of permits allowed, the unlimited permits approach is merely a carbon tax by another name, at least in the short term. In addition, the unlimited permits system requires the tracking mechanisms of a tradeable permit system if it is ever to evolve into a permit system. As with a carbon tax, setting the unlimited permit price could be contentious.

The contingent reduction approach attempts to turn both the price and the quantity of reductions into variables solved by the trading market. This requires agreements on both the profiles of emissions reductions and threshold price triggers. It also puts enormous pressure on the trading permit market to produce an accurate price to make the whole system work. Although in some ways the most innovative, the contingent approach also could be the most difficult in terms of arriving at acceptable parameters for the reductions and triggers.

In short, employing a safety valve shifts much of the emission reduction debate from compliance targets to the specifications of the safety valve. The safety valve becomes the controlling mechanism of the permit tradeable system, or the sole mechanism in the case of a carbon tax. Whether this shift would contribute to an acceptable result is not clear.