

ECONOMIC INCENTIVES IN A NEW CLIMATE AGREEMENT

Issue Paper

Prepared by

Joseph E. Aldy
Resources for the Future

Robert N. Stavins
John F. Kennedy School of Government, Harvard University

on behalf of

The Harvard Project on International Climate Agreements

for

The Climate Dialogue
May 7-8, 2008
Copenhagen, Denmark

ECONOMIC INCENTIVES IN A NEW CLIMATE AGREEMENT

Joseph E. Aldy and Robert N. Stavins

Virtually every aspect of economic activity results in greenhouse gas emissions, so meaningful climate policies will need to alter the fossil fuel foundation of economies over the long term. Climate change policy will likely cost more, benefit more, and require more changes in behavior by firms and individuals than any other environmental policy. The magnitude of this challenge has drawn attention to the potential use of *market-based* or *economic-incentive instruments* to ensure that polluters face direct cost incentives to mitigate emissions at the lowest possible cost. The first section describes various economic-incentive policy instruments and the second section discusses their potential application in the design of an international climate policy agreement.

1. ECONOMIC-INCENTIVE POLICY INSTRUMENTS

The market-based instruments most appropriate for climate policy are taxes and cap-and-trade. Under an emission tax, a government imposes a charge per unit of pollutant discharge, or it could set a tax on the carbon content of fossil fuels. Under a cap-and-trade scheme, the government sets an overall cap on emissions, allocates emission allowances – that in sum equal the cap – to firms in the economy, and allows trade in these allowances among firms. Under a variant of emission trading – an emission-reduction-credit system – firms generate credits for reducing their emissions that they can sell into a cap-and-trade system.

1.1 Emission Taxes

A tax on the carbon content of fossil fuels is a close proxy and a practical route for a tax on carbon dioxide (CO₂) emissions. To provide appropriate incentives for sequestration, firms could receive a tax credit for biological sequestration and carbon capture and storage (CCS) at power plants and other emission sources. The government could apply the carbon tax at a variety of points in the “product cycle” of fossil fuels, from fossil fuel suppliers based on the carbon content of fuel sales (“upstream” taxation/regulation) to final emitters at the point of energy generation (“downstream” taxation/regulation). An upstream approach could cover effectively the entire economy, requiring fewer monitoring points and resulting in lower implementation and administration costs than a downstream system. Such a tax approach could also cover other greenhouse gases.

The impact of a carbon tax on emission mitigation and the economy will depend in part on the use of the tax revenue, which could be put toward innumerable uses. The revenue could allow for reductions in existing distortionary taxes on labor and capital, thereby stimulating economic activity and offsetting some of a policy’s costs. This requires the difficult political task of integrating climate policy and tax reform. Other socially valuable uses of revenue could include reduction of debt, or funding desirable public programs, such as research and development on climate-friendly

technology. The tax receipts could also compensate low-income households for the burden of higher energy prices and others bearing a disproportionate cost of the climate policy.

Emission taxes may be especially appealing to countries with existing energy tax systems, but weak environmental policy bureaucracies. These countries may find it easier to integrate a carbon tax into the tax code than to attempt to build a cap-and-trade system. Some developing countries currently may not have the institutional capacity – in terms of allocating allowances in a fair and transparent manner, enforcing property rights, and creating the basis for a well-functioning allowance market – to support cap-and-trade.

1.2 Cap-and-Trade

A cap-and-trade system constrains the aggregate emissions of regulated sources by creating a limited number of tradable emission allowances - in sum equal to the overall cap - and requiring those sources to surrender allowances to cover their emissions. Faced with the choice of surrendering an allowance or reducing their emissions, firms place a value on an allowance that reflects the cost of the emission reductions that can be avoided by surrendering an allowance. Regardless of the initial allowance distribution, trading can lead allowances to be put toward their highest-valued use: covering those emissions that are the most costly to reduce and providing the incentive to undertake the least costly reductions. Prominent cap-and-trade systems include the U.S. SO₂ trading program to address acid rain and the EU Emission Trading Scheme (EU ETS) to reduce CO₂ emissions.

In developing a cap-and-trade system, policymakers must decide on several elements of the system's design. Policymakers must determine how many allowances to issue – the size or level of the emission cap. Policymakers then must determine the scope of the cap's coverage: identify the types of greenhouse gas emissions and sources covered by the cap, including whether to regulate upstream (based on carbon content of fuels) or downstream (based on monitored emissions).

After determining the amount of allowances and scope of coverage, policymakers must determine whether to freely distribute or auction allowances. Free allocation of allowances to firms could reflect some historical record (“grandfathering”), such as recent fossil fuel sales. Such grandfathering involves a transfer of wealth, equal to the value of the allowances, to existing firms, whereas, with an auction, this wealth is transferred to the government. The government would - in theory - collect revenue identical to that from a tax producing the same volume of emission abatement. As with tax receipts, auction revenues could be used to reduce distortionary taxes or finance other programs.

In an emission trading program, cost uncertainty – unexpectedly high or volatile allowance prices – can undermine political support for climate policy and discourage investment in new technologies and research and development. Recent attention has turned to incorporating “cost-containment” measures in cap-and-trade systems, including offsets, allowance banking and borrowing, and a safety valve. An offset provision allows regulated entities to offset some of their emissions with credits from emission reduction measures lying outside the cap-and-trade system's scope of coverage. An offset provision can link a cap-and-trade system with an emission-reduction-credit system.

Allowance banking and borrowing effectively permits emission trading across time. The flexibility to save an allowance for future use (banking) and to bring a future period allowance forward for current use (borrowing) can promote cost-effective abatement. Systems that allow banking and borrowing effectively redefine the emission cap as a cap on cumulative emissions over a period of years, rather than a cap on annual emissions.

A safety valve puts an upper bound on the costs that firms will incur to meet an emission cap by offering them the option of purchasing additional allowances at a predetermined fee (the safety-valve “trigger price”). This effective price ceiling in the emission allowance market reflects a hybrid approach to climate policy: a cap-and-trade system that transitions to a tax in the presence of unexpectedly high mitigation costs. When firms exercise a safety valve, their aggregate emissions exceed the emission cap.

This focus on cost-containment mechanisms reflects concerns about the cost uncertainty with a cap-and-trade system, and such measures attempt to incorporate some of the cost-stability features of a carbon tax. However, increasing certainty about mitigation cost – through a carbon tax or a safety valve – reduces certainty about the quantity of emissions allowed under a climate policy. Smoothing allowance prices over time through banking and borrowing reduces the certainty over emissions in any given year, but maintains certainty of aggregate emissions over a longer time period. A cost-effective policy with a mechanism insuring against unexpectedly high costs – either through cap-and-trade or a carbon tax – increases the likelihood that firms will comply with their obligations, and thereby can facilitate a country’s participation and compliance in a global climate agreement.

The implementation of a carbon tax or cap-and-trade system will increase the cost of consuming energy and could adversely affect the competitiveness of energy-intensive industries. This competitiveness effect can result in negative economic and environmental outcomes: firms may relocate facilities to countries without meaningful climate change policies, thereby increasing emissions in these new locations and offsetting some of the environmental benefits of the cap-and-trade or tax policy. This so-called “emission leakage” is limited because a majority of the emissions in developed countries occur in non-traded sectors, such as in transportation, electricity generation, and residential buildings. Energy-intensive manufacturing industries that produce goods competing in international markets, however, may face greater incentives to relocate. Additional emission leakage may occur through international energy markets – as countries with climate policies reduce their consumption of fossil fuels and drive down fuel prices, those countries without emission mitigation policies may increase their consumption. Since this leakage undermines the environmental effectiveness of any unilateral effort to mitigate emissions, international cooperation and coordination on mitigation policies becomes all the more important.

1.3 Emission Reduction Credits (ERCs)

An emission-reduction-credit system delivers emission mitigation by awarding tradable credits for certified reductions. Generally, firms that are not covered by a cap-and-trade system may voluntarily participate in such systems, and these systems serve as a source of credits that entities facing compliance obligations in cap-and-trade systems may use. For example, the Clean Development Mechanism (CDM) under the Kyoto Protocol provides credits used by firms covered by the EU ETS. A firm earns credits for projects that reduce emissions relative to a hypothetical

business-as-usual baseline. In determining the number of credits to grant a firm for a project, calculation of the appropriate baseline is as important as measuring emissions. Dealing with this unobserved and fundamentally unobservable hypothetical baseline is at the heart of the so-called “additionality” problem. In designing a credit system, policymakers must determine what types of emission sources and actions can receive credits. For example, concerns about the feasibility of accurately measuring results may rule out some projects. In addition, policymakers must decide on a method for calculating the credits for a project, reflecting a project-by-project evaluation, or a set of standards applied to all projects of a particular type.

1.4 Command-and-Control Regulations

The conventional approach to environmental policy employs standards to protect environmental quality. Such “command-and-control” regulatory standards can loosely be categorized as either *technology-based* or *performance-based*. Technology-based (or design) standards typically require the use of specified equipment, processes, or procedures. In the climate policy context, these could require firms to use particular types of energy efficient motors, combustion processes, or landfill gas collection technologies.

Performance-based standards are more flexible than technology-based standards, specifying allowable levels of pollutant emissions, but leaving the specific methods of achieving those levels up to regulated entities. Examples of uniform performance standards for greenhouse gas abatement include maximum allowable levels of CO₂ emissions from combustion or maximum levels of methane emissions from landfills.

Although uniform technology and performance standards can be effective in achieving established environmental goals and standards, they tend to lead to non-cost-effective outcomes in which some firms use unduly expensive means to control pollution. Since performance standards give firms some flexibility in how they comply, performance-based standards will generally be more cost effective than technology-based standards.

In addition, conventional technology or performance standards would not provide *dynamic* incentives for the development, adoption and diffusion of environmentally and economically superior control technologies. Once a firm satisfies a performance standard, it has little incentive to develop or adopt cleaner technology. Regulated firms may fear that if they adopt a superior technology, the government may tighten the performance standard. Technology standards are worse than performance standards in inhibiting innovation since, by their very nature, they constrain the technological choices available.

Given the ubiquitous nature of greenhouse gas emissions from diverse sources, it is inconceivable that a standards-based approach could form the center-piece of a meaningful climate policy. The substantially higher cost of a standards-based policy may undermine support for such an approach, and securing political support may require a weakening of standards and lower environmental benefits. However, in special cases where emission monitoring is infeasible – such as for methane in agriculture – a standards approach may be appropriate.

2. INCORPORATING ECONOMIC-INCENTIVE POLICY INSTRUMENTS IN A POST-2012 INTERNATIONAL CLIMATE AGREEMENT

Climate change is truly a global commons problem: the location of greenhouse gas emissions has no effect on the global distribution of damages. Hence, free-riding problems plague unilateral and multilateral approaches. Further, nations will not benefit proportionately from greenhouse gas mitigation policies. Thus, mitigation costs may exceed benefits for some countries, at least in the near term. Cost-effective international policies – insuring that countries get the most environmental benefit out of their mitigation investments – will help promote participation in an international climate policy regime.

In principle, internationally-employed market-based instruments can achieve overall cost effectiveness. Three basic routes stand out. First, countries could agree to apply the same tax on carbon (*harmonized domestic taxes*) or adopt a *uniform international tax*. Second, the international policy community could establish a system of *international tradable permits*, – effectively a nation-state level cap-and-trade program. In its simplest form, this represents the Kyoto Protocol’s Annex B emission targets and the Article 17 trading mechanism. Third, a more decentralized system of internationally-linked domestic cap-and-trade programs could also ensure internationally cost-effective emission mitigation.

2.1 Use of Carbon Taxes: International Taxes and Harmonized Domestic Taxes

In principle, a carbon tax could be imposed on nation states by an international agency. The supporting agreement would have to specify both tax rates and a formula for allocating the tax revenues. Cost-effectiveness would require a uniform tax rate across all countries. It is unclear, however, what international agency could actually impose and enforce such a tax, and so an alternative more frequently considered has been a set of harmonized domestic carbon taxes. In this case, an agreement would stipulate that all countries should levy the same domestic carbon taxes and retain their revenues.

The uniformity of tax rates is necessary for cost-effectiveness. But the resulting distribution of costs may not conform to principles of distributional equity, and so there may be calls for significant resource transfers. Under a harmonized tax system, an agreement could include fixed lump-sum payments from developed to developing countries, and under an international tax system, an agreement could specify shares of the total international tax revenues that go to participating countries.

As an alternative to these explicit transfers, developed countries could commit to constrain the use of their tax revenues in ways that produce global benefits. For example, carbon tax revenues in developed countries could, in part, finance major research and development programs on zero-carbon technologies and adaptation efforts in developing countries, while developing countries could freely use their tax revenues in ways that best facilitate their development.

In some developing countries reluctant to implement a carbon tax, an initial cost-effective contribution to combat climate change could take the form of reducing fossil fuel subsidies. For example, a developing country cutting a petrol subsidy equal to 10 percent of its price is approximately equivalent to a rich country imposing a carbon tax on petrol that raises its price 10

percent. Well-planned, broad fossil fuel price reforms in a developing country could deliver substantial emission mitigation just as a carbon tax in a developed country. The energy prices are higher in both countries, providing the incentive to invest in energy-efficient technologies and non-fossil energy sources, but the relative prices remain unchanged, so that energy-intensive firms do not face the incentive to relocate to the developing country. Lowering energy subsidies should free up government revenues that could be directed to other beneficial uses and improve the allocation of resources in the economy to promote faster economic growth. Of course, some energy subsidies in developing countries address pressing, basic energy needs and efforts to combat climate change should account for these important social policy objectives.

2.2 International Tradable Permits: Cap-and-Trade and ERCs

Under an international tradable permit scheme, all participating countries would be allocated permits for "net emissions," that is, emissions minus sequestration. A permit would define a right to emit a given volume over some time period, such as a year. In each period, countries would be free to buy and sell permits on an international exchange.

Initial permit allocations could reflect a variety of criteria, such as previous emissions, gross domestic product, population, and fossil fuel production. Whatever the initial allocation, subsequent trading can - in theory - lead to a cost-effective outcome, if transaction costs are not significant. This potential for pursuing distributional objectives while assuring cost-effectiveness is an important attribute of the tradable permit approach.

Providing large initial permits to developing countries (for reasons of distributional equity) implies that they would sell permits primarily to developed countries. Since permit prices represent an implicit tax on all participating countries, the terms of trade within the coalition for countries with the same carbon intensities in production would remain unaffected. From a distributional point of view, developing countries would receive compensation, whereas developed countries would have to pay for their own emission abatement and for permit purchases from abroad to cover the balance of their emissions.

An important obstacle to the successful operation of such a system is that by its very nature, the trading would be among nations. Nation-states are hardly simple cost-minimizers, like private firms, so there is no reason to anticipate that competitive pressures would lead to equating of marginal abatement costs across countries. The system would not have the cost-effectiveness property ordinarily associated with a domestic tradable permit system among firms. Even if nations were cost-minimizers, they do not have sufficient information about the marginal abatement costs of firms within their jurisdiction to define their own aggregate marginal costs. The notion of a simple trading program among countries may be more of a metaphor than a practical policy.

If every country participating in such a system were to devolve the tradable permits to firms within its jurisdiction, that is, if each country instituted a domestic tradable permit system as its means of achieving its national target, then the trading could be among firms, not governments, both within countries and internationally. Such a system could indeed be cost-effective. In the near term, this trading system could be integrated with an emission-reduction-credit system, such as the CDM, for countries that do not take on emission caps.

The current design of the CDM does not secure all low-cost mitigation opportunities in developing countries. The project basis for credits under the CDM increases transaction costs and excludes policy reforms could promote the cost-effectiveness of the mechanism. Modifying the CDM along several lines could improve its cost-effectiveness, increase the investment in low-carbon technologies in developing countries, and address concerns about whether CDM activities truly reflect additional emission mitigation effort.

First, the CDM could be expanded to cover mitigation policies. Some of the potentially low-hanging fruit in developing countries – from reducing energy subsidies to designing and enforcing building codes – do not neatly fall within a “project” under the CDM. A policy-oriented CDM could deliver price signals to a greater share of a developing country’s economy that can yield more emission mitigation and reduce the potential for emission leakage. This could also serve as a mechanism for transfers to developing countries that pursue a carbon tax. The obvious challenge lies in setting baseline emissions in order to assess the emission reduction benefits for any given policy. This effort may be substantial, but when spread over all of the potential emission reductions, the transaction costs may be minor in comparison to the costs of a project-based approach resulting in the same abatement.

Second, the CDM could be expanded to cover sectors as an alternative to projects. A sectoral CDM could establish emission baselines for entire sectors (such as the power sector or the steel sector), and allow countries to implement mitigation policies in those sectors to generate credits. Integrating these policies into the international regime – such as pegging a sectoral carbon tax to the international tradable permit price, or implementing a sectoral cap-and-trade system linked to the international regime – could ensure cost-effectiveness. Focusing on the most energy-intensive sectors could also address concerns about competitiveness and emission leakage in developed countries. It would also provide developing countries with the experience to inform their consideration of taking on broader emission or policy commitments in future agreements. Such an approach could be superior to some calls for sectoral policies that effectively set industry-specific performance standards common across participating developed and developing countries. This standard approach establishes walls between sectors that can increase the total mitigation cost for any given emission goal and eliminates opportunities to raise revenues, either through a carbon tax or an allowance auction, to benefit other social objectives.

2.3 A Bottom-Up Architecture

In addition to the top-down, centralized policy architecture embodied in the Kyoto Protocol, a bottom-up international policy architecture might evolve that requires relatively little centralized coordination. One example reflects the fact that cap-and-trade systems are emerging as the favored approach domestically in many parts of the world.

Cap-and-trade systems have been implemented or enacted in Europe with the EU Emission Trading Scheme, plus systems in Norway and Switzerland, and in the United States with the Regional Greenhouse Gas Initiative (RGGI) among northeastern states. The CDM has emerged as an important emission-reduction-credit system under the Kyoto Protocol. Furthermore, it now appears likely that Australia, Canada, and the United States will implement significant cap-and-trade systems over the next several years.

There is now great interest in establishing linkages among these programs, that is, direct or indirect connections that allow emission reduction efforts to be redistributed across systems. This is because such linkages can lead to significant cost savings, plus larger, more liquid markets can reduce transaction costs, reduce concerns about market power, and reduce price volatility.

There are, however, legitimate concerns about such linkage. First, linkage raises distributional concerns by creating winners and losers in each system. Second, linkage can increase overall emissions (through additionality problems) or decrease overall emissions (by reducing leakage). Perhaps most important, linkage among cap-and-trade systems brings with it automatic propagation of cost-containment provisions (banking, borrowing, and safety-valve) from one system to another. More broadly, once linked, nations have reduced control over domestic allowance prices and emission impacts.

It may be possible to achieve the principal advantages of linkage among cap-and-trade systems without the major disadvantages by instituting indirect rather than direct links. This could be accomplished by individual cap-and-trade systems forging one-way links with a single emission-reduction-credit system, such as the CDM. This would indirectly link the cap-and-trade systems with one another leading to allowance price convergence, cost-effectiveness, and risk diversification. But, the unintentional design-element propagation would not take place. Such linkage may turn out to be a key element of the de facto, if not the de jure post-2012 international policy architecture.

2.4 *Questions for the Climate Dialogue*

- What are the main policy elements that would contribute to a cost-effective global agreement?
- What is the role for carbon taxes (and/or subsidy removal)?
- What is the role for international emissions trading?
- What is the role for emission reduction credits, for instance the CDM-mechanism?
- What is the role for command-and-control regulation?
- What is the role for an international agreement to help facilitate a bottom-up architecture linking emissions trading systems?