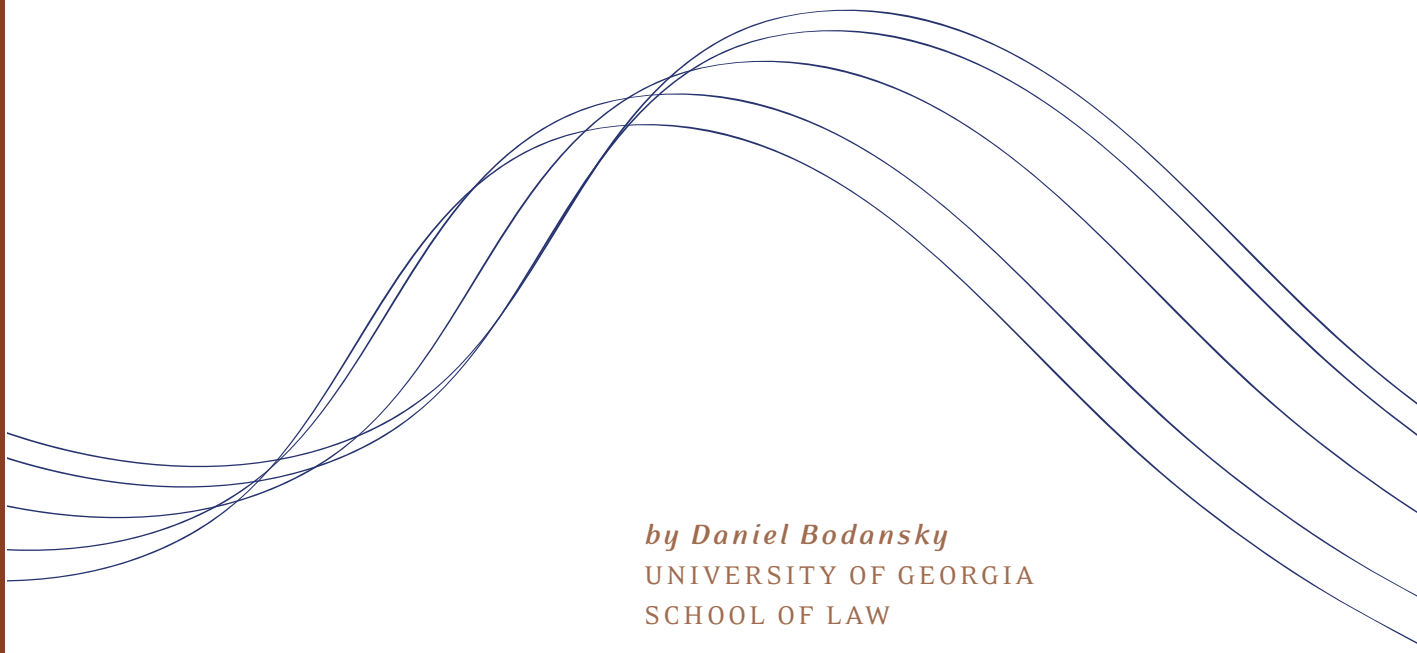
ADVANCING THE INTERNATIONAL EFFORT AGAINST CLIMATE CHANGE

INTERNATIONAL SECTORAL AGREEMENTS IN A POST-2012 CLIMATE FRAMEWORK

A Working Paper



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PEW CENTER ON Global CLIMATE CHANGE

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May 2007

Contents

Introduction

Since climate change first emerged as an international issue in the late 1980s, a recurring policy question has been whether to address it on a comprehensive or a sector-by-sector basis. The United Nations Framework Convention on Climate Change (UNFCCC) adopted a comprehensive approach, encompassing sources and sinks of all greenhouse gases (GHGs) from all sectors. In the Kyoto Protocol negotiations, countries opted to continue along similar lines, agreeing to economy-wide emission targets covering the six major GHGs, rather than separate protocols on energy, transportation, forestry and so forth. The principal exception to this comprehensive approach relates to emissions from "bunker" fuels used in international aviation and shipping, which are not included in national emission totals and hence are not subject to countries' emission targets.[1]

Although the UNFCCC establishes a comprehensive framework, it does not disfavor much less preclude sectoral initiatives. Indeed, the elaboration of protocols on a sectoral basis was seen as one of the avenues along which the Convention might develop. In recent years, sectoral approaches have received renewed attention and are among the options proposed for the post-2012 period.[2] In its report, *International Climate Efforts Beyond 2012*, the Climate Dialogue at Pocantico identified sectoral approaches as one of the potential elements of the future international climate change effort. The Ad Hoc Working Group established by Kyoto parties to negotiate new commitments for developed countries has included sectoral approaches among the topics relevant to the architecture of further commitments.[3]

Sectoral approaches have been successfully employed in the context of other international issue areas. For example, in the international trade regime, both agriculture and textiles have been addressed on a sectoral basis.[4] Similarly, the International Labor Organization often addresses issues on a sectoral basis, in order to target sectors in which an issue is particularly acute or to take account of relevant differences between sectors.[5]

In the climate change context, a large body of existing literature explores sector-specific technology options and national-level policy options—for example, policies and technologies to address emissions from the energy sector, the transportation sector, agriculture and so forth.[6] The present paper examines the broader policy and structural questions relating to the development of sectoral approaches at the international level—in particular, sectoral approaches taking the form of inter-governmental agreements.[7] Key issues that will be addressed include:

- Different types of international sectoral approaches;
- The relative advantages of sectoral agreements;
- Factors that make a sector more or less well suited for a sectoral agreement; and
- Key design variables that must be addressed in developing international sectoral agreements.

I. Defining a Sectoral Approach

A wide variety of arrangements and policies could be undertaken on a sectoral basis. This report focuses on one particular type of sectoral approach, namely multilateral agreements in which governments commit to actions intended to moderate or reduce GHG emissions from a given sector. Such agreements could contribute to the post-2012 climate effort in different ways. One possibility would be to negotiate one or more sectoral agreements that stand independent of one another. Alternatively, a series of sectoral agreements could be negotiated simultaneously or sequentially and linked in an overarching framework, with overlapping but not necessarily identical groupings of countries participating in each. A third option would be to incorporate sectoral agreements in a comprehensive framework alongside other types of commitments. For instance, some countries with economy-wide emission targets and others with policy-based commitments[8] could jointly enter into a side agreement setting out commitments within a given sector. For a country with an overall emissions target, a sectoral commitment could be one of several means of achieving that target, or the covered sector could be excluded from the overall cap. For countries without overall targets, sectoral commitments may be in addition to any other commitments they have undertaken.

A sectoral agreement could include virtually any type of mitigation commitment. It could establish sectoral emission targets, on either an absolute or an indexed basis. It could require states (or particular groups of states, if commitments are differentiated) to adopt uniform or harmonized policies and measures for a sector, such as technology-based standards, taxes, or best-practice standards. It could provide for cooperation on technology research or deployment. Or a sectoral agreement could combine a number of approaches. For example, states might agree to a transportation protocol that establishes a long-term emission reduction goal, fuel economy standards for vehicles, low-carbon standards for fuels, and a cooperative program to develop alternative technologies. Any of the different types of commitments could be established on a uniform basis for all participating countries, or could be differentiated to reflect differences in responsibility, capacity, and national circumstance. The different parameters of inter-governmental sectoral agreements will be further explored in section IV.

Although this report focuses on inter-governmental sectoral agreements, it is worth noting that the term "sectoral approach" is also used to refer to other types of arrangements and policies, which are not examined here. These include:

Sectoral crediting mechanisms—Currently, the Clean Development Mechanism (CDM) grants certified emission reduction units only on a project basis. Some have proposed redesigning the CDM to allow states to establish sectoral baselines and to grant emission reduction credits for emission reductions relative to these sectoral baselines.[9] In essence, a sectoral crediting mechanism would serve as a sectoral no-lose target: if emissions in the sector exceeded the baseline, there would be no legal consequences; but if emissions were below the baseline, then the state would receive emission reduction credits that could be traded internationally.

Unilateral industry initiatives—Companies in a particular sector could agree (possibly under the auspices of a sectoral trade association) on voluntary measures to reduce GHG emissions within their sector. An early example of an industry initiative relating to the environment was TOVALOP—the Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution—which tanker owners adopted in 1969 as a means of promoting compensation for victims of oil pollution. One climate-related effort is the World Business Council on Sustainable Development's Cement Sustainability Initiative, which includes ten leading cement companies representing approximately one-fourth of global production and aims to reduce the industry's GHG footprint. A principal output has been the Cement CO_2 Protocol, which elaborates a methodology for calculating and reporting cement-related emissions. The aluminum industry has undertaken a similar initiative unilaterally, focusing on perfluorocarbon (PFC) emissions.[10]

II. Why a Sectoral Approach?

Even proponents of sectoral approaches generally acknowledge that in some respects they represent second-best options. From both an environmental and an economic perspective, a comprehensive approach encompassing all GHG sources and sinks in all major emitting countries is clearly preferable. An economy-wide approach gives countries maximum flexibility to reduce emissions in whatever sector is cheapest, and discourages emission leakage from regulated to unregulated sectors. By contrast, focusing on particular sectors restricts options and thereby raises costs. A recent study, for example, estimated that an automotive transport sector agreement would be "significantly more costly" in reducing emissions than an economy-wide emissions trading system.[11] If, however, parallel agreements covering key sectors were linked in a common framework, they potentially could produce environmental benefits and economic efficiencies approaching those of the comprehensive approach.

Despite their limitations, international sectoral agreements offer several potential advantages as an alternative or complement to other approaches:

Broadening participation—As long as some major emitting countries are not prepared to take on economy-wide targets, sectoral agreements offer an alternative path to climate commitments. For developing countries without reliable economy-wide emissions monitoring, it would be more practical to assume a commitment for a sector where emission trends are well understood and can be forecast. Also, focusing on specific sectors can highlight complementarities between GHG reduction and other priorities such as energy security or air quality, which may create synergies with important political drivers and encourage the integration of climate mitigation in countries' broader sectoral strategies.

Simplifying negotiations—In sectors with relatively few important actors, agreement on a sectoral approach might be easier to negotiate for at least two reasons. First, the relevant actors would be easier to identify. Second, the complexity of negotiations tends to increase as the number of players increases, so negotiations among a smaller number of parties, with greater commonality of interests, would be more likely to succeed. Sectors such as steel, cement, aluminum, and auto manufacturing tend to be highly concentrated in terms of both companies and countries; addressing them on a sectoral basis could encompass globally significant emission sources through agreements involving a relatively small number of players.

Targeting efforts—Sectoral agreements would allow states to proceed in an incremental fashion, targeting initial efforts to sectors where action is most urgent (for example, because major capital decisions today will lock in emissions for years to come), where international cooperation is most critical (for example, because some countries cannot access or deploy key technologies on their own), or where progress can be made most easily (for example, because the sector involves relatively few important actors or is relatively easy to monitor). With sectoral agreements, governments also can tailor their choice of commitment type to particular sectors—efficiency standards for automobiles, emission targets for electricity generation, and so forth.

Addressing competitiveness—Sectoral approaches could address some of the competitiveness concerns raised by a comprehensive approach. Under a comprehensive approach, a state can shield a sector from emission reduction requirements by concentrating its mitigation efforts in other sectors, thereby giving the protected sector a competitive advantage *vis à vis* its foreign counterparts that do not receive similar protection from climate change mitigation burdens. In contrast, an international sectoral approach could ensure that all global competitors in the given sector undertake mitigation efforts, whether fully comparable or differentiated to reflect equity considerations. This would apply especially to energy-intensive industries producing globally traded goods such as steel or aluminum.

In sum, sectoral agreements may offer practical and political advantages that outweigh their shortcomings. To the extent that a sectoral approach compensates for its narrower substantive coverage by achieving broader, more comprehensive participation, then it may serve as a valuable supplement or alternative to an economy-wide approach.

Box 1

Illustrations of Sectoral Approaches

Automotive. Countries that are major producers and/or consumers of automobiles would commit to harmonized standards for fuel economy or vehicle emissions (GHGs per mile or kilometer). Countries could set an initial standard and periodically revise it, or could at the outset adopt a long-term schedule of standards. The agreement could be linked to emissions trading: countries or companies that perform better than the standards could earn and sell emission credits. The standards could be negotiated with major auto manufacturers; or governments could allow companies a specified time to act. The agreement could require participants to achieve a specified percentage improvement from current performance, rather than a common intensity target that does not take starting points into account.

Electricity. Countries could negotiate intensity-based GHG targets (GHG/megawatt-hour) for the electricity sector. Targets would be differentiated to reflect national circumstances, could be binding or no-lose, and could be calculated on a net basis (allowing credit for carbon capture and storage). Trading could take place within the sector or with other sectoral, national, or multilateral trading systems.

Aluminum. Countries could negotiate an agreement with major aluminum producers establishing targets for the percentage of products manufactured from recycled aluminum, for improvements in energy efficiency in the production process, and for reduction of PFC emissions from aluminum smelting.

Land-use. Countries could agree to sustainable forestry practices, to expand the use of sequestration-promoting practices such as "no till" agriculture (possibly through acreage targets) or to reduce subsidies that encourage deforestation. Countries might also commit to maintain net carbon stocks, increase them by agreed percentages, or slow the rate at which they are being reduced.

III. Assessing a Sector's Suitability for a Sectoral Agreement

Sectors can be defined in many different ways, at various levels of specificity. Identifiable sectors (and sub-sectors) relating to climate change include:

- Electricity (generation; industrial and/or residential consumption);
- Transport (automotive; aviation; shipping);
- Manufacturing (chemical and petrochemical; iron and steel; cement; aluminum; glass; etc.);
- Buildings (residential; commercial);
- Consumer goods (energy-intensive appliances);
- Land use (agriculture; forestry);
- Construction;
- Extraction (minerals; oil and gas);

Several factors are relevant in evaluating which sectors present the best candidates for a sectoral approach:[12]

Environmental—To begin with, sectors can be prioritized based on their potential climate benefits (or environmental benefits more broadly).

Share of global GHG emissions—Currently, the electricity and heat sector contributes approximately one quarter of overall GHG emissions (22%), followed by land-use change and forestry (18%), agriculture (14%), transport (13%), and manufacturing (10%).[13]

Rate of emissions increase—Rather than focus on a sector's share of current GHG emissions, one might instead focus on the sector's impact on climate change going forward. From this standpoint, emissions from the transportation sectors are the fastest growing source in most countries and pose perhaps the greatest long-term challenge. Emissions from electricity and heat are growing very rapidly in Asian countries, but are flatter elsewhere.[14]

Potential for emission reductions—Sectors might also be evaluated in terms of their potential for improvement, rather than their absolute contribution to the problem. A sector's potential for emission reductions has both technical and political dimensions: What technologies and other policy options are available to reduce emissions? How easy or hard would it be to address the sector as a political matter?

Environmental and developmental co-benefits—Finally, we could choose to widen our view and evaluate different sectors not merely in terms of their potential for climate change mitigation, but also in terms of the potential environmental and developmental co-benefits that could be achieved through climate mitigation efforts. To the extent that mitigation measures in a particular sector would also reduce local air pollution, for example, or contribute to other development goals, then this might make that sector a promising one on which to focus.

Economic—At least three economic factors are relevant in assessing the appropriateness of a sector for international cooperation.

Adjustment costs—A sector's potential for emission reductions involves issues not only of technological capacity but also of economic costs. Sectors where emissions can be reduced comparatively cheaply present good candidates for sectoral cooperation.

Capital lock-in—Sectoral agreements could target sectors where significant capital investments expected in the near term have the potential to lock in high-emitting technologies for a long period. For example, the International Energy Agency projects investments of about $1.3 trillion between now and 2030 in coal-fired power plants, which have a lifetime of 40–50 years.[15] A sectoral agreement focusing on electricity generation, or on coal-fired plants more specifically, could help steer these investments into lower-emission technologies.

International exposure—Sectoral approaches may also be desirable for sectors producing internationally traded goods, such as aluminum, aircraft, steel, chemicals, and forestry, which may be particularly vulnerable to competitive imbalances and to the risk of emissions leakage.[16] To the extent that capital and goods in a particular industry are highly mobile, a state may attempt to shield its domestic industry from climate change mitigation burdens to preserve its market position and to avoid inducing a shift in production to other countries with less burdensome climate change policies. A sectoral approach could address this competitiveness problem by establishing commitments across a given sector, thereby helping to ensure a more level playing field. By helping to prevent emissions leakage, an international sectoral agreement would also provide an environmental benefit.

Negotiability and participation—Sectors also vary in terms of the number of participants required for an effective agreement and the receptivity of those participants to climate change regulation.

Concentration—In some sectors, a substantial share of global emissions could be covered in an agreement among a relatively small number of countries. For example, in both electricity and transportation, the 10 largest emitting countries in each sector account for approximately 80 percent

of that sector's global emissions. In forestry, two countries, Indonesia and Brazil, account for roughly 50 percent of global emissions. In manufacturing, six countries represent nearly three-fourths of global steel production and 10 countries account for three-fourths of cement-related emissions.[17]

Tipping and network effects—Even with respect to sectors involving a larger number of players, agreement among all may not be needed in order to bring about significant change, if the adoption of a new technology by a smaller number of actors would tip the balance, causing other actors to adopt the technology as well.[18] For example, if the United States and the European Union (EU) were to agree to adopt the one-watt maximum standby power use for all new appliances (as supported by G-8 leaders at the 2005 Gleneagles Summit), the weight of these markets could be sufficient for all suppliers worldwide to comply, even if they were not party to the agreement.

Receptivity of business—The negotiability of sectoral agreements will depend on the receptivity not only of governments, but also of business actors. This will likely depend, in part, on the economic factors discussed above, including adjustment costs and effects on competitiveness. But it may also depend on more intangible and ad hoc factors, such as the business culture within a particular sector, historical patterns of regulation within the sector, the personal views of business leaders, and so forth.

Homogeneity—Sectors with uniform products and/or processes may be well suited to a sectoral approach. The cement industry, for example, is highly homogeneous, with standardized products, similar production processes and an agreed measurement protocol. In contrast, electricity generation is highly heterogeneous, with resource bases and fuel mixes varying significantly among countries, and therefore might be less amenable to a sectoral approach.

Ease of monitoring and administration—From the compliance standpoint, sectors with reliable emissions data or common regulatory approaches are more promising candidates for sectoral agreements. For example, emission targets would be more practical in a sector such as electricity with reliable emissions data than in land use, where data are less reliable. A sectoral agreement also may be easier to reach in a sector where national governments already have adopted similar regulatory approaches such as efficiency standards.

Unique sector-specific features—Sectoral agreements may be desirable for sectors with *sui generis* characteristics that make integration into a comprehensive, economy-wide approach difficult. For example, the Kyoto Protocol excludes international bunker emissions from its economy-wide approach, in part because of the difficulty of assigning emissions from aviation or maritime transport to particular countries. Similarly, the land-use and forestry sector is also addressed by the Kyoto Protocol on a sectoral basis, in part because of the difficulties of measuring emissions and of ensuring the permanence of emission reductions.

A systematic assessment of sectors according to these criteria is beyond the scope of this paper. Broadly speaking, however, few if any sectors stand out as ideal candidates for a sectoral agreement—large, homogenous, highly concentrated, and highly competitive. Different sectors seem likelier candidates on different grounds.[19]

From the perspective of competitiveness, highly concentrated and homogenous energy-intensive sectors such as steel and aluminum would appear good candidates. Indeed, the aluminum sector has already undertaken two voluntary initiatives to reduce GHG emissions under the auspices of the International Aluminum Institute. The cement industry, although also relatively homogenous and highly concentrated among countries, includes many smaller producers and is less subject to competitiveness issues.

Within transportation, sectoral climate agreements seem likeliest in international aviation and shipping, the two sectors singled out in the Kyoto Protocol for sectoral treatment. Given their international character, states have historically recognized the desirability of international regulation in these sectors, to avoid a patchwork of national regulatory standards. (Although little progress has been made to date in the International Civil Aviation Organization and the International Maritime Organization, the international bodies to which Kyoto referred aviation and shipping emissions, the EU has proposed including aviation in its emissions trading scheme, at first covering domestic flights only, then international flights as well.) The automotive sector also could be a good candidate for a sectoral approach. It is relatively homogenous, highly concentrated in terms of both countries and manufacturers, and is readily subject to tipping effects. Also, road transport accounts for about 10 percent of global GHG emissions and is among the fast growing sources in many countries.

Electricity may seem an unlikely candidate for a sectoral agreement given that it is so heterogeneous and decentralized and competitiveness is not a direct concern. On the other hand, its emissions, the largest of any sector, are well quantified and are growing rapidly. Long-term capital decisions in the near future could lock in emission increases for decades, making the sector a high priority for mitigation policy. Dramatically reducing electricity-related emissions will require technologies such as carbon capture-and-storage whose wide-scale deployment may be possible only through international cooperation. The necessary technology and financing terms may be most readily achieved as part of an agreement specific to the electricity sector.

Land use, the sector with the second largest share of global emissions, also presents a mixed picture. Emissions are highly concentrated in a few countries, and could potentially be reduced at a low cost, suggesting it as a promising candidate for a sectoral agreement (particularly given its *sui generis* features, which pose difficulties for incorporation into an economy-wide approach). But its emissions are not well quantified, and the factors responsible for these emissions vary widely between countries, posing challenges for either a target-based or a policy-based approach.

IV. Key Variables in Designing a Sectoral Agreement

Key variables in the design of a sectoral agreement include the types of commitments established, whether private industry is party to the agreement, the degree of international prescription, and the stringency of commitments.

Substantive Content of a Sectoral Agreement

A sectoral approach could include a tremendous array of substantive provisions, which could be adopted on a uniform basis or differentiated in order to reflect relevant differences between different states or groups of states.

Long-term target—A sectoral agreement could set out a long-term goal for the covered sector. In the climate context, long-term goals are often discussed in terms of atmospheric GHG concentrations (i.e., 550 parts per million) or maximum global temperature increase (i.e., 2 degrees Celsius). These metrics, however, reflect total global emissions over time, so offer little guidance to any one sector without some overarching agreement on how total emissions are to be apportioned among sectors.

A more practical quantified goal for a sector would be a long-term emissions target. For example, an agreement could call for a 50 percent reduction in a sector's emissions by a certain date. Or it could set a goal of zero-net emissions; in the case of electricity generation, this could allow continued use of coal and other fossil fuels provided all plants deploy carbon capture-and-storage technology. An alternative form of long-term goal could set a date for the phase-out or phase-in of a specific technology.

Emission targets and trading—Emission targets could be defined for a given sector. For example, an agreement could establish national emission targets, on either an absolute or an indexed basis, for electricity generation or for an energy-intensive industry. The allocation of allowances to individual emitters would most likely be left to national governments, although the agreement could establish principles to be applied by all countries in their allocation decisions. Trading could be allowed between countries participating in the agreement or, in addition, with countries with economy-wide or other sectoral targets.

Performance standards—Performance standards for a particular sector could be defined in a number of ways, including:

- Individual countries or companies could be required to reduce their emissions by a certain percentage per year.

- Emission or energy efficiency standards could be defined for individual products such as automobiles (e.g., CO_2 emissions per vehicle mile) or household appliances.[20] The 1973/78 MARPOL Convention, for example, establishes oil discharge standards for oil tankers, defined in terms of both the rate of discharge (60 liters of oil per nautical mile) and the overall level of discharge for a tanker's entire voyage (a specified percentage of a tanker's overall oil cargo). Similarly, the 1990 US-Canada Air Quality Agreement establishes maximum nitrogen oxide emission rates for mobile sources.

Like emission targets, performance standards define a result to be achieved, but not how to do so, and thus give actors flexibility in their choice of means. A fuel economy standard for automobiles, for instance, might be met through the use of hybrid technology, lighter materials, or improved aerodynamics.

Taxes—A sectoral agreement could provide for harmonized taxes. For example, an electricity agreement might provide for a harmonized tax on electricity, based on the CO_2 emitted in the generation process; or a transportation agreement might specify a harmonized tax on gasoline.

Technology/specification standards—In contrast to performance standards, specification standards identify particular means of reducing emissions. For example, a sectoral agreement on transportation might require states to ensure that a specified percentage of new vehicles use hybrid, biofuel, or other low-GHG technology; or an electricity agreement might require that a certain percentage of electricity be generated from non-fossil sources, or that carbon capture-and-storage be phased in at coal-fired power plants. Typically, international agreement on specification standards is easiest to achieve in highly globalized industries such as maritime or air transport. One example is the 1973/78 MARPOL Convention, which specifies standards for the construction, design and equipment of oil tankers.

Technology research, development and diffusion—A sectoral approach could also seek to promote the development and diffusion of new technologies, as either a supplement or an alternative to technology/specification standards.[21] For example, countries could commit funding for joint research and development of advanced technologies, with agreed terms for the sharing of any resulting breakthroughs. Or an agreement could help facilitate technology transfer by resolving any intellectual property rights or other issues specific to that sector.

Finance—To address equity concerns and encourage broader participation, a sectoral agreement could establish a financial mechanism to support capacity building, policy development or technology deployment in developing countries. Developed countries could commit to specific funding levels or funds could be generated through a tax on production or a levy on emissions trading. In a "feebate" approach, the financial mechanism could be tied to standard-setting, with developed country emitters that exceed a specified standard required to pay into a fund to support emission reduction in developing countries.

Information and data provisions—A sectoral approach could define particular methodologies for monitoring emissions in a particular sector or could establish common reporting standards.

Participation

As conceived here, the parties to an international sectoral agreement would typically be national governments only. However, a sectoral agreement could have a public-private nature, involving companies (or industry associations) as parties.[22] For example, a group of countries could negotiate directly with automobile companies to develop mandatory fuel efficiency standards or to establish a cooperative research program to develop hydrogen fuel cell cars. Or they could negotiate directly with cement or aluminum companies to develop mandatory emission standards. Thus far, public-private agreements have been largely voluntary, and have been used on a national basis with mixed success. Japanese industry has achieved significant emission reductions under voluntary agreements with the government. On the other hand, the EU's voluntary agreements with automobile manufacturers are not producing targeted reductions in GHG emissions for new cars and the EU is now preparing mandatory regulations.[23]

Another option is for companies within a given sector to negotiate an agreement among themselves and then present it to governments as the basis for a binding inter-governmental agreement. In that case, the companies would play a very direct role in the negotiations but would not be parties to the final agreement.

Degree of International Prescription

Because the activities that contribute to climate change are primarily private rather than governmental in nature, international climate policy is ultimately aimed at changing private conduct. But a sectoral agreement could attempt to steer private conduct in more or less direct and specific ways.

Targets—Targets steer conduct most indirectly. They establish regulatory requirements for states and give states flexibility as to how they achieve their targets. As a result, targets do not require states to adopt any particular policies or measures regulating private conduct.

Harmonized policies—A sectoral agreement could steer state conduct in more specific ways, by defining harmonized policies that states commit to undertake. For example, a harmonized carbon tax might provide for roughly comparable levels of taxation, but leave states with flexibility about the exact design of the tax.

Uniform standards—Rather than establish regulatory requirements only for states (such as targets or harmonized taxes), a sectoral agreement could target private conduct directly. For example, the MARPOL agreement establishes very precise standards for the construction and design of oil tankers, as well as permissible oil discharge levels. Similarly, a sectoral climate agreement might define standards for automobile emissions or appliance efficiency.

Menu approach—Finally, a sectoral agreement could define a set of options, among which states could choose. For example, an energy agreement might set forth a menu of policies and measures, such as emissions targets, efficiency standards, and requirements for the use of renewables. Under the agreement, states would be required to choose in specified ways among the various menu items.

Stringency

Typically the overall level of stringency set by an agreement, and the distribution of effort among parties, are the result of a political negotiation taking in a wide range of economic, technological, and other considerations. Factors that could enter into the stringency determination include:

Best-available technology—An assessment of available or emerging technologies could influence the level of effort set under any type of sectoral agreement. Or sectoral performance or specification standards could be set directly in terms of the best-available technologies (BAT) within a sector to reduce emissions. Examples of the BAT approach include the use of benchmarking methodologies to identify best practices,[24] and the "top runner" energy efficiency standards adopted by Japan for eighteen product groups (including electrical and electronic equipment, household appliances and for automobiles), which establish energy efficiency targets based on the most efficient products commercially used in large quantities in Japan.[25]

Cost-effectiveness—From an economic efficiency standpoint, the stringency of sectoral mitigation efforts should be set at levels that equalize marginal abatement costs across different sectors. An economy-wide cap-and-trade system achieves this result by allowing the market to determine how much of the overall reduction effort is achieved in different sectors. A sectoral agreement could seek to achieve the same result by setting the stringency of its mitigation efforts at the level that the market would be expected to achieve in that sector in an economy-wide system.

Cost-benefit balancing—To optimize efficiency, the stringency of sectoral measures could be set by attempting to compare the costs of the measures with their climate benefits. The difficulties of estimating climate benefits in a quantitative manner, however, may make this approach extremely difficult to use in practice—all the more so as facing up to the challenge of climate change requires action by all sectors, not just a few.

Parity—As a political matter, governments may need to balance the effort required of one sector against that required of others so that no sector feels singled out for a disproportionate share of the mitigation burden.

V. Conclusions

The test of any option for a post-2012 climate approach is how effectively it can engage governments and the private sector in cost-effective action to reduce GHG emissions across the key emissions-generating sectors and countries.

While from both an environmental and an economic perspective a global cap-and-trade system might be the preferred approach, it does not appear a viable option in the post-2012 timeframe because developing countries are highly unlikely to assume binding economy-wide emission caps. From a theoretical perspective, a series of parallel sectoral agreements could provide comprehensive coverage of major emission sources and, if linked in an overarching framework, could also achieve the cost efficiency of a fully comprehensive approach. However, this, too, appears improbable. While developing countries may be more willing to enter sectoral agreements than to accept economy-wide targets, they are unlikely to take commitments across all their major-emitting sectors. For countries willing to accept economy-wide targets, on the other hand, they would probably be more practical and efficient than a sector-by-sector approach.

More realistically, international sectoral agreements could contribute to a post-2012 effort as one element of a broader framework that includes other commitment types. In this context, they appear best suited to advancing agreement and action by:

- helping to defuse competitiveness concerns that, if not resolved, could preclude agreement across the full range of post-2012 issues;
- treating critical technology and finance issues within a discrete sector where they are most urgent, such as electricity, rather than on broader terms where agreement may be more difficult; and
- taking advantage of potential tipping effects, for instance in the automotive sector, to leverage agreement among a few parties into a broader, perhaps global, technological transformation.

While this paper presents a range of possibilities for structuring sectoral agreements, precisely how they could best fit into a multi-commitment framework would depend on the other commitments taken and ultimately, therefore, can be determined only through negotiation. Among issues that would need to be addressed are how best to compare relative effort across different commitment types and whether sectoral commitments fall within or are in addition to other commitments.

In the end, the likelihood of sectoral agreements within a post-2012 framework depends on their political attractiveness. In sectors such as cement and aluminum, where industry is well organized at the international level, companies facing competitive imbalances may have an incentive to initiate a sectoral approach that could be the foundation for an inter-governmental agreement. In other sectors without this motivating force, but where there may be other rationales for a sectoral approach, it may fall to governments to take the initiative if sectoral agreements are to emerge.

Notes

1. UNFCCC Decision 2/CP.3 (1997). Article 2.2 of the Kyoto Protocol provides that emissions from international aviation and maritime shipping should be addressed separately, on a sectoral basis, by the relevant international organizations – for aviation emissions, ICAO, and for maritime emissions, the IMO. In addition, land-use change and forestry are distinguished from other emission sources and are addressed by separate provisions, which among other things limit the emission credits that can be earned from land-use activities.

2. Bodansky (2004).

3. Pew Center (2005); Revised Report Proposed by the Chair on Planning of Future Work, Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol, UN Doc. FCCC/KP/AWG/L.2/Rev.1 (May 25, 2006).

4. In addition to the special agreements on agriculture and textiles, a sectoral approach was used in the Uruguay Round to eliminate or harmonize tariffs in a variety of other sectors, including paper; metals; and information technology products. WTO Member States have continued to pursue sectoral initiatives to reduce tariffs as part of the Doha Round of multilateral trade negotiations.

5. For information on ILO sectoral activities, see http://www.ilo.org/public/english/dialogue/sector/index.htm.

6. Brown (2005); IEA (2001); IPCC (2001); Smith (2002); Sperling (2002).

7. The international dimensions of sectoral approaches have also been addressed recently in Baumert et al. (2005b) and OECD (2005).

8. In a policy-based commitment, a country commits to undertake a national policy that reduces GHG emissions but is not bound to a specific emissions limit. For more, see Lewis and Diringer (2007).

9. Baron and Ellis (2006); Bosi and Ellis (2005); Samaniego and Figueres (2002); Schmidt et al. (2006).

10. http://www.world-aluminium.org/

11. OECD (2005).

12. Baumert et al. (2005b).

13. Baumert et al. (2005a), Figure 1.

14. *Id.*

15. OECD (2005), 92.

16. Since emissions leakage also undermines the environmental effectiveness of sectoral measures, international sectoral approaches are also important for environmental reasons in sectors subject to significant international exposure.

17. Baumert et al. (2005a). In all cases, the European Union, which is recognized under the UNFCCC as a regional economic integration organization, is counted as a single "country."

18. Barrett (2003), ch. 15.

19. For more extensive analysis of which sectors are amenable to a sectoral approach, see Baumert et al. (2005b); OECD (2005).

20. *See* Ninomiya (2003), described in Bodansky (2004), 42.

21. *See* Barrett (2002) (proposing negotiation of protocols that would both promote collaborative research and development and establish technology standards).

22. Brink (2002); Delmas (2002); OECD (2003).

23. Volpi (2002). Canada has adopted similar agreements with industry. On the EU plans, see "Questions and Answers on the EU Strategy to Reduce CO_2 Emissions from Cars," MEMO/07/46, Feb. 7, 2007, http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/46&format=HTML&aged=0&language=EN&guiLanguage=en

24. Benchmarking methodologies attempt to identify best practices through comparative analysis of similar products and program areas.

25. Swedish Environmental Protection Agency (2005).

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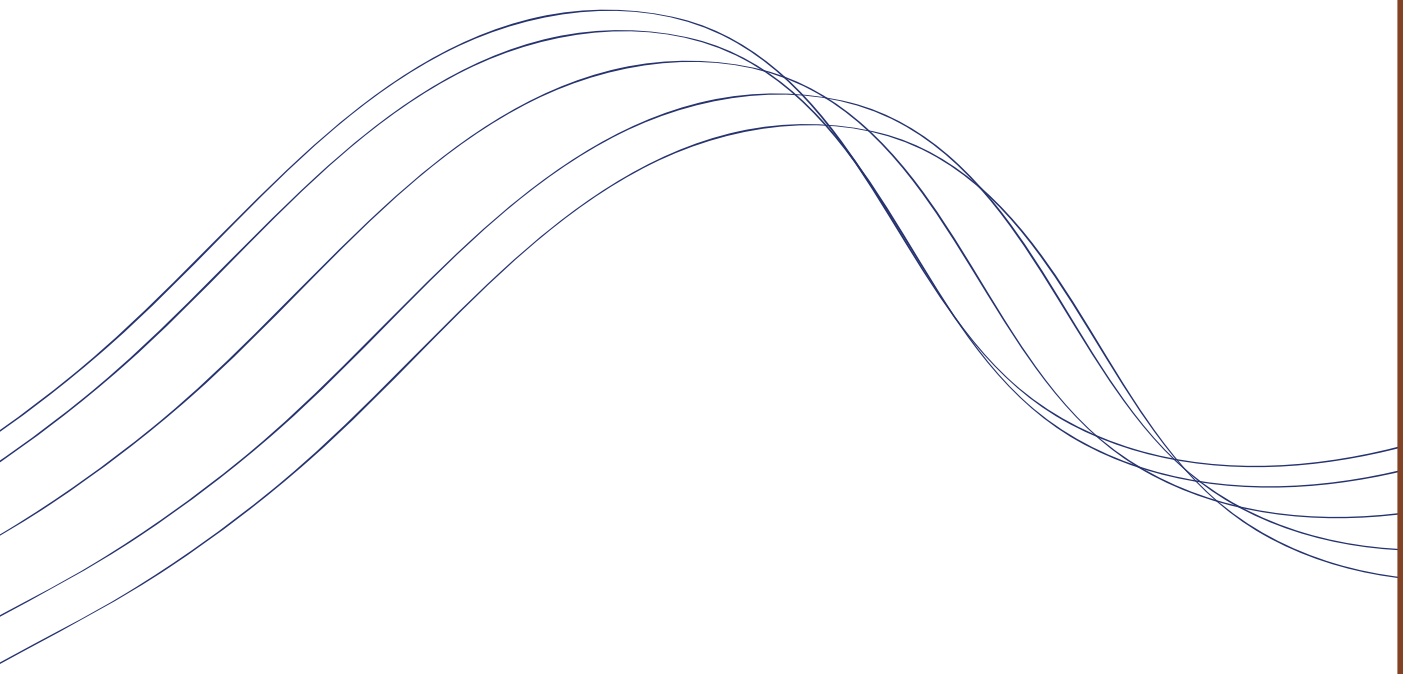
This paper examines international sectoral agreements as an element of a post-2012 climate change framework. It is part of a Pew Center series expanding on key recommendations of the Center's *Climate Dialogue at Pocantico.* The Pew Center was established by The Pew Charitable Trusts to bring a new cooperative approach and critical scientific, economic, and technological expertise to the global climate change debate. We inform this debate through wide-ranging analyses in four areas: policy (domestic and international), economics, environment, and solutions.



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