

Mitigation of Climate Change

TI: The Design and Implementation of an International Trading Scheme for Greenhouse Gas Emissions

AU: Zhang,-ZhongXiang

SO: Environment-and-Planning-C:-Government-and-Policy; 18(3), June 2000, pages 321-37.

AB: The inclusion of emissions trading in the Kyoto Protocol reflects an important decision to address climate-change issues through flexible market mechanisms. The author addresses a number of policy issues that must be considered in designing and implementing an international greenhouse gas (GHG) emissions-trading scheme. These include: how much of a Party's assigned amount of GHG emissions can be traded internationally; emissions-trading models; competitiveness concerns in the allocation of emissions permits; banking and borrowing; liability for noncompliance; how to enlarge the emissions-trading system; and bubbles. Although the focus is exclusively on emissions trading, its relationship with the clean development mechanism, joint implementation, and bubbles are discussed wherever necessary. By providing some new insights, the author aims to contribute to the design and operationalization of an international emissions-trading scheme.

TI: Setting Thresholds for Country Participation: A New Approach to Developing Country Commitments in the Global Climate Change Regime

AU: Waskow,-David-F.

SO: Journal-of-Public-and-International-Affairs; 11(0), Spring 2000, pages 1-20.

AB: This paper proposes a new framework for addressing the responsibility of developing countries to limit greenhouse gas emissions in the context of the international regime on climate change. Following the commitment of developed countries to greenhouse gas emissions limits under the 1997 Kyoto Protocol, significant attention has focused on whether or not to establish similar commitments for developing countries. This paper argues that the conventional debate over setting specific emissions targets for developing countries should be replaced by a focus on determining the appropriate emissions thresholds for developing country action. The paper explores the application of similar thresholds in other international agreements, describes relevant proposals for determining developing country responsibility for greenhouse gas emissions, and explores a series of interactive formulas for setting developing country thresholds. Finally, the paper proposes a three-part threshold standard that would provide for appropriate developing country participation.

TI: Klimaschutz durch Steuern oder Lizenzen. (Climate Protection by Means of Taxes or Tradeable Emission Permits. With English summary.)

AU: Rahmeyer,-Fritz

SO: Konjunkturpolitik; 45(4), 1999, pages 317-57.

AB: Climate protection is modelled in four steps: Economic activity and emission of greenhouse gases; greenhouse gases and climate change; costs and benefits of climate protection; environmental policy instruments and strategies of climate protection. Market economy orientated instruments of climate protection are environmental taxes vs.

tradeable permits. Environmental taxation is analyzed in view of an ecological tax reform in Germany. In addition to a reduction of carbon dioxide emissions ("first dividend") a welfare improving correction of the tax system and an increase in employment ("second dividend") is hoped for. However, a stepwise EC- or world-wide introduction of a system of tradeable permits is preferable in view of facilitating an internationally harmonized reduction of carbon dioxide emissions compared with carbon dioxide or energy taxes. The major problem is the fair allocation of permits to advanced industrial and to less developed countries and the organization of the permit market.

TI: Japan's Decision-Making about Climate Change Problems: Comparative Study of Decisions in 1990 and in 1997

AU: Kawashima,-Yasuko

SO: Environmental-Economics-and-Policy-Studies; 3(1), 2000, pages 29-57.

AB: This paper aims to assess Japan's decision-making process to finalize its proposal for the Kyoto Protocol by comparing it to a similar decision in 1990-92. The processes of the two periods are analyzed at both the international and domestic levels of decision making. At the domestic level, the process is divided into three areas--decision-making factors, the decision itself, and the process itself--to clarify the comparison. It is concluded that Japan's decision in 1997 may have been effective in mediating between the United States and the EU for a short time, but not in the last phase of the negotiation when countries started bargaining toward an agreement. The process may also not be suitable if Japan wants to take the lead in the climate-change debate. To overcome these weaknesses it is necessary to make changes in the decision-making process to involve more domestic stakeholders in the process, and to strengthen the capacity of such stakeholders.

TI: GATS and the Kyoto Mechanisms: Open Markets for Climate Change Mitigation Services?

AU: Springer,-Urs

SO: Aussenwirtschaft; 55(1), March 2000, pages 65-84.

AB: The Kyoto mechanisms Joint Implementation (JI) and Clean Development Mechanism (CDM) involve many services. In the General Agreement on Trade in Services (GATS), WTO members have committed to liberalize several service sectors. However, in the "environmental services" sector, which includes most services found in the JI/CDM value chain, only few countries have made commitments. Hence, companies delivering such services do not have market access in many countries, which leads to higher costs of JI/CDM services. Therefore, in the next WTO negotiation round environmental and energy services must be defined more accurately and further liberalization steps taken.

TI: Decoupling China's Carbon Emissions Increase from Economic Growth: An Economic Analysis and Policy Implications

AU: Zhang,-Zhongxiang

SO: World-Development; 28(4), April 2000, pages 739-52.

AB: As the world's second largest carbon emitter, China has long been criticized as a "free-rider" benefiting from other countries' efforts to reduce greenhouse gas emissions

but not taking responsibility for its own emissions. China has been singled out as one of the major targets of the subsequent negotiations after the Kyoto meeting. By analyzing the historical contributions of interfuel switching, energy, conservations, economic growth and populations expansion to China's CO₂ emissions during 1980-97, this article clearly demonstrates that the above criticisms unjustified. Moreover, given the fact that the role of China is an issue of perennial concern at the international climate change negotiations, the article envisions some efforts and commitments that could be expected from China until its per capita income catches up with the level of middle-developed countries. By emphasizing the win-win strategies, these efforts and commitments are unlikely to jeopardize China's economic development and, at the same time, would give the country more leverage at the international climate change negotiations subsequent to the Buenos Aires meeting.

TI: Economic Dimensions of Technological and Global Responses to the Kyoto Protocol

AU: Grubb,-Michael

SO: Journal-of-Economic-Studies; 27(1-2), 2000, pages 111-25.

AB: This paper examines economic aspects of the Kyoto protocol on climate change, focusing on the protocol's longer-term impact and possible global evolution. Specifically, the analysis considers the economics of likely technological responses to the protocol and the implication of international dissemination of technologies and institutional practices, including the wider future development of policies and commitments. It is argued that these factors, in tandem with the protocol's provisions on the clean development mechanism, technology transfer, and the structure of rolling commitment periods, mean that the protocol offers an effective basis for long-term solutions to the problem of climate change.

TI: Long-Term Emission Scenarios for China

AU: Jiang,-Kejun, et-al.

SO: Environmental-Economics-and-Policy-Studies; 2(4), 1999, pages 267-87.

AB: In order to formulate policies in response to climate change, it is essential to forecast future greenhouse gas (GHG) emissions over the long term. The Intergovernmental Panel on Climate Change (IPCC) developed the IS92 emission scenarios in 1992, which have contributed to climate change studies and negotiation activities. Most of these scenarios were developed by research teams in developed countries, and some experts from developing countries have argued that the scenarios did not sufficiently consider the viewpoint of the developing countries. In this paper, we present our study on long-term non-policy emission scenarios for China. This study examines China's socioeconomic development and energy activities in greater detail. The AIM/emission linkage model was developed for analysis. Seven emission scenarios were derived for China, covering six major gases from energy activities and land use changes. The results show that GHG emissions in China will increase until 2030 accompanying the country's economic development. However, it is possible for China to maintain low GHG emissions while achieving rapid economic development.

TI: The Impact of Emissions Trading on OPEC

AU: Ghanem,-Shokri; Lounnas,-Rezki; Brennand,-Garry

SO: OPEC-Review; 23(2), June 1999, pages 79-112.

AB: The latest reference case from OPEC's World Energy Model, OWEM, sees world oil demand growing to 88 million barrels per day by 2010 and increasing by a further 11 mb/d to 99 mb/d by 2020. With the growth in oil production from developing countries and Russia offset by a secular decline in OECD production, OPEC is set to increasingly supply the incremental barrel, with production rising to 40 mb/d by 2010 and 51 mb/d by 2020. Against the backdrop of this reference case, this paper considers the implications of measures to reduce the emissions of greenhouse gases (GHGs), in accordance with the Kyoto Protocol. The initial scenario assumes that three OECD regions each impose a carbon tax that is sufficient to reach their own Kyoto emissions targets, resulting in a fall in OECD demand of 6.5 mb/d by the year 2010, compared with the reference case. This translates into a loss in annual OPEC oil export revenue of \$23 billion. However, this scenario implies exceptionally high tax levels, and it is very likely that alternative options for abatement would be sought. Once full global trading in emissions is allowed, the cost imposed upon carbon-use falls dramatically, down to \$15 per tonne of CO₂, bringing OPEC revenue losses down to below \$12 bn per annum. There may perhaps be only limited scope for OPEC to defend its oil revenue by adopting a firm price strategy consistent with significant production restraint. However, the idea of joint production restraint with non-OPEC could lend some plausibility to the idea of using market management to ensure steady oil export revenue that would otherwise be eroded by climate change mitigation policies.

TI: Flexible Mechanisms of Climate Technology Transfer

AU: Forsyth,-Timothy

SO: Journal-of-Environment-and-Development; 8(3), September 1999, pages 238-57.

AB: Despite the recent adoption of "flexible" mechanisms for climate change mitigation, such as emissions trading and joint implementation, there has been little attention to the use of flexibility specifically for international climate technology transfer. This article proposes new flexible mechanisms of technology transfer that allow Annex I countries (or those with quantified targets to reduce greenhouse gas emissions) to achieve greenhouse gas abatement targets, and supply industrial environmental technology to developing countries. The article also discusses how such mechanisms may be used in conjunction with the Clean Development Mechanism (CDM), which was created under the Kyoto Protocol to promote climate-related investment in non-Annex I countries. It is argued that current approaches to technology transfer repel private investors by focusing too closely on long-term technology sharing rather than the potential benefits of the globalization of technology investment and ownership. However, simply subsidizing technology exports from Annex I countries may result only in damaging non-Annex I industries. It is, therefore, necessary to balance flexible mechanisms with strong national technological policies or governance by the CDM executive body.

TI: Joint Implementation of Greenhouse Gas Abatement under the Kyoto Protocol's 'Clean Development Mechanism': Its Scope and Limits

AU: Parson,-Edward-A.; Fisher-Vanden,-Karen

SO: Policy-Sciences; 32(3), September 1999, pages 207-24.

AB: The Kyoto Protocol on climate change includes four flexibility mechanisms, which pursue lower-cost global reduction of greenhouse gas emissions through voluntary international re-distribution of abatement effort. We consider the operation of one of these, the Clean Development Mechanism (CDM), which grants transferable credit for abatement achieved by individual projects in countries without national emission targets. An uncredited pilot phase in effect since 1995 provides only limited guidance for projecting the operation of the credited CDM. Under the CDM, intractable difficulties of accounting for project-level effects are likely to bias project activity toward particular project types for which exaggeration-resistant accounting rules are most readily available. This bias will favor retrofits over new investments, and will consequently limit the CDM to a modest contribution to required abatement in developing countries. Use of CDM credits as instruments of domestic policy in investor countries, as well as instruments of international policy, may mitigate this bias and the associated limitation. So may the use of projects based on novel technologies of carbon management.

TI: Harvesting Experience: A Reappraisal of the U.S. Climate Change Action Plan

AU: Brunner,-Ronald-D.; Klein,-Roberta

SO: Policy-Sciences; 32(2), June 1999, pages 133-61.

AB: For mitigating climate change and adapting to whatever impacts we cannot avoid, there are no politically feasible alternatives to improvements in the U.S. Climate Change Action Plan at this time or for the foreseeable future. Yet improvements in the Action Plan have been obstructed by the diversion of attention and other resources to negotiating a binding international agreement, to developing a predictive understanding of global change, and to documenting the failure of the Action Plan to meet its short-term goal for the reduction of aggregate greenhouse gas emissions. Continuous improvements depend upon reallocating attention and other resources to the Action Plan, and more specifically, to the many small-scale policies that have already succeeded by climate change and 'no regrets' criteria under the Action Plan. Sustaining the effort over the long term depends on harvesting experience from these small-scale successes for diffusion and adaptation elsewhere on a voluntary basis.

TI: Global Impacts of the Kyoto Agreement: Results from the MS-MRT Model

AU: Bernstein,-Paul-M.; Montgomery,-W.-David; Rutherford,-Thomas-F.

SO: Resource-and-Energy-Economics; 21(3-4), August 1999, pages 375-413.

AB: This paper analyzes the economic impacts on different regions of the world of a global agreement to limit carbon emissions. A multi-sector, multi-region trade model (MS-MRT) is developed that focuses on the international trade aspects of climate change policy. These include the distribution of impacts on economic welfare, international trade and investment across regions, the spillover effects of carbon emission limits in Annex 1 countries on non-Annex 1 countries, carbon leakage, changes in terms of trade and industry output, and the effects of international emissions trading. Our central estimates are presented with a set of sensitivity tests to assess the extent to which our conclusions depend on elasticity and baseline assumptions. A technical appendix presents algebraic details of the model structure and calibration.

TI: Acts of God or Toxic Torts? Applying Tort Principles to the Problem of Climate Change

AU: Penalver,-Eduardo-M.

SO: Natural-Resources-Journal; 38(4), Fall 1998, pages 563-601.

AB: The problem of climate change continues to be an intractable one for policymakers. Uncertainties over the likely costs of climate change as well as over the costs of proposed remedies have hampered the formation of consensus regarding the best course of action. The principles of tort law provide a useful means of analyzing the problem of climate change, particularly the issue of who should bear the costs associated with its effects. The two major goals of tort law (reducing the costs of accidents and corrective justice) both point towards the appropriateness of placing the costs of climate change on those who manufacture fossil fuels. Several obstacles, particularly issues of causation, stand in the way of a tort analysis of climate change. These obstacles can be overcome through a philosophically sound approach to the issue of causation and the adoption of a system of proportional liability.

TI: Political Economy of the Kyoto Protocol

AU: Barrett,-Scott

SO: Oxford-Review-of-Economic-Policy; 14(4), Winter 1998, pages 20-39.

AB: The Kyoto Protocol, negotiated in December 1997, is the first international treaty to limit emissions of greenhouse gases. But Kyoto does not mark the conclusion to international cooperation on climate change. It is really just a beginning. This paper shows that, in the aggregate, the benefits of undertaking the Kyoto reductions should exceed the corresponding costs-provided these are achieved cost-effectively. But, although Kyoto seeks to promote cost-effectiveness, it may yet prove very costly. Moreover, the agreement may not even achieve the reductions that it promises, either because emissions will relocate to the countries that are not required to stay within Kyoto-prescribed ceilings or because "paper" trades will be promoted by the protocol's mechanisms. More fundamentally, Kyoto does not deter non-compliance, and it only weakly deters non-participation. These flaws need to be mended, but the nature of the problem makes that an especially difficult task.

TI: Exploring Energy Technology Substitution for Reducing Atmospheric Carbon Emissions

AU: Knapp,-Karl-E.

SO: Energy-Journal; 20(2), 1999, pages 121-43.

AB: This paper presents a simple method for incorporating the time required for new technology to penetrate the market and subsequently substitute for an old one when evaluating the ability of new energy technology to impact global climate change. The methodology is applied to the two largest sources of energy-related carbon dioxide: electricity generation and motor vehicles. Carbon-free road transportation is hypothesized to substitute for petroleum-fueled vehicles and carbon-free electric power generation for fossil-fueled electricity based on empirical analogs for substitution dynamics parameters, beginning in the year 2000. The examples imply that near-term significant reductions to 1990 carbon emissions levels via technology substitution are unlikely. The time scale

relevant for realizing reductions in carbon emissions is several times the expected lifetime of the products that new technology is intended to replace.

TI: Aspectos economicos del cambio climatico: Responsabilidades y distribucion de los costos de mitigacion. (With English summary.)

AU: Girardin,-Leonidas-Osvaldo

SO: Desarrollo-Economico; 38(151), Oct.-Dec. 1998, pages 797-826.

AB: The issues related to climate change are of enormous complexity. Developing countries share the physical effects of atmospheric concentrations of greenhouse gases, in a proportion which goes far beyond their own contribution for causing the problem. It is therefore a mistake to approach the global environmental issues blaming all actors as regards their responsibility equally. There are opposed points of views about how to face mitigation cost distribution of expected climate change effects. In one hand, developed countries point of view, are based on issues related to economic efficiency (to mitigate in those places where it seems to do it cheaper). In the other hand, developing countries defend an asignative criteria based on the responsibility of each part in present and expected atmospheric concentrations of greenhouse gases, that depends not only on present and expected emissions but on past emissions as well. In this context, it is consigned the efforts done by Latin America and the Caribbean to mitigate greenhouse gases emissions.

TI: Sensitivity of Climate Change Mitigation Estimates to Assumptions about Technical Change

AU: Dowlatabadi,-Hadi

SO: Energy-Economics; 20(5-6), December 1998, pages 473-93.

TI: Climate Change and Dietary Choices--How Can Emissions of Greenhouse Gases from Food Consumption Be Reduced?

AU: Carlsson-Kanyama,-Annika

SO: Food-Policy; 23(3-4), June-Aug. 1998, pages 277-93.

TI: Joint Implementation: Strategic Reactions and Possible Remedies

AU: Wirl,-Franz; Huber,-Claus; Walker,-I.-O

SO: Environmental-and-Resource-Economics; 12(2), September 1998, pages 203-24.

AB: This paper investigates the promising proposal of Joint Implementation (JI) to mitigate greenhouse gas emissions. This was ultimately the only concrete outcome of the Conference on Climate Change in Berlin, albeit restricted to a pilot phase. The basic idea, given the public's awareness of global warming, sounds economically plausible: The industrialized countries, the only ones required to stabilize and lower carbon emissions, can search for cheaper reductions of greenhouse gas emissions in developing countries and economies in transition. However, this proposal leads to strategic reactions by developing countries reinforced by the fact that this cheating coincides with the interest of the industrialized country. In short, this proposal will lead to cheating (given asymmetric information) and will thus produce largely faked reductions in emissions. On the constructive side, an efficient mechanism retaining the spirit of JI is derived, which deters strategic reactions. This differs from a usual principal-agent problem through an

additional hierarchical layer: a global authority (e.g. the Conference of Parties on Climate Change), an industrialized country and a developing country. The unavoidable loss that is even associated with an optimal scheme due to strategic, behavioural reality (the first best optimum is unattainable, except at the top) leads, of course, to much less glamorous predictions in emission reductions. Moreover, the implicit subsidization scheme focuses and favours on already 'efficient' partners.

TI: Climate Change and Forestry: What Policy for Canada?

AU: Stennes,-Brad; Krcmar-Nozic,-Emina; van-Kooten,-G.-Cornelis

SO: Canadian-Public-Policy; 24(0), Supplement May 1998, pages S95-104.

AB: On the basis of projected global climate change, Canada is expected to experience large land-use impacts. As indicated in this paper, forestry and agriculture are likely to be net gainers from climate change, with Canada as a whole possibly gaining from global warming. Adaptation to climate change will require shifting land out of forestry and into agricultural activities. Nonetheless, cost-effective mitigation strategies will likely involve the opposite--planting trees on agricultural land. The quandary for decision makers is whether to pursue mitigation strategies that could be to the detriment of future adaptation.

TI: Biomass Energy Use to Reduce Climate Change: A General Equilibrium Analysis for Austria

AU: Breuss,-Fritz; Steininger,-Karl

SO: Journal-of-Policy-Modeling; 20(4), August 1998, pages 513-35.

AB: A further increase in biomass energy supply is a crucial future option for reducing the Austrian contribution to climate change. Analysis of it has so far focused mainly on supply potentials and costs of production. Increased biomass energy supply, however, is also connected to economy-wide effects and to feedback effects on its own demand. This paper quantifies such effects in a general equilibrium framework of the Austrian economy for different supply scenarios. Increases in biomass energy are shown, for example, to cause substantial changes in the necessary CO₂ tax rate to reach a given emission objective level.

TI: Tradable Emission Quotas, Technical Progress and Climate Change

AU: Bertram,-I.-G.

SO: Environment-and-Development-Economics; 1(4), October 1996, pages 465-87.

AB: The paper reviews two alternative rules for allocation of property rights in a global greenhouse-gas emissions budget, assuming implementation of a tradable-quota arrangement. These are the per capita rule and no-regrets-for-the-South (NRFTS) rule. The operation of a quota market under these alternative regimes is simulated on a spreadsheet, using 1990-1 data from 125 countries. A significant result is that once the South has secured a quota allocation based on the per capita principle, it stands collectively to lose from progress in abatement technology because of the strong link from technical progress to the world market price of quota. The more restricted NRFTS rule gives the South smaller gains from the quota system, but enables it to retain some of the rents from its own technical progress. Some implications for the South's position in future negotiations are noted.

TI: Assessing Effects of Mitigation Strategies for Global Climate Change with an Intertemporal Model of the U.S. Forest and Agriculture Sectors

AU: Alig,-Ralph et-al.

SO: Environmental-and-Resource-Economics; 9(3), April 1997, pages 259-74.

AB: A model of product and land markets in U.S. forest and agricultural sectors is used to examine the private forest management, land use, and market implications of carbon sequestration policies implemented in a "least social cost" fashion. Results suggest: policy-induced land use changes may generate compensating land use shifts through markets; land use shifts to meet policy targets need not be permanent; implementation of land use and management changes in a smooth or regular fashion over time may not be optimal; and primary forms of adjustment to meet carbon policy targets involve shifting of land from agriculture to forest and more intensive forest management combinations varying with the policy target. Coauthors are Darius Adams, Bruce McCarl, J. M. Callaway, and Steven Winnett.

TI: Carbon Emission Tax and Its Impact on a Developing Country Economy--A Case Study of India

AU: Jayadevappa,-Ravishankar; Chhatre,-Sumedha

SO: Journal-of-Energy-and-Development; 20(2), Spring 1995, pages 229-46.

AB: Global climate change has become one of the most important of recent issues. It is estimated that roughly 60 percent of projected global climate change will be caused directly by the energy sector. Developing nations are the fastest growing greenhouse gas (GHG) emission sources. The restricted focus of the GHG problem to fossil fuels and carbon dioxide emissions in particular frightens the developing countries. Most studies on global climate change neglect the impact of proposed measures carbon tax on the economies of the developing bloc. In this paper we examine the impacts of implementing carbon emission tax on the economy of India using an input-output model. After discussing the economy wide impacts of a carbon emission tax, possible measures for combating global climate change are examined. We also address the usefulness of energy-efficient technology to ameliorate carbon emissions.

TI: The Global Warming Game--Simulations of a CO₂-Reduction Agreement

AU: Fankhauser,-Samuel; Kverndokk,-Snorre

SO: Resource-and-Energy-Economics; 18(1), March 1996, pages 83-102.

AB: We analyse incentives for, and the benefits of a possible international cooperation to reduce CO₂-emissions. The negotiations are modelled as a reciprocal-externality game in CO₂-emissions between 5 world regions. CO₂-emissions affect the players in two ways: First, each country's income depends (via energy inputs) on the amount of CO₂ emitted. But emissions may also cause future damage due to climate change. The paper calculates illustrative estimates of the Nash equilibrium and the social optimum. It shows that the currently observed differences in countries' attitudes towards a CO₂-reduction agreement can largely be explained by economic factors.

TI: An Inventory-Based Procedure to Estimate Economic Costs of Forest Management on a Regional Scale to Conserve and Sequester Atmospheric Carbon

AU: Lewis,-David-K.; Turner,-David-P.; Winjum,-Jack-K.

SO: Ecological-Economics; 16(1), January 1996, pages 35-49.

AB: Estimation of the costs of managing forests to conserve and sequester atmospheric carbon is necessary to define the role of forests to mitigate the onset of projected global climate change. The role of forests as both carbon pools and an element in the flux of atmospheric carbon dictate new requirements in estimating the costs of forest management to mitigate climate change. These requirements include recognition of the inventory as a capital stock in the estimation of the costs; the need to allow the integration of biological, social and economic considerations across nations and regions; and the need to facilitate consideration of the distributional impacts of forest policy alternatives. An inventory-based procedure is presented to estimate forest management costs based on recognition of the opportunity costs of holding forest inventories. To demonstrate this procedure, the costs of four policy scenarios projected in the carbon budget of the United States are examined. Based on the demonstration, the inventory-based procedure is shown to meet the requirements for estimating forest management costs to conserve and sequester atmospheric carbon on a regional scale. The demonstration also illustrates the potential of the procedure to provide insights into differences in costs associated with management of forest ecosystems among geographic regions and forest policies.

TI: Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion

AU: Jaffe,-Adam-B.; Stavins,-Robert-N.

SO: Journal-of-Environmental-Economics-and-Management; 29(3), Part 2 Nov. 1995, pages S43-63.

AB: We develop a framework for comparing empirically the effects of alternative environmental policy instruments on the diffusion of new technology. "Market-based" and "command-and-control" approaches can be quantitatively compared by estimating the economic penalty that firms, through their actions, reveal to be associated with violation of standards. In the context of concerns about global climate change, we empirically examine the likely effects of Pigouvian taxes, technology adoption subsidies, and technology standards. We employ state-level data on the diffusion of thermal insulation in new home construction, comparing the effects of energy prices, insulation, cost, and building codes. (c) 1995 Academic Press, Inc.

TI: Climatic Change and Canada's Boreal Forest: Socio-economic Issues and Implications for Land Use

AU: van-Kooten,-G.-Cornelis

SO: Canadian-Journal-of-Agricultural-Economics; 43(1), March 1995, pages 133-48.

AB: This paper reviews the effect of climate change and policies to sequester carbon on forest land use. Efficient mitigation strategies often require the conversion of agricultural land to forestry in order to sequester carbon, but such strategies could be wrong for Canada's boreal forest region if global warming is inevitable. It is argued that, from both an economic and a social perspective, conversion of the southern boreal forest to grassland or agriculture might be a better policy.

TI: Protection versus Retreat: The Economic Costs of Sea-Level Rise

AU: Fankhauser,-S.

SO: Environment-and-Planning-A; 27(2), February 1995, pages 299-319.

AB: The author analyses the relative role of protection (or damage mitigation) expenditures within the total costs associated with raised sea levels induced by climate change. A rule of thumb is derived to approximate the optimal level of protection. Economic efficiency requires that protection expenditures are designed such that the sum of protection costs plus remaining land-loss damage is minimised. The optimal protection level will depend on the relative importance of dryland loss compared with the costs of accelerated wetland loss plus protection expenditures. This framework is then used to estimate the damage-cost functions associated with a sea-level rise for the countries of the OECD.

TI: Tradable Cumulative CO₂ Permits and Global Warming Control

AU: Kosobud,-Richard-F. et-al.

SO: Energy-Journal; 15(2), 1994, pages 213-32.

AB: As an alternative to current global warming policy proposals to freeze greenhouse gas "emissions" at their 1990 levels by the year 2000, this study examines the implications of a long-run objective of stabilizing greenhouse gas "concentrations" at low to moderate risk levels by the year 2100. The current proposals to control emissions slow but do not end the build-up of concentrations, and they could imply costly short-term adjustments of the energy industries. Our objective is to explore an alternative policy that could (1) stabilize induced climate change, (2) provide for the creation of international "property rights" in the stratosphere by means of tradable emission permits, and (3) be more intertemporally cost-effective. Our method for analyzing this effort is a tested, dynamic, price sensitive, global economic model to which is linked a climate change submodel. Together these models enable us to project price and quantity time paths of energy, climate, and tradable permit variables under alternative policy actions. Coauthors are Thomas A. Daly, David W. South, and Kevin G. Quinn.

TI: Some Estimates of the Insurance Value against Climate Change from Reducing Greenhouse Gas Emissions

AU: Parry,-Ian-W.-H.

SO: Resource-and-Energy-Economics; 15(1), March 1993, pages 99-115.

AB: Estimates of the value of reduced risk from marginal reductions in current greenhouse gas emissions are presented, using Nordhaus's results and predictions from the scientific models. Only under extreme scenarios for climate change, or when future utility is discounted at an unusually low rate, does the insurance value seem likely to be significant relative to the costs of cutting emissions.

TI: Rolling the 'DICE': An Optimal Transition Path for Controlling Greenhouse Gases

AU: Nordhaus,-William-D.

SO: Resource-and-Energy-Economics; 15(1), March 1993, pages 27-50.

AB: Economic analyses of efficient policies to show climate change require combining economic and scientific approaches. The present study presents a dynamic integrated climate-economy ("DICE") model. This model can be used to investigate alternative

approaches to slowing climate change. Evaluations of five policies suggest that a modest carbon tax would be an efficient approach to slow global warming, while rigid emissions-stabilization approaches would impose significant net economic costs.

TI: UN Convention on Climate Change: Effects on Australia's Energy Sector

AU: Jones,-Barry-P.

SO: Agriculture-and-Resources-Quarterly; 4(2), June 1992, pages 186-95.

AB: The Australian government's interim planning target for reducing greenhouse gas emissions calls for a larger cut in emissions than is implied by the commitments contained in the recently completed UN Convention on Climate Change. The commitments in the Convention also leave considerable scope for how fast and by how much emissions are to be reduced. Lesser targets than the Australian government's interim planning target can be expected to be easier and less costly to achieve. These lesser targets could also allow a more gradual and managed transition to a less fossil fuel dependent economy, if such an outcome were desirable. But analysis of alternative targets also implies that there could be benefits from deferring some greenhouse response actions.

TI: Towards a Comprehensive Approach to Global Climate Change Mitigation

AU: Morgenstern,-Richard-D.

SO: American-Economic-Review; 81(2), May 1991, pages 140-45.

TI: The Cost of Slowing Climate Change: A Survey

AU: Nordhaus,-William-D.

SO: Energy-Journal; 12(1), 1991, pages 37-65.

AB: Policies to deal effectively and efficiently with the threat of greenhouse warming must balance the costs of slowing climate change against the potential damages. This survey discusses one half of this question, the costs of slowing climate change by reducing greenhouse gas (GHG) emissions. The analysis provides estimates of the cost of reducing chlorofluorocarbon and CO₂ emissions, and inquires into the costs of using forestry options to remove CO₂ from the atmosphere. A promising new approach, the use of geoengineering, is discussed qualitatively.

TI: Macroeconomic Implications of Reducing Greenhouse Gas Emissions: A Survey of Empirical Studies

AU: Hoeller,-Peter; Dean,-Andrew; Nicolaisen,-Jon

SO: OECD-Economic-Studies; 0(16), Spring 1991, pages 45-78.

AB: This paper surveys various estimates of the macroeconomic implications of reducing greenhouse gas emissions. Most available studies focus on policies to reduce CO₂ emissions and are limited to the costs of such policies. The survey first examines the key factors shaping baseline emission scenarios. It then looks at the aggregate cost of emission reductions, as shown by both global and country-specific models, and discusses the key determinants of the model outcomes. The paper also briefly reviews other options for reducing greenhouse gas emissions and draws some more general lessons for the policy response to the threat of climate change.

TI: Potential Effects of Climate Change on Agriculture in the Prairie Region of Canada
AU: Arthur,-Louise-M.; Abizadeh,-Fay
SO: Western-Journal-of-Agricultural-Economics; 13(2), December 1988, pages 216-24.

TI: The Greenhouse Effect: What Government Actions Are Needed?
AU: Lave,-Lester-B.
SO: Journal-of-Policy-Analysis-and-Management; 7(3), Spring 1988, pages 460-70.
AB: The worst consequences of greenhouse induced climate change will occur to unmanaged ecosystems and to poor countries. The industrial nations may experience only minor irritations, apart from the eventual rise in sea level. Uncertainty dominates current forecasts of the climate change as well as contingent forecasts of the resulting ecosystem and social consequences. Current actions are warranted, despite the uncertainty, that are unlikely to be costly or harmful and are likely to help for the estimated range of climate changes.