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Global Climate Change and the Use of Economic Approaches: The Ideal Design Features of Domestic Greenhouse Gas Emissions Trading with an Analysis of the European Union's CO2 Emissions Trading Directive and the Climate Stewardship Act

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ABSTRACT

This Article discusses the ideal design features of a domestic greenhouse gas (GHG) emissions trading program that are critical to the cost-effective implementation of future U.S. climate change policy. The discussion of a properly designed domestic GHG trading program is coupled with an analysis of both the European Union's Carbon Dioxide (CO_2) Emissions Trading Directive and the Climate Stewardship Act of 2003, proposed by Senators John McCain and Joseph Lieberman.

The Article begins with the argument that climate change policy does not necessarily entail huge compliance costs. Rather, implementation of well-designed domestic climate change policy will have the effect of aligning energy development and environmental protection goals while minimizing its short-term economic impacts. By encouraging reduced fossil fuel usage, climate change policy has the potential to integrate sustainability concerns into all levels of economic decision making, thereby producing ancillary societal benefits such as improvements in existing air quality and public health.

In light of the large number of pollution sources and the relative ease in measuring CO_2 emissions, this Article argues that emissions trading or a carbon tax system should be an essential part of any successful climate stabilization strategy. However, it

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is unlikely that a carbon tax will be politically acceptable in the United States despite the tax's theoretical appeal. Based on prior experiments with emissions trading programs in the United States, the Article discusses the ideal design features of domestic GHG emissions trading. These features include early reduction credits, banking and borrowing, opt-in, offset trading, international emissions trading, and effective monitoring and verification. During the course of discussion, the Article examines the program elements of the European Union's CO_2 *Emissions Trading Directive and the Climate Stewardship Act.*

Lastly, this Article briefly introduces several studies that have estimated the economic effects of the Climate Stewardship Act. The Article concludes that domestic climate change policy can be implemented in a cost-effective manner and stresses the need for the United States to take domestic action on climate change.

INTRODUCTION

We cannot live without utilizing energy; easy access to inexpensive and abundant fossil-fuel-based energy is the foundation of today's globalized economy. However, the mobility, convenience, and Western life style made possible by the excessive use of fossil fuels do not come without a price. From exploration and development to transportation and end-use, the production and consumption of fossil fuels result in ecosystem destruction and species extinction, massive-scale air pollution and related public health costs, global warming, unstable energy prices, and huge national defense expenditures.

Most importantly, the phenomenon of global climate change caused by the ever-increasing atmospheric build-up of carbon dioxide (CO_2) and other greenhouse gases (GHGs) emitted by various human sources is a resounding warning signal that our fossil-fuel-based civilization may not be sustainable in the long term. Indeed, future generations may end up paying unjustifiably high costs ascribed to past and present mismanagement of fossil fuel consumption patterns.

Given this scenario, it is not surprising that sustainable use of fossil-fuel-based energy has become the overriding concern in the formulation and implementation of energy policy worldwide. However, the economic system of the United States is skewed toward promoting use of nonrenewable carbon-based resources. Despite several decades of national efforts to promote clean and efficient energy technologies, the American energy structure is still characterized by coal dominance in electricity generation[1] and the heavy consumption of foreign petroleum in the transportation sector.[2]

This reliance on fossil fuel is largely due to the failure of domestic environmental and energy law and policy to adequately balance energy development goals with the goals of environmental protection. To put it in economic terms, the failure of the current legal system to promote clean energy development has sent wrong price signals to producers and consumers that do not adequately reflect environmental externalities. The inefficiency of the U.S. energy structure explains the strong opposition by the U.S. government to the Kyoto Protocol on Climate Change;[3] ratification of the Kyoto Protocol

1. Electric utilities are the number one source of CO_2 emissions in the United States. This sector was responsible for approximately 40 percent of national CO_2 emissions in 2001. U.S. ENVTL. PROT. AGENCY (EPA), EPA-430-R-03-004, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2001, ES-15 (2003) [hereinafter U.S. GHG EMISSIONS AND SINKS FOR 1999-2001]. In 1998, electric utilities were responsible for 25 percent of national nitrogen oxide (NO_x) emissions, 67 percent of sulfur dioxide (SO_2) emissions, and eight percent of emissions of particulate matter that is equal to, or bigger than, ten microns in diameter (PM_{10}), respectively. U.S. EPA, EPA-454-R-00-002, NATIONAL AIR POLLUTANT EMISSION TRENDS: 1900-1998, 2-2, 2-3 (2000) [hereinafter NATIONAL AIR EMISSION TRENDS FOR 1900-1998]. In 2002, coal was used to generate 50 percent of total electricity net generation in the United States. ENERGY INFO. ADMIN., DOE/EIA-0384, ANNUAL ENERGY REVIEW, 2004 tbl. 8.2a., *at* http://www.eia.doe.gov/emeu/aer/pdf/aer.pdf [hereinafter Annual Energy Review]. Coal combustion produced approximately 85 percent of CO_2 emissions from fossil-fuel-fired electric generation because of the high carbon content of coal compared to other fossil fuels. U.S. GHG EMISSIONS AND SINKS FOR 1999-2001, *supra*, at 2-4, tbl. 2-3, ES-14. More than 90 percent of electric utility NO_x and SO_2 emissions came from coal-fired power plants. NATIONAL AIR EMISSION TRENDS FOR 1900-1998, *supra*, at 2-2.

2. U.S. dependence on foreign oil supplies has deepened since the 1970s. U.S. net petroleum imports increased from about six million barrels per day in 1973 to 11.24 million barrels per day in 2003. This constituted about half of the nation's total petroleum consumption, 19.7 million barrels per day in that year. Annual Energy Review, *supra* note 1, tbl. 5.1. Stability in oil prices since the late 1970s is the most significant factor contributing to increased petroleum consumption. When valued in real dollars, crude oil refinery acquisition costs peaked at $56.5 per barrel in 1981, dropped to $19.32 in 1986, and then stabilized at around $20 until 2002. *See id.* tbl. 5.19. The transportation sector emitted nearly 31 percent of U.S. GHG emissions in 2001. U.S. GHG EMISSIONS AND SINKS FOR 1999-2001, *supra* note 1, at ES-7, tbl. ES-3. Although vehicle fuel efficiency and emission controls have improved significantly since the Clean Air Act (CAA) was enacted in 1970, the increase in both vehicle miles traveled (VMT) and the size of the vehicle fleet has offset most of the air quality benefits derived from the use of more energy-efficient vehicles. *See* ARNOLD W. REITZE, JR., AIR POLLUTION CONTROL LAW: COMPLIANCE AND ENFORCEMENT 270 (2001).

3. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, U.N. Doc. FCC/CP/1997/L.7/Add.1, *reprinted in* 37 I.L.M. 22 (1998) [hereinafter Kyoto Protocol].

necessarily requires a reconfiguration of current U.S. energy law and policy, which potentially implicates huge short-term transition costs.[4]

As the history of the Clean Air Act's (CAA) New Source Review (NSR) program has clearly demonstrated,[5] environmental regulations favor older, dirtier energy sources.[6] In most instances, the regulations

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4. Under the Kyoto Protocol, the United States, if it ratifies the treaty, would be obligated to reduce its 1990 level GHG emissions by seven percent during the 2008-2012 compliance period. *Id.* art. 3.1 & Annex B. It is generally understood that the seven-percent reduction target is difficult to achieve under the current business-as-usual scenario. *See, e.g.*, U.S. EIA, DOE/EIA-0383, ANNUAL ENERGY OUTLOOK 2001 WITH PROJECTIONS TO 2020, at 97, fig. 124 (Dec. 22, 2000); U.S. DEP'T OF STATE, U.S. CLIMATE ACTION REPORT 2002: THIRD NATIONAL COMMUNICATION OF THE UNITED STATES OF AMERICA UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 73 (May 2002). It is important to note that the United States is a contracting party to the U.N. Framework Convention on Climate Change (UNFCCC). United Nations Framework Convention on Climate Change, May 29, 1992, U.N. Doc. A/AC.237/18 (1992), *reprinted in* 31 I.L.M. 849 (1992). The UNFCCC declared as its objective the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system," and exhorted developed countries to stabilize their GHG emissions to 1990 levels. *Id.* arts 2, 4(2)(b). Therefore, it is fair to say that, under the present "no regrets" approach, the United States as a party to the UNFCCC is certain to fail to meet the legal obligation to stabilize its GHG emissions at even 1990 levels.

5. Under the CAA, major new sources, and existing stationary sources proposing a change (physical or operational) entailing a significant increase in emissions of a criteria or regulated air pollutant (or emissions of any such pollutant not previously emitted), must obtain preconstruction permits. *See* 42 U.S.C. §§ 7475(a), 7503(a) (2000); *see also id.* § 7411(a)(2), (a)(4) (definitions of new source and modification). NSR subjects new sources in attainment areas and nonattainment areas to rigorous air quality-related study requirements and the offset requirement, respectively. 42 U.S.C. §§ 7475(e), 7503(c). Upon a finding of NSR applicability, new sources must install the best achievable control technology (BACT) or the lowest achievable emissions rate (LAER), depending on the area's attainment status. *Id.* §§ 7479(3), 7501(3). This technology requirement is quite onerous in that sources are required to pursue the right mix of control options to minimize air quality impacts to the maximum extent possible. *See id.* Note that an area can be in attainment for one criteria pollutant and in nonattainment for another pollutant. As a result, both technology standards could apply to the same source. In such a case, the source applicant must prepare for both prevention of significant deterioration and nonattainment NSR simultaneously. Contrary to initial expectations that more and more existing sources would be brought under NSR over time, the dichotomy between new and existing sources has allowed grandfathered sources to stay operational beyond their expected life cycle without being subject to NSPS and NSR requirements using such loopholes as "netting" and the "routine maintenance" exception. This is one of the factors that has played a prominent role in perpetuating coal dominance in the electric utility industry.

6. One of the key features permeating the CAA and other environmental statutes is that they often distinguish between new and existing sources. This is generally known as "grandfathering." The oldest such examples are the new source performance standards (NSPS). *See* 42 U.S.C. § 7411 (CAA); 33 U.S.C. § 1316 (Clean Water Act). Under the grandfathering scheme, sources that existed at the time of enactment or proposed rule making are exempted from more stringent new pollution control requirements. The reason for the differential treatment may be political (the great influence of industry on politics) or

impose more stringent percentage-input based emission reduction requirements on new sources, even though these sources are oftentimes much cleaner than older, grandfathered sources.[7] This so-called new source bias has created perverse incentives for grandfathered sources to escape stringent new requirements, while negatively impacting the competitiveness of newer, cleaner fossil-fuel-burning technologies and renewable energy technologies.[8]

In the past, "cost-of-service" electricity regulation, based on average cost pricing, discouraged capital investments in efficient use of fossil fuels and promotion of renewable energy resources.[9] Since its

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a lack of economic feasibility of requiring a reconfiguration of the whole facility for compliance purposes. Whatever the justification, grandfathering contributes significantly to creating an uneven playing field between new and existing sources. This is especially true in the case of the energy sector, which is characterized by economies of scale and natural monopolies; "grandfathering" potentially functions as a significant entry barrier to new entrants.

7. Technology-based standards take the form of "emission rate" standards, which are typically expressed in terms of the amount of emissions of a regulated pollutant based on heat input, such as pounds (lbs.) per million British Thermal Unit (mm Btu). More demanding emission rates are required of clean-fuel-burning sources under the name of "best available technology." Establishing emission reduction requirements on a percentage, input basis penalizes new clean-fuel-burning sources in two respects. First, clean-fuel-burning sources usually employ highly energy-efficient fuel combustion technologies. For example, the maximum thermal efficiency of state-of-the-art combined-cycle, natural-gas-fired plants is close to 60 percent, whereas the most energy-efficient coal-burning technology currently in dominant use has a thermal efficiency of 33 percent at best. *See* STEVEN FERREY, THE NEW RULES: A GUIDE TO ELECTRIC MARKET REGULATION 4 (2000). Thus, input-based emission standards disregard energy efficiency aspects, producing the practical effect of rewarding old, energy-inefficient sources. Second, clean-fuel-burning sources embodying energy-efficient technologies are subject to percentage reduction requirements. Though less polluting and more energy-efficient, these sources must install expensive modern post-combustion control equipment whose efficiency gains are questionable in terms of effectiveness in pollution control compared to incurred investment monies. *See* Byron Swift, *Grandfathering, the New Source Review, and Nitrogen Oxide – Making Sense of a Flawed System*, 15 ENV'T REP. 1538, 1539 (2000) (observing that new gas-fired plants subject to rigorous NSR control requirements would have to incur the cost of $2,500 to $10,000 per ton of NO_x removed, while grandfathered, coal-fired plants could reduce NO_x emissions "at prices as low as $300 per ton").

8. Notably, electric utilities have kept their old coal-fired electric units operating beyond normal life expectancy. Since 1980, few new coal-burning electric power plants have been constructed, and preconstruction permits for major modifications have rarely been issued to grandfathered coal-fired power plants. *See* Swift, *supra* note 7, at 1538. Presumably, grandfathered coal-fired utilities have escaped NSR by making use of such legal loopholes as netting and the routine maintenance exception, given the lack of a formal notice requirement regarding intra-facility netting transactions and the fact that most of the EPA or state-initiated NSR enforcement actions have targeted the industry practice using the routine maintenance exception as an excuse for foregoing NSR.

9. Cost-of-service (or rate-of-return) regulation has a tendency to create an incentive for making capital investments more (or less) than are necessary from an economic

introduction in the early 1990s,[10] electricity sales competition at the wholesale and retail levels has created an uncertain market environment

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efficiency standpoint. This incentive depends on the generosity of a rate of return granted to franchised utilities by state public utility commissions (PUCs) ("Averch-Johnson (AJ) effect" or "reverse AJ effect"). *See generally* H. Averch & L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1053 (1962); Peter Navarro, *The Simple Analytics of Performance-Based Ratemaking: A Guide for the PBR Regulator*, 13 YALE J. REG. 105, 122 (1996). Also, it is highly likely to provide incentives to exaggerate operational expenses, because incumbent utilities may be allowed to recover expenses on a dollar-for-dollar basis unless it is clear that those expenses are beyond reasonable bounds ("X-inefficiency"). *See generally* Harvey Leiberstein, *Allocative Efficiency vs. "X-Efficiency"*, 56 AM. ECON. REV. 392 (1966). Under cost-of-service regulation, rates are set based on accounting average cost, not on actual marginal cost. This means that utility service is priced regardless of its actual cost. *See* Bernard S. Black & Richard J. Pierce, Jr., *The Choice Between Markets and Central Planning in Regulating the Electricity Industry*, 93 COLUM. L. REV. 1341, 1388 (1993). Moreover, under the "universal service" doctrine, low-cost customers subsidize high-cost customers (including low-income residents)—business and industrial customers versus residential customers and urban customers versus rural customers. Especially in the electricity market, cost per unit is different depending on time of day and season. *Id.* Pricing regardless of marginal cost promotes overconsumption during peak demand and hence increases total social cost, including adverse environmental impacts. *Id.* at 1388–89; Paul L. Joskow & Richard Schmalensee, *Incentive Regulation for Electric Utilities*, 4 YALE J. REG. 1, 13 (1986). Relying on the "natural monopolies" rationale, state PUCs have granted a de jure monopoly to one incumbent public utility and restricted competition because of their concerns about "cream-skimming" by new entrants that potentially undercuts the incumbent's competitiveness in highly lucrative segments of the relevant market supporting the universal service goal. Thus, new and competitive electricity suppliers have had a hard time marketing their products and services that would otherwise have contributed to a cleaner environment and greater energy efficiency and conservation.

10. Electricity competition began at the interstate wholesale level with the enactment of the Energy Policy Act of 1992; the Act gave the Federal Energy Regulatory Commission (FERC) "wholesale wheeling" authority. Energy Policy Act of 1992, Pub. L. No. 102-486, tit. VII, subtit. B, § 721, 106 Stat. 2915 (1992) (codified at 16 U.S.C. § 824j). Pursuant to this authorization, the FERC issued three implementing orders. The first two orders, called the Open Access Rule, required public utilities owning or operating transmission facilities to unbundle their transmission service from other functions in an open, non-discriminatory manner and created a utility-operated electronized real-time information sharing system on the availability of transmission capacity. U.S. FERC, Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 61 Fed. Reg. 21,540 (May 10, 1996) (codified at 18 C.F.R. §§ 35, 385); Open Access Same-Time Information System (Formerly Real-Time Information Networks) and Standards of Conduct, 61 Fed. Reg. 21,737 (May 10, 1996) (codified at 18 C.F.R. § 37). The third order enumerated minimum requirements and functions for the approval of independent system operators (ISOs) or regional transmission organizations (RTOs) that would be formed in order to create and maintain fully regional competitive wholesale markets. U.S. FERC, Regional Transmission Organizations, Order 2000, 65 Fed. Reg. 809 (Jan. 6, 2000) (codified at 18 C.F.R. § 35). Shortly thereafter, some of the states with the highest electricity prices opened their retail markets. Currently, 18 of the 24 states with electricity-restructuring legislation or administrative orders allow, or plan to allow, all or some classes of customers to choose retail service providers. *See* U.S. EIA, *Status of State Electric Industry Restructuring*

that is detrimental to the development of cleaner, more efficient, but cost-sensitive, energy technologies, while not yet delivering its promise of maximizing economic efficiency and low electricity prices for the benefit of the nation's economy and the public at large.[11]

On the other hand, notwithstanding their relative success in curbing pollution from large industrial sources, environmental regulations have often failed to control small, diffuse pollution sources, such as automobiles and nonpoint sources. Currently, these sources, in the aggregate, cause more environmental harm than do conventional

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Activity, *at* http://www.eia.doe.gov/cneaf/electricity/chg_str/restructure.pdf (last updated Feb. 2003).

11. Electricity competition has resulted in highly volatile spot markets, as the 2001 California energy crisis demonstrated. Transmission bottlenecks in many parts of the country create market uncertainty and spikes in retail prices during peak-demand periods. In a highly uncertain legal environment during the transition period, public utilities located in deregulation states are unwilling to invest in electric supply infrastructure because of increased competitive pressure and high financial risks associated with transmission investment decisions. *See, e.g.*, N. AM. ELEC. RELIABILITY COUNCIL, RELIABILITY ASSESSMENT 1998-2007, at 34 (1998) (pointing out that transmission owners may not have sufficient incentive to make transmission capacity additions and upgrades due to uncertainty about full cost recovery). Many utilities divested themselves of production and transmission functions, acting solely as power marketers or electricity resellers or distributors. In this highly uncertain market environment, capital investments in new and cleaner energy technologies with cost disadvantages would likely be chilled. On the other hand, many low-cost states, mostly those in the Northwest and the South, have resisted outside attempts to open their wholesale markets. *See* Richard J. Pierce, Jr., *Completing the Process of Restructuring the Electricity Market*, 40 WAKE FOREST L. REV. 451, 459-61 (2005). As of now, there are only five "organized" markets located in the Northeast, California, and Texas: (1) ISO New England (ISO-NE), (2) New York ISO (NYISO), (3) P-J-M (Pennsylvania, Maryland, New Jersey, Delaware, and the District of Columbia), (4) Electric Reliability Council of Texas (ERCOT), and (5) California ISO (CAISO). *See* OFF. OF MARKET OVERSIGHT & INVESTIGATIONS, THE FED. ENERGY REGULATORY COMM'N, STATE OF THE MARKETS REPORT 17 (Jan. 2004), *available at* http://www.ferc.gov/legal/maj-ord-reg/land-docs/som-2003.pdf. Market fragmentation, combined with transmission bottlenecks, has the adverse effects of suppressing real competition and inhibiting the development and deployment of renewable energy facilities. The best practical solution to this market conundrum is to mandate the establishment of RTOs in all regions and the adoption of efficient transmission pricing rules that can make possible viable price competition and reward investments in transmission facilities. *See, e.g.*, Richard J. Pierce, Jr., *FERC Must Adopt an Efficient Transmission System – Now*, ELEC. J., Oct. 1997, at 79–85; Kevin Porter, *If SMD Dies, What Parts of Order 888 Do We Need to Fix?*, ELEC. J., Dec. 2003, at 81–84. Standard market design (SMD) rules proposed in 2002 by the FERC embodied these ideas but are now being stalled in the face of strong opposition from many states, including California. U.S. FERC, Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design (Docket No. RM01-12-000), 100 F.E.R.C. ¶ 61,138, 2002 FERC LEXIS 1739 (July 31, 2002); *see also* Lori A. Burkhart, *A Fight Over Market Design*, PUB. UTIL. FORT., Nov. 15, 2002, at 18-31 (compiling responses to SMD from six state PUC chairpersons representing each of the regions with divergent interests).

smokestack and manufacturing industries.[12] Contrary to politicians' and policy makers' initial expectations that modern science and technology would be capable of solving most of the persistent environmental pollution problems without changing Western heavy-consumption lifestyles,[13] it became apparent that pollution would continue unless the legal system addresses its root cause head-on: wasteful use of scarce natural resources, perpetuated by industrial society's predisposition to reward wealth-creating economic activity without regard to its environmental consequences.

It is clear, however, that current levels of consumption and population growth cannot be continued indefinitely. Because the adverse consequences of past and present mismanagement of the environment and natural resources will be borne by future generations, it is time to pursue sustainable development to secure a better future. The success of our efforts to pursue sustainable development hinges on whether and how we are able to create new political, legal, and socio-economic structures that recognize the limits of the Earth's carrying capacity.

The issue of global climate change is highly relevant to this endeavor because the massive fossil fuel consumption that supports the globalized economy creates many forms of environmental degradation. Climate change policy encouraging the efficient use of fossil fuels and the development of alternative renewable energy resources has the potential to help the nation and the rest of the world move in the direction of sustainable development. Contrary to the general perception that directly addressing climate change could potentially become the death knell for our economic prosperity, implementation of well-designed climate change policy may well have the effect of aligning energy development and environmental protection goals while

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12. In 1998, the transportation sector was responsible for 79 percent of carbon monoxide (CO) emissions, 53 percent of NOx emissions, and 43 percent of emissions of volatile organic compounds (VOCs). NATIONAL AIR EMISSION TRENDS FOR 1900–1998, *supra* note 1, figs. 2-1, 2-2, 2-3. The majority of the remaining water quality problems are caused by polluted runoff from nonpoint sources not subject to permitting requirements under the CWA. *See* U.S. EPA & DEP'T OF AGRIC., EPA 840-R-98-001, CLEAN WATER ACTION PLAN: RESTORING AND PROTECTING AMERICA'S WATERS 9 (1996); OFF. OF WATER, U.S. EPA, EPA 841-S-00-011, A SUMMARY OF THE NATIONAL WATER QUALITY INVENTORY: THE 1998 REPORT TO CONGRESS 7 (2000).

13. *See, e.g.*, 1970 CAA § 110 (setting May 31, 1975, as the initial target date for compliance with the primary national ambient air quality standards without mentioning legal consequences in cases of nonattainment), Pub. L. No. 91-604, § 110 (1970) (codified as amended at 42 U.S.C. § 7410)); 1972 CWA section 101 (a)(1)–(3) (declaring as statutory objectives the attainment of (1) the "zero discharge" goal by 1985; (2) swimable, fishable waters by July 1, 1983; and (3) no discharge of "toxic pollutants in toxic amounts"), Pub. L. No. 92-500, § 110 (a)(1)–(3) (1972) (codified at 33 U.S.C. § 1251(a)(1)–(3)).

minimizing its adverse short-term economic impacts. Resulting benefits of a well-designed climate change policy include improvements in existing air quality and public health and the diversification of the nation's fuel mix.

Prompt and meaningful domestic actions coupled with a panoply of policy tools can achieve the goal of climate stabilization without incurring unacceptably high compliance costs, provided that their implementation is well-coordinated under an ideally designed national strategy. By directly addressing the issue of "scale," *i.e.*, the total amount of natural resources exploited and their by-products such as wastes,[14] climate change policy has the potential to bring sustainability concerns into economic decision making, especially given the lack of commercially viable GHG reduction technologies. In this way, climate change policy can create a necessary precondition for inducing lifestyle changes and technological innovation, two essential factors contributing to the ultimate success in moving toward an ecologically balanced, less carbon-intensive human civilization. To summarize, the successful implementation of climate change policy will be the key to attaining the overarching goal of sustainable development.

This Article aims to discuss, in detail, the ideal design features of a successful domestic GHG emissions trading program, which should be an integral part of future U.S. climate change policy. Based on the nation's prior experiences with emissions trading in other policy areas, the Article's messages are two-fold: (1) emissions trading or any other kind of economic incentive-based system should be carefully designed after taking into account all relevant factors impacting its effectiveness, and (2) emissions trading should be used in the context of climate change policy to assist future climate change mitigation efforts, along with other available policy tools.

This Article analyzes the program elements of GHG emissions trading under both the European Union's CO_2 Emissions Trading Directive and the Climate Stewardship Act as proposed by Senators John McCain and Joseph Lieberman in 2003. Part I provides a short summary of delivery mechanisms under the Kyoto Protocol and briefly explains

14. The term "scale" is used by ecological economists as meaning "the physical scale or size of the human presence in the ecosystem, as measured by population times per capita resource use." HERMAN E. DALY, BEYOND GROWTH: THE ECONOMICS OF SUSTAINABLE DEVELOPMENT 28, 50 (1996). Pointing out that current rates of economic growth cannot be continued indefinitely, ecological economics tries to address three aspects of sustainability: overpopulation, overconsumption, and technological sufficiency, which all boil down to the issue of scale. In this way, the concept of development is translated into a "qualitative" one, and, hence, "environmental sustainability" becomes an integral component of sustainable development.

why emissions trading should be employed in the climate change policy context. It then considers the theoretical underpinnings of economic approaches to environmental protection, such as emissions trading or pollution taxes, and discusses air emissions trading in the United States. Part I also observes that pollution taxes (or a carbon tax in the context of domestic climate change policy) would not gain sufficient political currency in the political and legal environment of the United States despite the taxes' theoretical appeal. Part II discusses the ideal design features of a successful domestic GHG emissions trading program and examines the elements of both the European Union's CO_2 Emissions Trading Directive and the Climate Stewardship Act. Part III introduces several studies that have estimated the economic effects of the Climate Stewardship Act. The Article concludes that domestic climate change policy can be implemented in a cost-effective manner and stresses the urgent need for the United States to take domestic action on climate change.

I. AN EXAMINATION OF THE ECONOMIC APPROACHES TO ENVIRONMENTAL PROTECTION IN THE UNITED STATES AND THEIR IMPLICATIONS FOR A FUTURE CLIMATE POLICY

A. Introduction

1. Delivery Mechanisms under the Kyoto Protocol

In addition to independent domestic action, the Kyoto Protocol permits contracting parties to utilize three types of flexibility mechanisms to meet GHG reduction targets: international emissions trading, joint implementation (JI), and the Clean Development Mechanism (CDM). The Protocol allocates to each Annex B country an assigned amount of emissions reduction units (AAUs) that are equal to the nation's allowable GHG emissions.[15] Each Annex B country is allowed to trade or sell emissions reduction units with another Annex B country in order to comply with its GHG reduction obligation under the Protocol.[16]

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15. Annex B of the Protocol lists parties that assume GHG reduction obligations and establishes the specific reduction target for each of these countries that must be achieved during the first commitment period. Therefore, a country's AAUs are allocated in an amount that is equal to its baseline emissions minus the percentage of emission reductions required under the Kyoto Protocol. Annex B countries include developed countries and Russia and other former Communist countries in Eastern Europe, technically termed "economies in transition." Kyoto Protocol, *supra* note 3, art. 3. & Annex B.

16. *Id.* art. 17.

Both JI and the CDM are project-based credit-trading mechanisms that permit any Annex B country, or private entities thereof, to earn emissions reduction units by engaging in a project that helps another contracting party decrease its GHG emissions, *e.g.*, through energy efficiency upgrading, or to increase GHG removal capacity of carbon sinks, *e.g.*, through reforestation. The only difference between the two is that JI is to be implemented between Annex B countries that can transact with each other's emissions reduction units (ERUs), which are created as a result of implementation of qualifying projects,[17] whereas under the CDM, Annex B countries can obtain certified emissions reduction units (CERs) by carrying out projects within non-Annex B countries.[18]

Compliance with the Protocol is determined after considering improvements in GHG removal capacity by sinks generated through eligible human-induced, land-based activities, officially termed land-use, land-use change and forestry (LULUCF) activities that have been conducted within the territory of each of the Annex B countries during the relevant commitment period.[19] Each Annex B country may implement JI or CDM projects designed to help other Annex B or non-Annex B countries enhance their removal capacity by sinks and then use the newly created credits for its own compliance purposes.

Thus, the Kyoto Protocol gives each Annex B country enough leeway to meet its individual GHG reduction obligation; it may proceed with the go-it-alone approach or it is allowed to create a link between implementation of its domestic GHG reduction programs and international emissions trading and/or other project-based credit trading programs. Although some restrictions have been placed on the manner in which reduction credits are generated and used by carrying out forestry projects,[20] the Kyoto Protocol does not limit the maximum

17. *Id.* art. 6.

18. *Id.* art. 12.

19. *Id.* art. 6. ¶ 1(d); *see* U.N. Framework Convention on Climate Change (UNFCCC), Report of the Conference of the Parties on the Second Part of its Sixth Session, held at Bonn from 16 to 27 July 2001, U.N. Doc FCCC/CP/2001/5, Sept. 25, 2001, at 45 [hereinafter Bonn Agreements].

20. The Bonn Agreements and the Marrakesh Accords impose several restrictions on forestry activities. First, the total GHG emissions reductions Annex B parties can claim from both human-induced forest management and JI-related forestry activities must be limited to a total of 54 megatons of carbon, a little more than two percent of aggregate emissions from Annex B countries, which were apportioned among Annex B countries according to the formula contained in Appendix Z. *Id.* at 46 and 47, Ann. Z; *see also* Report of the Conference of the Parties on Its Seventh Session, Held at Marrakesh, 29 October to 10 November 2001, Seventh Conference of Parties, Part Two, Vol. I, at 63, Annex, U.N. Doc. FCCC/CP/2001/13/Add.1 (2002) [hereinafter Marrakesh Accords] (doubling the cap for

number of credits that can be generated by other types of land-based sink-creating activity. Nor does it expressly put a quantitative ceiling on the total amount of GHGs to be covered by opting-in to flexibility mechanisms.[21] Notably, the Protocol does not impose any restrictions on GHG emissions trading or "burden-sharing" within a regional bloc, which may be established by an agreement between two or more Annex B countries so long as bloc-wide actual emissions do not exceed the combined AAUs of each of the participating countries.[22]

2. Viability of Using Incentive-Based Economic Approaches in the Climate Change Context

Carbon dioxide and other GHGs are not classified as regulated air pollutants in the United States. Because CO_2 and other GHGs are airborne substances, they theoretically may be regulated by the CAA. Under the CAA, the term "air pollutant" is defined as "any air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air."[23] Further, section 103(g) of the CAA specifically lists CO_2 as an air pollutant.[24] In view of these

forest management-related credits for Russia). Second, "[a]fforestation and reforestation projects [should] be the only eligible [LULUCF] activities under the CDM during the first commitment period." Bonn Agreements, *supra* note 19, at 44. Qualifying afforestation and reforestation CMD project activities account only for a maximum of one percent of base year emissions, multiplied by five, that a party may use toward its first commitment period goals. *Id.* at 46. Third, the use of early reduction credits shall not be allowed, except in the CDM context. *See* Marrakesh Accords, *supra* note 20, pt. 2, vol. II, at 23. Fourth, Annex B countries may use banked GHG emission credits in any subsequent commitment period, but "removal units" (RMUs) earned from eligible human-induced LULUCF activities, including JI projects, carried out in Annex B countries may not be banked. *Id.* The amount of bankable credits earned from JI and CDM projects is limited to 2.5 percent of the nation's AAUs. *Id.* at 61.

21. Articles 6 and 17 use the phrase "shall be supplemental to domestic actions." *See* Kyoto Protocol, *supra* note 3, arts. 6, 17. While a reasonable reading of the text indicates that the Protocol appears to require "supplementarity," it does not impose any limit on the percentage of emissions reduction credits that any Annex B country may use toward meeting its emissions reduction target.

22. *Id.* art. 4. The European Union operates as one entity under this article, and has moved to craft an EU-wide emissions trading regime. The original 15 EU member nations in 1998 agreed to a "burden-sharing target" and jointly ratified the Kyoto Protocol on May 31, 2002. *See* European Council, Council Decision 2002/358/CE: Council Decision of 25 April 2002 Concerning the Approval, on behalf of the European Community, of the Kyoto Protocol to the U.N. Framework Convention on Climate Change and the Joint Fulfillment of Commitments Thereunder (May 31, 2002).

23. 42 U.S.C. § 7602(g) (2000).

24. *Id.* § 7403(g)(1).

provisions and the Act's clean air goal, the CAA can be interpreted in a manner that gives the federal government the authority to regulate CO_2.[25]

Because sole reliance on administrative rulemaking requires too much time and too many resources to be viable, emissions limits for GHGs should be established by Congress through amendments to the CAA or by enacting special legislation in order for the regulation of GHGs under the CAA to succeed.[26] Given that technological solutions have yet to be developed, however, implementation of congressionally set enforceable emissions limitations would entail high short-term compliance costs to the nation's economy and, thus, would not be politically acceptable. Along with initiating aggressive legal reforms in the energy sector, implementation of economic incentive-based systems, such as emissions trading and pollution taxes, should become an integral part of national climate change mitigation policy.

One of the strengths of an incentive-based system lies in its potential to reduce transaction costs provided that the problem of monitoring emissions accurately can be solved. An incentive-based system is relatively easy to administer, does not dictate the use of any specific compliance methods, and can create quasi-market forces, thereby aligning the functioning of environmental regulation with a

25. Notwithstanding its contrary 1998 tentative legal conclusion, strong outside pressures led the EPA to withdraw from the previous position. *Compare* U.S. EPA, EPA's Authority to Regulate Pollutants emitted by Electric Power Generation sources, Memorandum from Jonathan Z. Cannon, Gen. Counsel (Apr. 10, 1998), *available at* http://www.law.umaryland.edu/faculty/bpercival/casebook/documents/EPACO2memo1.pdf, *with* U.S. EPA, EPA's Authority to Impose Mandatory Controls to Address Global Climate Change Under the Clean Air Act, Memorandum from Robert E. Fabricant, Gen. Counsel (Aug. 28, 2003), *available at* http://www.law.umaryland.edu/environment/casebook/documents/EPACO2memo2.pdf; U.S. EPA, Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52,922 (Sept. 8, 2003) (denying petition for rulemaking on GHG emissions from mobile sources).

26. The CAA's state implementation plan (SIP) process, which is designed to strike the proper power balance between the federal government and states under the Constitution, has been very cumbersome and time consuming. Revisions to the national ambient air quality standards (NAAQS) have always been the subject of intense debate between environmental and health organizations and some states and industry groups. In particular, states and industries fear that the newly-revised NAAQS could subject them to more onerous schedules of compliance and requirements under the CAA. Although section 109(d), added to the CAA during the 1977 amendments, requires the EPA to review the NAAQS every five years after 1980, the NAAQS were amended only a few times during the past 35 years. *See* 42 U.S.C. § 7409(d) (2000). Legal battles surrounding the new $PM_{2.5}$ and eight-hour ozone NAAQS demonstrate the fact that the Act's SIP process is inadequate to deal with climate change issues. *See* Am. Trucking Ass'n v. EPA, 175 F.3d 1027 (D.C. Cir. 1999), *reh'g denied in part and granted in part*, 195 F.3d 4 (D.C. Cir. 1999), *aff'd in part and rev'd in part sub nom.*, Whitman v. Am. Trucking Ass'n, 531 U.S. 457 (2001).

firm's profit motives. Emissions trading or a carbon tax system can be employed in the global climate change policy context in order to reduce compliance costs and make the smooth transition to a less carbon-intensive economy possible.

Sources of GHG emissions are too ubiquitous to be brought under traditional technology-based, command-and-control regulation. Compliance costs vary between sources and regions. There are no significant monitoring problems because the carbon content of a fossil fuel can easily be used instead of a direct, real-time emissions monitoring system, which is often too expensive to be required of smaller sources. In addition, as far as the electric power sector is concerned, GHG emissions trading can be successfully implemented without requiring significant additional costs by building on a multi-pollutant trading system, which has been developed incrementally over the last decade.[27] We have much

27. Beginning with the enactment of the CAA's Title IV SO_2 allowance trading program in 1990, large electric utilities and some large industrial boiler units have incrementally become part of various air emissions trading programs. Under CAA sections 176A and 184, northeastern states comprising the Ozone Transport Commission (OTC), except Virginia, agreed to implement a regional NO_x cap-and-trade program in 1994 and finalized a model rule for NO_x allowance trading in 1996, which would be implemented by participating states beginning in 1999. *See id.* §§ 7506a, 7511c; LAUREL J. CARLSON, NESCAUM/MARAMA NO_x BUDGET MODEL RULE (1996), *available at* http://www.epa.gov/airmarkets/otc/otcrule.zip (last visited Sept. 19, 2005) [hereinafter OTC NO_x CAP-AND-TRADE MODEL RULE]. Relying on its authority under CAA section 110(k) to force states to amend their SIPs upon a finding of "significant contribution" to another state's NAAQS attainment or maintenance, called a "SIP call," the EPA in 1998 made a NO_x SIP call against 22 eastern states and the District of Columbia. The NO_x SIP call gave the states the flexibility to choose which sources to target and which mix of control measures was needed to achieve the required NO_x emissions reductions. Its most significant feature, however, was its requirement that the states allocate a budget for fossil-fuel-fired electric steam generating units, with the option to participate in an EPA-administered regional cap-and-trade program. *See* 42 U.S.C. § 7410(k)(5) (2000); U.S. EPA, Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone; Final Rule, 63 Fed. Reg. 57,356 (Oct. 27, 1998). The EPA's NO_x Budget Trading Program (NBP), which was designed to help states implement the 1998 NO_x SIP call, was launched on May 1, 2003, in eight OTC states and the District of Columbia and thereby replaced the OTC NO_x cap-and-trade program for these states. Beginning on May 31, 2004, eleven other states subject to the NO_x SIP call joined the EPA's NBP. *See* U.S. EPA, EPA-430-R-04-010, NO_x BUDGET TRADING PROGRAM: 2003 PROGRESS AND COMPLIANCE REPORT (Aug. 2004) [hereinafter EPA NBP REPORT FOR 2003]. On January 30, 2004, the EPA published proposed rules that would adopt an emission trading mechanism for reducing SO_2, NO_x, and mercury emissions from electric utilities. Based on the new ozone and PM standards, the proposed rules covered 29 states and the District of Columbia for $PM_{2.5}$-related SO_2 and NO_x emissions and 25 states and the District of Columbia for NO_x emissions, with the main features being a lowered cap on SO_2 emissions and/or year-round NO_x reduction requirements. *See* U.S. EPA, Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Rule), 69 Fed. Reg. 4566 (proposed Jan. 30, 2004); Proposed National Emission Standards

to learn about the promises and pitfalls of emissions trading from previous experience with multi-pollutant trading in the electric power sector.

Economic incentive systems can and should be utilized to help the nation achieve a carbon reduction goal in a cost-effective manner. Establishing a link between a domestic trading program and international GHG emissions trading and other flexibility mechanisms, together with the deployment of various policy tools designed to facilitate sustainable energy development at home, would further bring down compliance costs.

B. An Examination of Economic Theories for Incentive-Based Environmental Regulation

1. *The Pigouvian Price-Based Approach*

For a moment, consider the theoretical underpinnings of economic approaches to environmental protection. The rationale supporting an incentive-based approach is that such an approach simulates market conditions, giving owners incentives to reduce pollution. According to economists, environmental pollution occurs due to the lack of a well-functioning market for a clean environment. One of the earliest pioneers in this area was British economist A.C. Pigou, who explained pollution problems as a market failure because pollution

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for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 69 Fed. Reg. 4652 (proposed Jan. 30, 2004). On March 10, 2005, the EPA issued final interstate air quality rules based on the proposed rules. In the final rules, EPA made relatively minor changes to the proposed rules by reducing the number of covered states subject to fine particle-related SO_2 and NO_X reduction requirements based on new modeling results, by adding such new features as opt-in requirements and by deciding to apply new NO_X reduction requirements in 2009 instead of 2010. *See* U.S. EPA, Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Rule); Revisions to Acid Rain Program; Revisions to the NO_X SIP Call, 70 Fed. Reg. 25,162 (May 12, 2005) (codified at 40 C.F.R. §§ 51, 72, 73, 74, 77, 78, 96); U.S. EPA, Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 70 Fed. Reg. 28,606 (May 18, 2005) (codified at 40 C.F.R. §§ 60, 63, 72, 75). Hence, a "three-pollutant" trading scheme will soon emerge. There is a possibility that "four-pollutant" trading will take off in the foreseeable future, possibly including some other large industrial sources for which accurate monitoring systems can be implemented without creating significant technical and/or financial problems. The so-called "four-pollutant" bill, called the Clean Power Act, was introduced in the Senate to mandate reductions in SO_2, NO_X, mercury, and CO_2 emissions from electric power generators using a cap-and-trade approach on a pollutant-by-pollutant basis. *See* S. 556, 107th Cong. (2001); S. 366, H.R. 2042, 108th Cong. (2003). President George W. Bush instead has pushed the "Clear Skies" Initiative (three-pollutant bill), excluding CO_2 from its coverage. S. 485, H.R. 999, 108th Cong. (2003).

generates external costs ("negative externalities") to society. He called for taxes on pollution as a solution.[28] For this reason, pollution taxes are oftentimes called Pigouvian taxes, and Pigou represents a school of economic thought advocating the use of price-based controls or liability rules to control pollution.

In economic terms, the rate of taxes should be equal to the difference between private marginal production cost and social marginal production cost.[29] Pigouvian taxation is close to technology-based, command-and-control regulation; command-and-control regulation also imposes government-set compliance costs on regulated firms, creating an economic incentive for firms to reduce pollution only to the extent that marginal compliance costs do not exceed marginal abatement costs.[30]

While a tax system or liability scheme would be relatively easy to administer with minimal cost and would generate an additional revenue stream that could be used for environmental clean-up or other beneficial purposes,[31] it must be able to accurately assess environmental harm in order to function properly.[32] To provide firms with an adequate incentive to reduce pollution, a tax rate must be initially set at a level exceeding the marginal cost of pollution control.[33] Otherwise, the tax leads to under- or over-protection of public health and environmental quality.

The problem facing legislatures and economists is that it is not always easy to calibrate a tax rate or the amount of damages adequate to achieve pollution reduction goals in the real world. This is due to an "imperfect knowledge of [the nature] and the cost structures and price

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28. A.C. PIGOU, THE ECONOMICS OF WELFARE 172-203 (4th ed. 1932). Note that Pigou did not actually use the term externalities.

29. *See* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 41, fig. 2.15 (2000).

30. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 WASH. & LEE L. REV. 289, 305 (1998) ("Traditional regulation offers little incentive to spend additional monies to reduce pollution more than necessary to protect oneself from enforcement penalties, when the costs of doing so exceed the costs of adequate compliance.").

31. Pollution taxes have dual benefits: improvement in both environmental quality and economic efficiency from "the use of environmental tax revenues to reduce other taxes such as income taxes that distort labor supply and saving decisions." In the economics literature, this is called the "double dividend" effect. *See* Don Fullerton & Gilbert E. Metcalf, *Environmental Taxes and the Double Dividend Hypothesis: Did You Really Expect Something for Nothing?*, 73 CHI.-KENT L. REV. 221, 221 (1998).

32. *See* WILLIAM F. BAXTER, PEOPLE OR PENGUINS: THE CASE FOR OPTIMAL POLLUTION 73-78 (1974).

33. Driesen, *supra* note 30, at 340.

elasticities of firms."[34] A tax system or a liability scheme can also distort labor incentives. This distortion occurs when a tax rate or a damage award is set at such a high level that it could adversely impact some industries and regions disproportionately and reduce disposable personal income.[35] Therefore, in order to avoid the economic inefficiency problem, and ensuing public opposition, the revenues collected must be recycled to reduce taxes on income, capital, and labor[36] and to compensate the hardest-hit industries, regions, and low-income households.[37]

2. The Coasean Quantity-Based Approach

Another school of economics supports quantity-based or property-based policy tools such as emissions trading. In 1960, Ronald H. Coase published his seminal writing, *The Problem of Social Cost*.[38] In this article, he faulted the Pigouvian solution as too idealistic and inefficient, pointing out that "the problem [the policymaker faces in establishing a system aimed at internalizing externalities] is [the difficulty of] devis[ing] practical arrangements which will correct defects in one part of the system without causing more serious harm in other parts."[39] In Coase's view, Pigou started from the mistaken belief that "any measure which will remove the deficiency [of unregulated pollution] is necessarily desirable,"[40] and overlooked the difficulties in executing a policy that is aimed at eliminating a divergence between private and social products.[41] He argued for a social wealth-maximizing

34. Gary E. Marchant, *Global Warming: Freezing Carbon Dioxide Emissions: An Offset Policy for Slowing Global Warming*, 22 ENVTL. L. 623, 632 (1992).

35. *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 353–56 (1986) (pointing out the difficulty of "setting the correct tax rates" and the regressivity of proportional pollution taxes); J. Andrew Hoerner, *Breath and Taxes: Air Pollution Taxes in the Works*, 46 TAX NOTES 1356, 1357 (1990) (quoting Edward F. Mitchell of the Edison Electric Institute as saying that an emissions tax under consideration by Congress would raise the cost of electricity, thereby having an impact which is "regressive, and will disproportionately penalize low- and fixed-income residential customers," and restating a remark by Stan Garnett of the Coalition for Acid Rain Equity as saying that "an emissions tax would be an unfair burden on the midwest").

36. Richard L. Ottinger & William B. Moore, *The Case for State Pollution Taxes*, 12 PACE ENVTL. L. REV. 103, 106 (1994).

37. POSNER, *supra* note 35, at 355 (stating that, "to assure proportionality or progressivity of the tax system, comprehensive pollution taxes would require exemptions, rebates, or compensating changes elsewhere in the tax system").

38. R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

39. *Id.* at 34. *Cf.* POSNER, *supra* note 35, at 357 (contending that "emission standards require cost-benefit analysis; pollution taxes require only benefit analysis").

40. Coase, *supra* note 38, at 43.

41. *Id.* at 41–42.

solution contingent on individual circumstances, observing that, "[w]hen an economist is comparing alternative social arrangements, the proper procedure is to compare the total social product yielded by these different arrangements."[42] In a world without transaction costs and other obstacles to market transactions, voluntary negotiations between the parties will result in the Pareto-superior outcome, maximizing aggregated social wealth,[43] and "the decision of the courts concerning liability for damage would be without effect on the allocation of resources."[44] This proposition is known as the "Coase Theorem."[45]

Coase framed environmental problems "as a competition over conflicting uses for scarce resources."[46] He postulated that when transaction costs are near to zero, the bargaining parties would reach an agreement whereby the natural resource at issue is put to a higher valued use. Direct government intervention, Coase observed, in the market would not be justified where its own costs are expected to outweigh the gains that might come from regulating socially harmful behavior.[47]

Coase did recognize, however, that market-based solutions do not always lead to the efficient outcome, saying that government

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42. *Id.* at 34.

43. *See id.* at 2-15. A transaction is Pareto superior when at least one party is better off from the result of it and no other parties are worse off. For the standard definition of Pareto superiority, see J. Coleman, *Efficiency, Auction and Exchange, in* MARKETS, MORALS, AND THE LAW 72 (1988).

44. Coase, *supra* note 38, at 10. In other words, the issue of who owns or controls the property at issue is irrelevant to the final outcome. *See also* Ronald H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1, 27 (1959) ("[T]he delimitation of rights is an essential prelude to market transactions; but the ultimate result is independent of the legal decision."); A. MITCHELL POLINSKY, AN INTRODUCTION TO LAW AND ECONOMICS 12 (1983) ("If there are zero transaction costs, the efficient outcome will occur regardless of the choice of legal rule.").

45. Robert Cooter, *The Cost of Coase*, 11 J. LEGAL STUD. 1, 14 (1982) ("The basic idea of the theorem is that the structure of the law which assigns property rights and liability does not matter so long as transaction costs are nil; bargaining will result in an efficient outcome no matter who bears the burden of liability."); Michael I. Swygert & Katherine Earle Yanes, *A Unified Theory of Justice: The Integration of Fairness into Efficiency*, 73 WASH. L. REV. 249, 259 (1998) (restating the Coase Theorem as follows: "if all parties to be affected by a given situation could bargain costlessly, and if each potentially-affected party could come to the table with complete knowledge of all relevant factors, then the parties, in pursuing their preferences, would reach an agreement that would allocate their respective rights, obligations, and entitlements in a manner that would maximize the situation's total output").

46. Terry L. Anderson & J. Bishop Grewell, *From Local to Global Property: Privatizing the Global Environment?: Property Rights Solutions for the Global Commons: Bottom-Up or Top-Down?*, 10 DUKE ENVTL. L. & POL'Y F. 73, 73 (1999).

47. Coase, *supra* note 38, at 17-18.

regulation would be the preferred option "when, as is normally the case with the smoke nuisance, a large number of people is involved and when therefore the costs of handling the problem through the market or the firm may be high."[48] Coase stressed the importance of a case-by-case approach to solving market dysfunctions; the role of the judge or the law should be to maximize social utility by "choosing the appropriate social arrangement for dealing with the [problem at hand]."[49]

Coase's article has been extremely influential in law and economics literature and is one of the most cited and debated law review articles. His strong influence on public policy making is found both in the recent trend toward incentive-based regulation in public utility industries and the cost-benefit analysis requirement imposed on administrative agencies by presidential orders.

There is no doubt that the Coase Theorem has limits when applied to the field of environmental law. As Coase himself recognized, because environmental problems so often involve many parties, "the cost of bringing together and coordinating such large numbers of stakeholders" can be prohibitively high.[50] Another problem lies in the public good or common-pool resource characteristics of many environmental amenities.[51] In order for Coasian bargaining to work, property rights to the clean environment must be effectively defined and enforceable by government.[52] Otherwise, public ownership would result in degradation or over-consumption of these common goods by promoting free-riding behavior or ruinous competition by resource users.[53]

Property-based rules are also susceptible to the holdout problem, which tends to be more magnified when the number of people involved increases. This problem could be the result of strategic behavior

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48. *Id.* at 18.

49. *Id.* at 18–19.

50. *See* STEVEN C. HACKETT, ENVIRONMENTAL AND NATURAL RESOURCES ECONOMICS: THEORY, POLICY, AND THE SUSTAINABLE SOCIETY 130 (2001).

51. *Id.*

52. Anderson & Grewell, *supra* note 46, at 76.

53. Public goods have two characteristics: nonrivalrous consumption and non-excludability. This means that the benefits of the supply of a public good must be shared by all others. Thus, public goods are highly likely to be undersupplied, because people have little incentive to voluntarily contribute to the production of these goods. *See* COOTER & ULEN, *supra* note 29, at 42–43. On the other hand, commonly shared, commercially valuable open-access resources, such as fish stocks, are characterized by "subtractability, meaning that resource units appropriated by one party subtract from what is available to others." HACKETT, *supra* note 50, at 100. Therefore, rivalry among resource users tends to lead to unsustainable harvest patterns and makes it difficult for a common solution based on cooperation to have efficacy.

or exceedingly high valuation of his property by an individual person.[54] Transaction costs are further increased by scientific uncertainty surrounding the level of harm or risk posed by environmental hazards and uncertainty regarding the appropriate amount of compensation for the harm caused by the hazard. Conversely, scientific consensus facilitates cooperative behavior by minimizing friction among stakeholders, thus making it easier for stakeholders to agree on solutions to the problem in question.[55]

A Coasean solution to an environmental problem is also problematic because it can instill the notion of a property right to pollute. Moreover, when transaction costs are high, initial assignments of property rights have wealth distribution effects. Therefore, the success of the Coasean approach hinges on a well-developed property rights regime. A well-developed property rights regime must reduce transaction costs, including costs related to acquiring and processing perfect information, to a manageable level. The regime must also have mechanisms to enforce property rights, effectively preventing gaming behavior like free riding and holdouts that often plague natural resource management. However, establishing such an ideal regime may be difficult given the complexities and unpredictability that inhere in natural resource systems.

Nonetheless, property right regimes arise when it becomes economic for those affected by externalities to internalize benefits and

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54. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1106–08 (1972). The Japanese history of sunlight regulation exemplifies the problems with property-based rules. Japan has a high population density; the majority of the Japanese population is concentrated in a small number of metropolitan areas. A construction boom in the 1960s generated numerous nuisance lawsuits between developers and property owners because nearby tall buildings obstructed local residents' access to sunlight. Bruce Yandle, *From Local to Global Commons: Private Property, Common Property, and Hybrid Property Regimes: Grasping for the Heavens: 3-D Property Rights and the Global Commons*, 10 DUKE ENVTL. L. & POL'Y F. 13, 20 (1999). Local governments initially responded to this problem by assigning the right to a certain minimum amount of sunlight to property owners. Developers were required to "obtain unanimous consent from all affected property owners" if they "wished to secure airspace in order to construct a building." *Id.* at 20-21. Municipalities enforced this property right to air and light by delaying construction approvals or by "deny[ing] developers connection to the water supply or sewage system" to those who failed to "gain unanimous support of affected residents." *Id.* Because of the high transaction costs and the holdout problem associated with developers' negotiations with local residents, the national government finally intervened and replaced local sunshine rights with nationwide building codes that established standards for "the 'emission' of shadows extending beyond a building site." *Id.* at 25-26.

55. Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241, 258–62, 271–74 (2000).

costs because of factors that transform the preexisting cost-and-benefit equation, such as the emergence of new technologies and techniques or changes in market values of certain goods and services.[56] Thus, increased reliance on property-based rules for air emissions control and natural resource management is indicative of incremental changes in human institutions: (1) natural resources have become scarce commodities of economic value, and (2) technological solutions to demarcate natural boundaries and/or to enforce property rights have begun to be developed.[57] Although bottom-up private property rights regimes have yet to emerge, top-down regulated property rights have emerged in some areas of environmental and natural resources law.[58]

3. The Dominance of Technology-Based Standards and the Presumptive Superiority of the Price-Based Approach versus the Quantity-Based Approach

a. Theoretical Support for the Use of Pollution Taxes

The above discussion explains why, since the 1970s, government-imposed technology-based standards or liability rules have supplanted common law tort remedies.[59] Further, it explains why money damages, rather than injunctions, have become the dominant remedy for those who suffered personal injuries or property damages due to harmful pollutant discharges.[60]

The standard explanation for the shift is that when transaction costs are so high as to prevent private bargaining, liability rules are preferable to property rules, with the caveat that "damages can be computed with reasonable accuracy," or vice versa.[61] In recent years, this commonly held view has been challenged. Many within the academic circle prefer pollution taxes or liability rules to property-based instruments such as tradeable allowances. Academics argue that liability rules are presumptively superior to property rules in controlling harmful

56. *See* Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 350 (1967).

57. *See* Anderson & Grewell, *supra* note 46, at 77-78.

58. *Id.* at 88-93. Professor Yandle observed that "the politics of special interests" can block the use of bottom-up property rights even when the costs of enforcement are lower than the benefits. *See* Yandle, *supra* note 54, at 31-36.

59. *See* Arnold W. Reitze, Jr., *Overview and Critique: A Century of Air Pollution Control Law: What's Worked; What's Failed; What Might Work*, 21 ENVTL. L. 1549, 1555-69 (1991).

60. *See, e.g.*, Oscar H. Boomer et al. v. Atl. Cement Co., Inc., 257 N.E. 2d 870 (N.Y. 1970) (denying the issuance of permanent injunctions to plaintiffs on the ground of "the large disparity in economic consequences of the nuisance and of the injunction").

61. James E. Krier & Stewart J. Schwab, *Property Rules and Liability Rules: The Cathedral in Another Light*, 70 N.Y.U. L. REV. 440, 456 (1995). For one of the earliest seminal writings, see Calabresi & Melamed, *supra* note 54.

externalities even when barriers to voluntary market transactions are eliminated by well-defined property rules. According to academics, this is so because liability rules would promote sincere negotiations between the parties by removing perverse incentives to hide subjective valuation, which may still remain on the part of property owners even in cases of low transaction costs.[62] When there is great uncertainty about the magnitude of harm, partial compensation by liability rules both induces polluters to reduce environmental harm and creates incentives for potential victims to avoid such harm.[63]

According to advocates of the Pigouvian approach, pollution taxes are more efficient than tradeable pollution permits "chiefly because the price instruments are thought to perform better under uncertainty, to raise valuable revenues, and to avoid transaction costs."[64] On the other hand, "the government's estimates of costs [that become the basis for setting the total quantity of allowable pollution] are likely to be inaccurate, so the price of tradeable rights is likely to be incorrect."[65] In their view, pollution trading would not be expected to reduce pollution to the socially optimal level. This is a bit of an overstatement, however, considering that getting the tax rate right is also a difficult task for the government. Yet, there is some merit to an argument favoring pollution taxes in that it echoes a general belief that a viable market for tradeable pollution rights can rarely exist unless government makes the right decision and clears all market barriers to free trade. These preconditions cannot easily be satisfied in the real world.

In fact, there is no hard evidence that emissions trading works simply because it can either harness market power or induce technological innovation. The success of both lead and chlorofluorocarbons (CFCs) trading can be ascribed to the law's phase-out mandate.[66]

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62. *See* Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1995).

63. *See* Louis Kaplow & Steven Shavell, *Property Rights and Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713 (1996). Note that the authors argue for the *general* superiority of liability rules versus property rules. *See id.* at 720 ("Our conclusion about the superiority of the liability rule might not follow, though, if courts were systematically to underestimate harm in setting damages, rather than to use estimates of harm that are correct on average."); *id.* at 721 ("[T]here is a *prima facie* case favoring liability rules over property rules for controlling harmful externalities, but property rule protection may become desirable on account of one or more of the factors mentioned above.").

64. Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 682 (1999).

65. Kaplow & Shavell, *supra* note 63, at 750–51.

66. The principal reason for the success of lead trading was attributable to (1) the clarity and stringency of the regulations, and (2) "personnel at different refineries...were accustomed to conducting business with each other." *See* Robert W. Hahn & Gordon L.

In the case of sulfur dioxide (SO_2) allowance trading, utilities have been able to comply with the applicable emissions limit by switching to low-sulfur western coal or by installing scrubbers, without incurring significant additional costs. Fuel switching or blending has been the dominant compliance method thanks to the availability of inexpensive supplies of western coal.[67] Congress and some state public utility commissions (PUCs) encouraged the use of scrubbers by setting aside bonus allowances to grandfathered coal-fired units and by generously allowing the recovery of capital investments.[68]

Reliance on post-combustion controls like scrubbers also has negative implications for future efforts to address climate change. Scrubbers will increase the costs of limiting CO_2 emissions because they do not actually help to reduce CO_2 emissions; over 97 percent of carbon

Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOLOGY L.Q. 361, 390 (1989). In the case of ozone depletion, the vivid picture of ozone holes in the polar regions sent a strong message to the world community, leading to prompt and decisive action under the Vienna Convention and the Montreal Protocol. Another important factor that helped the world community to reach consensus on the phase out of CFCs was the small number of CFC manufacturers and the availability of alternatives to CFCs. American manufacturers such as DuPont wanted to seize the opportunity to sell alternative products in the world market while avoiding more stringent reduction requirements under U.S. domestic law. *See* DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 541–43 (2002); Elizabeth R. DeSombre, *The Experience of the Montreal Protocol: Particularly Remarkable, and Remarkably Particular*, 19 UCLA J. ENVTL. L. & POL'Y 49, 57–62 (2000).

67. *See* Dallas Burtraw & Byron Swift, *A New Standard of Performance: An Analysis of the Clean Air Act's Acid Rain Program*, 26 ENVTL. L. REP. 10,411, 10,416 (1996); DALLAS BURTRAW & KAREN PALMER, RESOURCES FOR THE FUTURE, DISCUSSION PAPER NO. 03-15, THE PAPARAZZI TAKE A LOOK AT A LIVING LEGEND: THE SO_2 CAP-AND-TRADE PROGRAM FOR POWER PLANTS IN THE UNITED STATES, at 22–23 (Apr. 2003), *available at* http://www.rff.org/rff/Documents/RFF-DP-03-15.pdf; U.S. EIA, DOE/EIA-0582, THE EFFECTS OF TITLE IV OF THE CLEAN AIR ACT AMENDMENTS OF 1990 ON ELECTRIC UTILITIES: AN UPDATE, figs. ES-1, ES-2 (Mar. 1997).

68. Up to 3.5 million extension allowances were given to coal-fired units that install a "qualifying Phase I technology." 42 U.S.C. § 7651c(d) (2000). These bonus allowances had the purpose of encouraging the use of high-sulfur coal—and the installation of scrubbers—at the eligible affected units. *Id.* § 7651a(19). The SO_2 Acid Rain program contains other provisions that offer benefits to old coal-fired units, such as an extension of the compliance deadline and financial assistance. *See id.* §§ 7651h(b)(1), 7651n(b)(3) ("repowered" sources); *id.* § 7651n(b)(1)-(2), (c) ("clean coal" demonstration projects); *id.* § 7651d(a)(3) (bonus allowances for listed existing coal-fired units during Phase II). Some of the state PUCs promoted the continued use of high-sulfur coal to protect local coal producers and miners' jobs, discouraging other activities, including allowance trading, that could have had negative impacts on the pursuit of their policy goal. *See, e.g.*, James J. Winebrate et al., *Estimating the Impacts of Restrictions on Utility Participation in the SO_2 Allowance Market*, ELEC. J., May 1995, at 50; Douglas R. Bohi, *Utilities and State Regulators Are Failing to Take Advantage of Emission Allowance Trading*, ELEC. J., Mar. 1994, at 20; *Phased Implementation of Acid Rain Is Program's Worst Flaw, EPA Official Says*, DAILY ENV'T REP., June 23, 1995, at A-11.

emissions are oxidized during combustion.[69] Thus, it is no surprise that utilities with scrubber units, most of which are concentrated in the Midwest region, have resisted legislative attempts to enact carbon reduction requirements.[70]

From a theoretical standpoint, the current SO_2 allowance trading program is not perfectly designed. The emissions limitation standard under the SO_2 Acid Rain Program has been phased-in,[71] and the Phase II SO_2 requirement of 1.20 pounds (lbs) per million (mm) British Thermal Unit (Btu) is actually the three-decade-old SO_2 new source performance standard (NSPS) for coal-fired units. SO_2 allowances were allocated non-gratis based on an input-based formula,[72] and auctions have been used in a non-revenue raising manner on a very limited basis.[73] In other words, the SO_2 Acid Rain Program continues the dichotomy between new and old units, creating an uneven playing field in favor of older, dirtier

69. U.S. GHG EMISSIONS AND SINKS FOR 1999-2001, *supra* note 1, at 2-14 n.20.

70. Edward A. Smeloff, *Utility Deregulation and Global Warming: The Coming Collision*, 12 NAT. RESOURCES & ENV'T 280, 285 (1998) (stating that "[l]eaving the reduction of greenhouse gas emissions to some future date will make them harder to resolve because some investments in clean air compliance may not be recovered in a competitive market").

71. In Phase I, which began on January 1, 1995, 263 affected units received SO_2 allowances equal to an emissions rate of 2.5 lbs/mm Btu times average fuel consumption rates in the baseline years divided by 2000. 42 U.S.C. § 7651c(a)(2). The 2.5 lbs/mm Btu emissions limitation was to be reduced to 1.2 lbs/mm Btu after January 1, 2000, when the Phase II program became effective. *Id.* § 7651c(a)(1).

72. *See* 42 U.S.C. §§ 7651c(a)(2), 7651d.

73. *See id.* § 7651o. Congress authorized the EPA to set up a special reserve of allowances for sales to eligible independent power producers (IPPs) and new and existing affected units required to hold allowances under the SO_2 Acid Rain Program, and even any other person or entity that would want to buy SO_2 allowances. *Id.* To establish such a special reserve, the EPA must take 2.8 percent of each Phase I source's annual allowances from 1995 through 1999 and 2.8 percent of the basic Phase II allocation of allowances for each year beginning in 2000. *Id.* § 7651o(b). The EPA must transfer the proceeds from the auction, on a pro rata basis, to the owners or operators of affected unit(s) at an affected source from whom allowances were withheld. *Id.* § 7651o(d)(3)(B). Therefore, the SO_2 allowance trading program does not provide for a "revenue-recycling" mechanism. And EPA-administered auctions are to be held on a very limited basis. For most of the time, average auction prices have been kept at a lower level than SO_2 allowance prices in the secondary market. *See* U.S. EPA, *Acid Rain Program Allowance Auctions* (1993–2005), *at* http://www.epa.gov/airmarkets/auctions/index.html (last updated May 5, 2005). Generally speaking, auction prices have shown a similar fluctuation pattern as that of SO_2 allowance prices in the trading market. The reason for the low prices appears to be that the number of bidders has been extremely low, with a few large utilities dominating auction processes. The number of bidders for spot allowances was below 30 in many cases; the number of bidders for seven-year advance allowances was below ten in most auctions. *See id.* This indicates that the availability of various low-cost options has offered little incentive for most electric utilities to participate in auctions.

sources.[74] While it is certainly true that the program has had the venerable effect of equalizing applicable emissions limits among existing sources, its allowance allocation method based on historical heat input and other operating data places unequal economic burdens on different utilities, since allowances become valuable commodities in the marketplace.

Requiring new facilities to purchase SO_2 allowances creates another entry barrier: the allocation of SO_2 allowances without charge to existing utilities constitutes "the conveyance of scarcity rents to the private sector."[75] The combined use of output-based emissions standards and revenue-raising auctions as a primary allocation method would have spread compliance costs more evenly and promoted greater economic efficiency. Many economists argue that "the failure to raise revenue and to use that revenue to offset distorting taxes squanders much of the cost savings in compliance costs that can be achieved by a flexible tradeable permit system."[76] One study estimated that the costs of the SO_2 Acid Rain Program would have been 25 percent less if tradeable allowances had been auctioned.[77]

Although many economists believe that SO_2 allowance prices reflect the marginal abatement cost of compliance,[78] many studies have

74. New facilities that begin operation after December 31, 1995, must purchase allowances in EPA-administered auctions or from existing sources that have allowances to sell in the secondary market. 42 U.S.C. § 7651d(g)(3)-(4).

75. ROBERT N. STAVINS, RESOURCES FOR THE FUTURE, DISCUSSION PAPER NO. 03-43, MARKET-BASED ENVIRONMENTAL POLICIES: WHAT CAN WE LEARN FROM U.S. EXPERIENCE (AND RELATED RESEARCH)?, 9 (Aug. 2003), *available at* http://www.rff.org/rff/Documents/RFF-DP-03-43.pdf.

76. BURTRAW & PALMER, *supra* note 67, at 20-21.

77. Lawrence H. Goulder, Ian W.H. Parry, & Dallas Burtraw, *Revenue-Raising vs. Other Approaches to Environmental Protection: The Critical Significance of Pre-Existing Tax Distortions*, 28 RAND J. ECON. 708 (1997).

78. The average prices of auctioned allowances or allowances traded in the secondary market have stayed at a much lower level than expected at the time of enactment. *See* U.S. EPA, *Allowance Prices* (1995-2004), *at* http://www.epa.gov/airmarkets/trading/so2market/alprices.html (last updated Oct. 6, 2004); *supra* text accompanying note 73. Lower-than-expected compliance costs, utilities' overcompliance by banking unused allowances, some of which came from SO_2 reductions at substitution and compensation units, and other factors that created market distortions may have created an oversupply of SO_2 allowances and thereby "put downward pressure on prices" in the first several years of the program. *See* 42 U.S.C. § 7651c(b); 40 C.F.R. §§ 72.41, 72.43, 72.8(b)(2) (allowing affected units to acquire additional allowances by designating unaffected existing units as substitution units or compensating units, or by permanently retiring old units, during Phase I of the program.); *See* REITZE, *supra* note 2, at 264; U.S. EPA, EPA-430-R-03-011, ACID RAIN PROGRAM: 2002 PROGRESS REPORT 5 (Nov. 2003) [hereinafter 2002 SO_2 ACID RAIN PROGRAM PROGRESS REPORT]. *See also* U.S. EPA, EPA-430-R-01-008, ACID RAIN PROGRAM: ANNUAL PROGRESS REPORT, 2000, at 6, exhibit 4 (Aug. 2001) (reporting that the number of

found that other exogenous factors, such as state public utilities regulation and utilities' inexperience with emissions trading or "autarkic behavior," would have impeded the realization of allowance trading's full potential for cost savings, especially during Phase I.[79] State PUCs typically required utilities to return all the net gains or losses of allowance trading to ratepayers, thus limiting real cost savings from trading and dampening utilities' enthusiasm for allowance trading.[80] As noted earlier, some of the state PUCs promoted the use of high-sulfur coal to protect their local coal industry and discouraged inter-utility allowance transactions. If inter-firm trading is underutilized,[81] despite cost disparities among firms, emissions trading would become nothing but "averaging." Small firms without economies of scale would be economically disadvantaged; clean units would not benefit from trading.[82]

These observations are not intended to argue that the SO_2 allowance trading program has not succeeded in achieving its goals. By any account, the program's environmental performance has exceeded initial expectations thus far.[83] The program's success becomes more evident when compared with the CAA's Title IV nitrogen oxides (NO_X) reduction program.[84] What the above discussion aims to demonstrate is

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cumulative banked allowances was about 11.6 million by the end of Phase I, leading to significant over compliance throughout the Phase I period). Bonus allowances granted to midwestern sources may have functioned as a partial contributing factor to the oversupply of SO_2 allowances. *See supra* text accompanying note 68.

79. BURTRAW & PALMER, *supra* note 67, at 16–18 (citing a number of studies indicating the existence of such exogenous factors impeding trading).

80. A. DENNY ELLERMAN ET AL., MARKETS FOR CLEAN AIR: THE U.S. ACID RAIN PROGRAM 193 (2000).

81. Trading volumes under the SO_2 Acid Rain Program have been relatively insignificant. *See* U.S. EPA, *Trading Activity Breakdown* (1994–2003), *at* http://www.epa.gov/airmarkets/trading/so2market/transtable.html (last updated Oct. 15, 2004).

82. The fact that the participation of opt-in units has been minimal may indicate that allowance trading has failed to provide enough incentive for clean sources to innovate for the purpose of making economic profits. In 2002, there were only eleven opt-in units, which produced 99,188 allowances. *See* 2002 SO_2 ACID RAIN PROGRAM PROGRESS REPORT, *supra* note 78, at 3, fig. 3.

83. In its 2002 progress report to Congress, the EPA reported that SO_2 emissions from electric power plants in 2002 were reduced by 41 percent from the 1980 baseline levels. *Id.* at 2.

84. The EPA estimated overall NO_X reductions from Phase II's full implementation at 2.1 million tons per year. U.S. EPA, Factsheets, Nitrogen Oxides (NO_X) Reduction under Phase II of the Acid Rain Program: Group I and Group II Boilers, *at* http://www.epa.gov/airmarkt/arp/nox/phase2.html (last updated Oct. 25, 2002). However, the impact of implementation of the CAA's Title IV NO_X reduction program has been rather limited because the program's requirements are emissions rate-based and, therefore, do not adequately address increased production at electric utilities in response to increased

that the program has not been implemented in a manner that is faithful to the teachings of economic theory. The primary source of the program's success is not clear: it could be attributable to the emissions cap, banking, or the lowered cost of western coal.[85] A viable market for allowances has not yet been created. Clean and innovative technologies have not performed better, which might indicate that SO_2 allowance trading has failed to play a catalytic role in encouraging technological innovation and the development of clean energy.[86]

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demand for electricity. While electric utilities' share of national NO_X emissions dropped from 25 percent to 22 percent during the 1996–2001 period, NO_X emissions from coal-fired plants are still responsible for over 85 percent of utility NO_X emissions. *See* U.S. EPA, *Average Annual Emissions, All Criteria Pollutants Years Including 1970–2001*, tbl. A-4, *at* http://www.epa.gov/ttn/chief/trends/index.html (last updated Aug. 2003).

85. *See* Curtis A. Moore, *The 1990 Clean Air Act Amendments: Failing the Acid Test*, 34 ENVTL. L. REP. 10,368 (2004) (stating that, "if any element of the program saved money, it was almost certainly the cap, not trading").

86. *See id.* at 10,366 (arguing that "enactment of the trading program is one of the largest single obstacles confronting those seeking to deploy new [clean and efficient] technologies [such as integrated gasification-combined cycle (IGCC) and large-scale wind farm systems]. Acid rain trading has not been a boon to these entrepreneurs, but a burden."). Congress directed the EPA to set up a Conservation and Renewable Energy Reserve (CRER) and specifically allocated 300,000 SO_2 allowances to energy conservation and renewable projects implemented by affected units between 1992 and 1999, based on the calculation of avoided SO_2 emissions during that time span. *See* 42 U.S.C. § 7651c(f), (g). However, CRER performed very poorly and finally expired after January 1, 2000. It is understood that the program's failure was due to electricity restructuring at the federal and state levels that adversely affected electric utilities' incentives to engage in demand-side management (DSM) and integrated resource planning (IRP) under pre-existing state programs. *See generally* DAVID R. WOOLEY, RENEWABLE ENERGY POLICY PROJECT, ISSUE BRIEF NO. 15, A GUIDE TO THE CLEAN AIR ACT FOR THE RENEWABLE ENERGY COMMUNITY 18–19 (Feb. 2000), *available at* http://www.repp.org/repp_pubs/pdf/caaRen.pdf. Even clean coal technologies such as IGCC have had difficulty in penetrating the electricity market. IGCC involves a steam-recycling combustion process pressuring and gasifying coal, thereby significantly reducing air emissions from coal-fired units. *See* Moore, *supra* note 85, at 10,372–73; Henry R. Linden, *Bridging the Carbon Gap: Fossil Fuel Use for the 21st Century*, PUBLIC UTILITIES FORTNIGHTLY, Nov. 15, 2002, at 40. As of now, there are only two IGCC electric power plants in the United States. IGCC projects at these two plants began with the help of financial assistance from the Department of Energy (DOE) prior to or after the 1990 CAA Amendments under the DOE's Clean Coal Technology program. *See* Moore, *supra* note 85, at 10,372–73. The number is not encouraging, given the fact that a total of 38 clean coal demonstration projects had been implemented between 1985 and 2003. *See* John A. Herrick, *Federal Project Financing Incentives for Green Industries: Renewable Energy and Beyond*, 43 NAT. RESOURCES J. 77, 85–86 (2003). Disincentives to install IGCC technology lie in its high costs. NSR, Title IV's allocation of extra allowances to existing coal-fired plants, and the availability of cheap western low-sulfur coal have thus far combined to create an entry barrier to IGCC and other clean coal technologies.

b. The Increasing Popularity of Coasean Solutions to Environmental Problems in the United States

Although the general superiority of price-based systems is recognized in academia,[87] they have rarely been used in the United States. For example, liability rules have only been used during implementation of the Oil Pollution Act of 1990[88] and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, the portion of CERCLA known as "Superfund."[89] In comparison, Coasean solutions have been greatly used over time.

Since the mid-1980s, the EPA has implemented an internal emissions trading policy—bubbles, netting, offsets, and banking.[90] For example, the EPA utilized a trading mechanism to phase out the lead

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87. *See* Wiener, *supra* note 64, at 682 (observing that "the [prevailing] presumption [within academic circles] is that, among the incentive instruments, the price-based tax and liability rule instruments...will typically be superior to the quantity-based tradeable allowance and property rule instruments....").

88. The Oil Pollution Act imposes strict liability on dischargers and requires damage awards to include "natural resource" damages. Pub. L. No. 101-380, 104 Stat. 486 (1990) (codified at 33 U.S.C. §§ 2701-2761 (2000)). The inclusion of natural resource damages is intended to provide an incentive for owners of oil tankers to make efforts to prevent or minimize oil spills in the first place.

89. Pub. L. No. 96-510, 94 Stat. 2767 (1980) (codified as amended at 42 U.S.C. §§ 9601-9622 (2000)). The CERCLA imposes *strict* and *joint and several* liability on "potential responsible parties," which include former and current owners or operators of Superfund sites, and contractors and transporters of hazardous substances who were involved in the supply chain for ultimate disposal or treatment. Potential responsible parties are liable for all relevant costs, such as remediation costs, natural resource damages, and health assessment costs. 42 U.S.C. § 9607.

90. *See generally* U.S. EPA, Emissions Trading Policy Statement; General Principles for Creation, Banking and Use of Emission Reduction Credits, 51 Fed. Reg. 43,814 (Dec. 4, 1986) [hereinafter 1986 EPA Emissions Trading Policy]. Netting is an internal trading mechanism in which increased emissions in one point are used to offset decreased emissions in other points as long as it is expected that there is no net increase in emissions within the entire plant (facility). Bubble is a very similar mechanism because all individual emission sources under the control of the same person are regarded as a single source for regulatory purposes, as if the total emissions combined were coming from a single imaginary outlet in the bubble. The bubble is what makes netting legal in the first place; but it is different in that it is used by existing sources to pursue flexibility in complying with pollution control requirements, and the use of bubbles is limited by the regulatory definition of a source. Netting is used in the NSR context to forego preconstruction review, allowing the source to make a physical or operational change without obtaining a permit. *See* Reitze, *supra* note 59, at 1622-25. Offsets are used to cover increased emissions from new or significantly modified major stationary sources in nonattainment areas. 42 U.S.C. § 7503(c). Offsets, also called emissions reduction credits (ERCs), can be obtained from banked allowances. Emission reductions may be banked if they are surplus, enforceable, permanent, and quantifiable, and may be deposited in state-managed banks whose rules must be approved by the EPA. *See* 1986 EPA Emissions Trading Policy, 51 Fed. Reg. at 43831, 43841, 43849.

content of gasoline during the mid-1980s.[91] The 1990 CAA Amendments created the SO_2 allowance trading program covering the electric power sector. Since then, some electric power plants and large industrial boilers in eastern states subject to the EPA's 1998 NO_X SIP call have begun to participate in the Agency's NO_X Budget Trading Program (NBP).[92]

At the state level, California and other opt-in states allow covered automobile manufacturers to trade NO_X and VOC emission credits with another manufacturer or to bank them for future use under their low emission vehicle (LEV) program.[93] The South Coast Air Quality Management District's (SCAQMD) Regional Clean Air Incentives Market (RECLAIM) program provides for NO_X and SO_2 emissions trading between covered stationary sources.[94]

Other examples of the use of Coasean approaches to solving environmental problems include effluent trading[95] and wetlands mitigation banking[96] under the Clean Water Act (CWA). In a broader

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91. Under the program, refineries were allowed to trade and bank creditable lead rights between and among themselves. The amount of credits was determined by pooling leaded gasoline and unleaded gasoline produced in relation to the allowable lead content under the then-existing fuel and fuel additive standard. This was terminated in 1986. *See* 40 C.F.R. § 80.20 (1988); U.S. EPA, Regulation of Fuel and Fuel Additives, 47 Fed. Reg. 49,322 (Oct. 29, 1982); Regulation of Fuel and Fuel Additives: Gasoline Lead Content, 50 Fed. Reg. 9386 (Mar. 7, 1985); Regulation of Fuels and Fuel Additives, Banking of Lead Rights, 50 Fed. Reg. 13,116 (Apr. 2, 1985).

92. 42 U.S.C. §§ 7651-7651o (SO_2); 63 Fed. Reg. 57,356 (NO_X). *See also supra* text accompanying note 27.

93. *See* CAL. CODE REGS. tit. 13, § 1960.1(g)(2),(b) (2004).

94. The South Coast Air Quality Management District, Regulation XX—Rules 2000-2020.

95. Effluent trading takes place between sources sharing the same watershed: (1) intra-plant trading, (2) pretreatment trading, (3) point-point trading, (4) point-nonpoint trading, and (5) nonpoint-nonpoint trading. Intra-plant trading is a bubble in the context of water quality management. Pretreatment trading is a variant of early reduction credits in that indirect dischargers obtain extra credits by agreeing to comply with more stringent pretreatment standards implemented at publicly owned treatment works (POTWs). *See* U.S. EPA, Effluent Trading in Watersheds Policy Statement, 61 Fed. Reg. 4994 (Feb. 9, 1996). Ineffectual nonpoint pollution control has placed a disproportionate economic burden on industrial point sources. For the most part, effluent trading is aimed at providing financial incentives for nonpoint sources to reduce their pollution, while lessening compliance costs to be paid by point sources. Currently, implementation of effluent trading is in a pilot phase. Effluent trading will not be implemented on a massive scale, because, unlike air emissions, effluents have stronger localized effects (so-called "hot spot" problems), and the geographical scope of any effluent trading program is severely limited by locational and seasonal patterns of water currents.

96. Under the CWA, dredging or filling wetlands requires a permit from the Army Corps of Engineers. *See* 33 U.S.C. § 1344 (2000). Wetlands mitigation banking allows a wetland developer to obtain the speedy regulatory approval of his or her wetland development plan by requiring the purchase (or creation) of wetland credits in the market. Usually, wetland developers are required to hold wetland credits that represent the size of

sense, the use of various techniques for land use control purposes, such as transferable development rights (TDRs) and conservation easements, can be classified as a Coasean solution; these policy tools are aimed at creating a financial incentive for land owners to engage in sustainable land management practices by offering a quid pro quo for accepting restrictions on the exercise of their property rights.

C. The Reasons for the Underutilization of Pollution Taxes in the United States

1. *Lack of Political Currency*

Political, rather than economic, reasons explain why pollution taxes have been underutilized in the United States. Pollution taxes are considered an additional burden by industry, because it cannot escape reduction requirements under a pollution charge system unless it completely reduces emissions.[97] Industry prefers technology-based control systems that "impos[e] higher entry costs in the forms of regulatory expenses on new plants and products."[98] Industry accepts the idea of tradeable allowances more readily because it can influence allocation decisions and perceives allowance trading as offering greater flexibility.

In short, because "[t]he process of defining property rights defines wealth and its distribution in society,"[99] regulators, politicians, and industry all have vested interests in perpetuating the current regulatory system and resisting the short-term legal uncertainty, instability, and related costs that may be caused by institutional changes.[100] This is the best possible explanation why the use of grandfathered tradeable permit systems is so prevalent in the United States. Also, where substantial political capital has already been spent on

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wetlands three times the amount of lost wetlands. This can be achieved by buying credits in the market or by agreeing to implement wetland restoration projects somewhere else. *See* J.B. Ruhl & R. Juge Gregg, *Integrating Ecosystem Services into Environmental Law: A Case Study of Wetlands Mitigation Banking*, 20 STAN. ENVTL. L.J. 365, 368-72 (2001).

97. Reitze, *supra* note 59, at 1618-19; Adam Chase, *The Efficiency Benefits of "Green Taxes,"* 11 UCLA J. ENVTL. L. & POL'Y 1, 24 (1992); Nathaniel O. Keohane, Richard L. Revesz & Robert N. Stavins, *The Choice of Regulatory Instruments in Environmental Policy*, 22 HARV. ENVTL. L. REV. 313, 348-51 (1998).

98. Chase, *supra* note 97, at 22-23. *See also* Michael T. Maloney & Robert E. McCormick, *A Positive Theory of Environmental Quality Regulation*, 25 J.L. & ECON. 99, 105-06, 121-22 (1982) (explaining how uniform federal environmental regulation can raise rivals' costs and "redistribute wealth among competing firms in [the same] industry").

99. Yandle, *supra* note 54, at 26.

100. Chase, *supra* note 97, at 21-23 (stating that "the United States' shortterm orientation and political structure makes for a strong status quo bias").

establishing a tradeable permit system, as in the case of the SO_2 Acid Rain Program, it is highly unlikely that pollution taxes will replace such a system.

Setting a tax rate at the socially optimal level is hardly an easy task. It can be extremely difficult to come up with a politically acceptable tax plan due to the difficulty of calculating the total social cost of pollution, and because marginal abatement costs can be grossly uneven among different firms, industries, and regions.[101] Under the American administrative law system, "delegating authority to fix tax rates to EPA or a similar state agency might lead to delay and uncertainty similar to that experienced under traditional regulation."[102] Even if Congress sets the tax rate, "because a political process fixes the tax rate, taxes do not provide the escape from government decisions inspired by the free market vision."[103] In order for pollution taxes to be effective, the tax rate should be adjusted over time. Whereas frequent rate revisions may "create uncertainties...that weaken a tax's ability to stimulate innovation," stable tax rates over a long period of time do not provide enough incentive to innovate and "may delay an appropriate response to changing conditions and new information about environmental effects."[104]

General American sentiments against tax increases or new taxes come into play as well, because proportional taxes tend to be *regressive*. Energy taxes in particular have faced fierce political opposition because they are certain to cause uneven regional impacts due to vastly differing energy structures and energy consumption patterns from region to region. For example, northeastern states have opposed taxes that would increase the price of heating oil during winter when consumption is the highest.[105] Western states dislike increases in gasoline taxes because of greater-than-average driving distances.[106] Corn-belt states have been sensitive to diesel fuel price increases because of their heavy consumption of diesel fuels for agricultural use.[107] Energy-producing states in the Midwest and the Southeast are generally hostile to the idea

101. Reitze, *supra* note 59, at 1621 (stating that "pollution control taxes raise questions of fairness and distribution because they affect industries and geographic regions unevenly. They tend to impact small businesses more harshly than large entities.").

102. Driesen, *supra* note 30, at 341.

103. *Id.*

104. *Id.* at 341–42.

105. Henry Lee, *The Political Economy of Energy Taxes: An Assessment of the Opportunities and Obstacles*, 12 PACE ENVTL. L. REV. 77, 84 (1994).

106. *Id.* at 84, 86.

107. *Id.* at 84.

of energy taxes because of the expectation that energy-intensive local industries will be hardest hit.[108]

These variations are also present within the electricity sector. The Pacific Northwest satisfies most of its electricity needs by relying on hydroelectric power from local dams, which also supply electricity to the Southwest.[109] The Northeast and the South have relatively low CO_2 emissions, despite the fact that prevailing weather conditions require heavy use of heating oil and electricity, respectively, because a great share of the electricity used comes from nuclear power.[110] On the other hand, average per capita CO_2 emissions in the Midwest are higher than those in any other region because the Midwest uses electricity generated primarily by coal-fired power plants, which are concentrated in that region.[111]

At this point, it is useful to briefly discuss the use of pollution taxes in European countries, where the general public is more supportive of pollution taxes than emissions trading. The following discussion shows the difference between theory and practice in implementing pollution taxes as well as an attitudinal change toward the use of pollution taxes in Europe that illustrates the problems facing a pollution tax system in today's globalized economy.

Some European countries have implemented green energy taxes ("eco-taxes") whose rates are set based on a fossil fuel's environmental impact. For example, Germany and the United Kingdom (U.K.) impose an electricity consumption tax or levy that is assessed on a per kilowatt (kWh) basis on electric utilities.[112] One of the environmental benefits of this type of tax system is that cleaner, more energy-efficient electricity generators gain a competitive advantage in the restructured national electricity market. Scandinavian nations have enforced a carbon tax system for over a decade.[113] Some other nations, including Italy, have

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108. *Id.*

109. RICHARD D. MORGENSTERN ET AL., RESOURCES FOR THE FUTURE, ISSUE BRIEF NO. 02-03, THE DISTRIBUTIONAL IMPACTS OF CARBON MITIGATION POLICIES 12 (Feb. 2002), *at* http://www.rff.org/rff/Documents/RFF-IB-02-03.pdf.

110. *Id.*

111. *Id.*

112. *See* Joachim Schleich et al., *Germany: Unification and Contradiction, in* CLIMATE CHANGE AND POWER: ECONOMIC INSTRUMENTS FOR EUROPEAN ELECTRICITY 167-68 (Christiaan Vrolijk ed., 2002); Nocola Steen & Christiaan Vrolijk, *United Kingdom: Power Markets and Market Policies, in* CLIMATE CHANGE AND POWER: ECONOMIC INSTRUMENTS FOR EUROPEAN ELECTRICITY, *id.* 236-38.

113. *See* Richard A Westin, *Understanding Environmental Taxes*, 46 TAX LAW. 327, 341-42 (1993).

recently moved in this direction as part of their electricity restructuring efforts.[114]

Most of the pollution taxes now being implemented in Europe are not ideally designed. Dominant electricity generators and some local industries are frequently exempted from tax liability.[115] The fuel mix and the economic structure of the electricity industry, as well as the pace and shape of electricity restructuring in Europe, vary from country to country.[116] As in the United States, transmission bottlenecks, less-than-expected competition in many of the national retail markets, and ineffective policy coordination of transmission pricing rules at the EU level have slowed the pace of establishing a healthy and competitive regional electricity market. In this situation, many legal uncertainties significantly affect the behavior of relevant stakeholders.

Despite the general tendency of Europeans to favor a tax approach, most countries, with the exception of Italy, are now reluctant to enact a progressive carbon tax system or eco-taxes.[117] The short answer is that economic integration in general and the transition to electricity restructuring taking place within the European Union have an adverse effect on EU member nations' attitude toward environmental

114. Since 1999, Italy has implemented carbon taxes. Marcella Pavan, *Italy: Climate Change Policy and Electricity Liberalization*, *in* CLIMATE CHANGE AND POWER: ECONOMIC INSTRUMENTS FOR EUROPEAN ELECTRICITY, *supra* note 112, at 185–87. France also plans to tax carbon emissions beginning in 2010. Christophe de Gouvello, *France: Focus on Non-Fossil Fuels*, *in* CLIMATE CHANGE AND POWER: ECONOMIC INSTRUMENTS FOR EUROPEAN ELECTRICITY, *supra* note 112, at 140–42.

115. For example, Sweden excludes coal from taxable fuels to protect the economic interests of coal-fired power plants and exempts electricity use from the program's coverage; fuel consumption in industry is entitled to a 65% tax rate reduction. *See* Thomas Sterner & Gunnar Kohlin, *Environmental Taxes in Europe*, 1 PUB. FIN. & MGMT. 117, 132 (2003), *available at* Social Science Research Network Electronic Paper Collection, http://ssrn.com/abstract=461537 (last visited Sept. 19, 2005).

116. Denmark derives more than half of its electricity from coal-fired power plants. Poul Erik Grohnheit, *Demark: Long-term Planning with Different Objectives*, *in* CLIMATE CHANGE AND POWER: ECONOMIC INSTRUMENTS FOR EUROPEAN ELECTRICITY, *supra* note 112, at 108, fig. 6.1. Germany has a relatively large and politically powerful coal industry. Scandinavian countries have abundant sources of hydropower. In France, the share of nuclear power in electricity generation is nearly 75 percent, while only ten percent of electricity generation comes from fossil fuel combustion. de Gouvello, *supra* note 114, at 134, fig. 7.1. Recently, its former electricity monopoly, Electricité de France (EdF), has aggressively pursued mergers with and acquisitions of energy companies in neighboring countries. *See, e.g.*, Michael Albers, *European Union Law: Energy Liberalization and EC Competition Law*, 25 FORDHAM INT'L L.J. 909, 922–26 (2002).

117. The Italian carbon tax system does not permit any tax exemptions. Preferential tax rates apply to industrial self-generators and cogenerators. To amplify a double dividend effect, the tax revenues collected are used to reduce other tax burdens, primarily labor taxes and heating fuel costs, and to support investments in projects and activities that are aimed at GHG emission reductions. *See* Pavan, *supra* note 114.

taxes. The aforementioned problems have combined to create a situation in which many European countries are unwilling to enact a carbon tax or any other pollution taxes of a progressive nature due to their concerns about the impact of such taxes on electricity prices and the competitiveness of energy-intensive local industries and dominant domestic electric utilities.

Political support for pollution taxes, especially a carbon tax, has eroded worldwide, as many public sectors previously subject to extensive government regulation are transitioning to free competition in today's globalized economy. Given the different economic structures and energy use patterns among nations, the process of globalization makes a pollution tax system less politically appealing. Without concerted international efforts to implement pollution taxes, the future of pollution taxes will be bleak.

2. Major Types of Energy Taxes

There are three types of energy taxes: (1) the ad valorem tax, (2) the BTU tax, and (3) the carbon tax.[118] An ad valorem tax is assessed "based on a percentage of a fuel's sales price";[119] gasoline taxes belong in this category. An ad valorem tax promotes coal use and is the most discouraging to the development of renewable energy. Additionally, an ad valorem tax has the greatest income effect on the general public because of its cost sensitivity and regressivity. The BTU tax is calculated based on the heat input of a fuel. It penalizes more efficient energy technologies because "the more heat one could extract per unit of fuel, the greater the amount of tax that would be incurred."[120] The carbon tax is calculated based on the carbon content of fuels. Thus, it is relatively easy to administer compared with the ad valorem method and the BTU tax.

Among the three types of taxes, the carbon tax is most effective for addressing climate change concerns and promoting sustainable patterns of energy production and consumption because it "place[s] a disincentive on dirty fuel consumption" and stimulates energy conservation and the use of clean fuels.[121] The winners are nuclear power and renewable energy sources. Thus, a carbon tax system should be the choice if the nation chooses to use a tax approach under its climate change policy. Given that most renewable energy sources do not emit

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118. Amy C. Christian, *Designing a Carbon Tax: The Introduction of the Carbon-Burned Tax (CBT)*, 10 UCLA J. ENVTL. L. & POL'Y 221, 229 (1992).

119. *Id.*

120. *Id.* at 231-32.

121. *Id.* at 232.

CO_2 and other GHGs, a carbon tax will facilitate the development of renewable energy technologies. If some of the revenues are used to finance renewable energy projects, the tax's positive effects will be further magnified.

The Midwest and other coal-producing areas will be hardest hit by the imposition of a carbon tax. Midwestern and southeastern coal-fired utilities would have to increase their rates to shift some of the tax burden to consumers, or they would have to absorb the tax burden themselves due to intense competition in the market.[122] Hence, higher electricity prices, production curtailments, or plant shutdowns would result. In either case, the carbon tax system would induce reduced coal consumption and increased use of cleaner fuels.

Resistance from energy-producing states, including midwestern states, will be a significant barrier to the enactment of a carbon tax in the United States. This observation is based on historical experience; a BTU tax proposal by the Clinton administration failed to garner enough support for its passage in Congress, despite the fact that a BTU tax is assessed based on energy input and, hence, is much more acceptable to the coal and utility industries than a carbon tax.[123] The tax failed to pass in Congress because a broad-based BTU tax plan, as initially proposed by the administration, was considered by virtually every industry to carry additional burdens; concessions and compromises made during congressional deliberations ultimately led to collapse.[124]

According to one study, a carbon tax or a CO_2 emissions trading system would impose significantly different burdens on households in different regions unless wealth distributional impacts are dealt with properly.[125] For example, average electricity prices would differ among regions by the order of two due to regional variations in CO_2 emissions.[126] Therefore, in order to gain public support, it is imperative that any proposed pollution tax have the broadest base as possible and be instituted as a part of a larger tax reform effort to be revenue-

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122. *Id.* at 242.

123. For a detailed discussion of political battles leading up to the abandonment of the BTU tax proposal, see generally Dawn Erlandson, *The Btu Tax Experience: What Happened and Why It Happened*, 12 PACE ENVTL. L. REV. 173 (1994).

124. *Id.* at 176–84.

125. MORGENSTERN ET AL., *supra* note 109, at 12 (citing William Pizer, James N. Sanchirico & Michael Batz, *Regional Patterns of Household Energy Use and Carbon Emissions* (paper presented at Resources for the Future Workshop, The Distributional Impacts of Carbon Mitigation Policies, Dec. 11, 2001)).

126. *Id.* at 20, fig. 2. For annual CO_2 emissions per household, see also *id.* at 12. For annual CO_2 emissions per household, see also *id.* at 20, fig. 2.

neutral.[127] Again, these efforts are certain to be subject to cumbersome political processes, which, along with other factors, may explain why property-based tradeable permit systems rather than pollution taxes have been used in the United States.

3. The Comparative Advantages of Emissions Trading in the Context of Climate Change

Emissions trading has several advantages over a carbon tax. First, the emissions cap can be more easily established using such benchmarks as the Kyoto Protocol's seven-percent reduction target or the UNFCCC's GHG emissions stabilization goal. Given that a specific national commitment under international law is usually a precondition for domestic implementation of climate change mitigation policy, "the certainty about the size of the emissions reductions" would make emissions trading preferable to the carbon tax system.[128] Different cost curves among various industrial sectors might produce political wrangling over applicable tax rates, even when reliable cost figures are readily available.

Furthermore, emissions trading has an additional advantage over a carbon tax: the grandfathering of CO_2 emissions allowances. While it can achieve the same result through tax ceilings or credits, rate adjustments, or rebates, a carbon tax with such features would become too complex to administer or would create too many loopholes, compromising the tax's underlying environmental goals. Finally, CO_2 emissions trading can build on the nation's prior experience with tradeable permit systems.

4. Similarities between Pollution Taxes and Emissions Trading

The above discussion might indicate that pollution taxes are a different creature from emissions trading. But they could become comparable, depending on chosen design features and allocation methods, or the two systems could be combined in a manner that maximizes economic efficiency. If a pollution tax is designed to allow tax exemptions for the portion of emissions below a certain threshold level, it becomes similar to a grandfathered tradeable permit system. If

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127. According to a poll conducted in 1998, over 70 percent of the people surveyed responded that they would support a revenue-neutral tax bill for reducing fossil fuel consumption. Lamont C. Hempel, *Climate Policy on the Installment Plan*, *in* ENVIRONMENTAL POLICY 299 (Norman J. Vig & Michael E. Kraft eds., 2000) (citing a poll conducted by International Communications Research for Friends of the Earth).

128. A. Myrick Freeman III, *Economics, Incentives, and Environmental Regulation*, *in* ENVIRONMENTAL POLICY, *supra* note 127, at 204–05.

allowances are allocated by means of auctioning, a tradeable allowance system becomes identical to a pollution tax.

Moreover, if auction revenue is recycled to neutralize unequal wealth distribution effects, a tradeable allowance system can have the same "double dividend" effect as the revenue-neutral pollution taxes. In a combined system with tax credits applied to a certain minimum amount of pollution, firms can choose between either of the options: paying the full tax or purchasing emissions reduction credits in the trading market, depending on the different cost curve of pollution abatement facing each firm.[129]

5. Incentive-Based Approaches as an Additional Layer of Preexisting Technology-Based Command-and-Control Regulation

Economists generally have a hidden bias for market-based approaches because they tend to think that these approaches entail less cost than "command-and-control" regulation. However, this perception does not give significant weight to the fact that the success of market-based approaches hinges on highly-sophisticated monitoring capacity and a threat of enforcement strong enough to prevent regulated firms from cheating on their performance. In some cases, the reliable monitoring of some pollutant emissions may not be available because installation and operating costs of the monitoring equipment could be prohibitively high, or because the chemical nature of a regulated pollutant precludes reliable monitoring. For instance, the operation of the continuous emissions monitoring system (CEMS) as required under the CAA's SO_2 Acid Rain Program involves huge costs relating to the installation and operating of such a system.

Professor David Driesen has consistently argued that emissions trading does not constitute a better alternative to command-and-control regulation. In his view, "[emissions] trading reduces the incentive for high-cost sources to apply new [pollution control] technology," while providing some incentive for low-cost sources to reduce their emissions beyond required levels.[130] Further, Driesen argues, the overall effects of emissions trading on technological innovation may be negative because high-cost sources may not have to make substantial innovation to achieve facility-specific emission reductions as may be required under a comparable technology-based regulation.[131]

129. Chase, *supra* note 97, at 31–32.

130. *See* David M. Driesen, *The Economic Dynamics of Environmental Law: Cost-Benefit Analysis, Emissions Trading, and Priority-Setting*, 31 B.C. ENVTL. AFF. L. REV. 501, 519 (2004).

131. *See, e.g.*, *id.* at 519–20.

In a law review article published in 1985, Professor Howard Latin argued against economic incentive-based systems, stating that instrument choice in environmental regulation must be tailored to particularized circumstances and must be more flexible and attuned to taking into account the costs and benefits of the selected policy tool. Latin observed that such "fine-tuning" would be impracticable in many cases because "theoretically 'efficient' regulatory strategies require more data, more sophisticated scientific and economic analyses, more agency expertise and resources, and more cooperation from regulated parties."[132] According to Latin, the dominance of uniform regulatory standards can be explained by "inherent limitations on environmental decision making and from conflicts between the legitimate but incompatible interests of diverse parties."[133] Professor Latin argued that there is no guarantee that the implementation limitations inherent in environmental policy-making would be resolved under a new regulatory paradigm advocated by critics of command-and-control regulation.[134] Rather, regulatory fine-tuning would "increase decisionmaking costs, delays, inconsistencies, bureaucratic discretion, and opportunities for manipulative behavior by regulated parties."[135]

It is important to note that, with the exception of the SCAQMD's RECLAIM, market-based programs have never been substitutes for command-and-control in the United States. Rather, these programs represent an additional layer of preexisting technology-based regulations, capitalizing on prior regulatory work and experiences. Based on prior experience with pollution trading programs, the viability and effectiveness of a market-based solution in the United States depend on the following factors: the numbers of regulated sources; the physical and chemical nature of a regulated pollutant; the range of technology options available; the existence of a cost-effective monitoring, reporting and verification system; adaptive decision-making processes; and so forth.

The failure of the SCAQMD's RECLAIM, and other related programs, typifies this point. The RECLAIM program was implemented as a substitute for command-and-control. Its early implementation had the effect of relaxing then-existing technology-based standards by allocating allowances based on allowable, rather than actual,

132. Howard Latin, *Ideal versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267, 1304 (1985).

133. *Id.* at 1331.

134. *Id.*

135. *Id.* at 1331-32.

emissions.[136] Because of the inclusion of relatively large numbers of small sources, monitoring requirements have not been effectively enforced.[137] Further, the SCAQMD has failed to establish a reporting and verification system that allows cost-effective, efficient real-time checking on submitted information, thereby making timely regulatory responses possible[138] and providing regulated firms disincentive to violate.[139] The trading of volatile organic compounds (VOCs) emissions between refineries and car scrappers has been ineffective in curbing ozone pollution, because increased VOC emissions from refineries have created local toxic hot spots, and because of faulty assumptions on the amount of avoided mobile source emissions and alleged car scrappers' gaming of the system.[140]

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136. *See* South Coast Air Quality Management District, Regulation XX—Rule 2002(c). California suffered from an economic downturn during the late 1980s and the early 1990s. The SCAQMD faced enormous political pressure from in-state industry stakeholders who were critical of traditional source-specific technology-based standards that were applied to them with ever-increasing stringency. Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy*, 9 DUKE ENVTL. L. & POL'Y F. 231, 245 (1999). As a result of RECLAIM, the vast majority of sources had little difficulty complying with their permit conditions with no discernible environmental benefits, and, hence, the trading market was underutilized until after the energy crisis in 2000 and 2001 hit the state of California. *See* U.S. EPA, AN EVALUATION OF THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT'S REGIONAL CLEAN AIR INCENTIVES MARKET—LESSONS IN ENVIRONMENTAL MARKETS AND INNOVATION 12 (Nov. 2002) [hereinafter EVALUATION OF SCAQMD CLEAN AIR INCENTIVES MARKET].

137. The EPA found that monitoring requirements are more burdensome on smaller sources; the EPA also noted environmentalists' belief that emission factors are more heavily used than necessary. EVALUATION OF SCAQMD CLEAN AIR INCENTIVES MARKET, *supra* note 136, at 35. Note that RECLAIM covers existing and new stationary sources with more than "four" tons of annual NO_x or SO_2 emissions, unless these sources are not subject to permit requirements or are exempted emission sources. SCAQMD, Regulation XX-Rule 2001(c)(1)(C).

138. EVALUATION OF SCAQMD CLEAN AIR INCENTIVES MARKET, *supra* note 136, at 31-32. As the EPA indicated, over-allocations of emissions reduction credits raised fewer, if any, enforcement problems in the early years of RECLAIM. *Id.* at 32. Many facilities were slow to comply with monitoring and reporting requirements. Drury et al., *supra* note 136, at 280-81.

> [A]n audit of the RECLAIM program found that industry has been slow to comply with the [CEMS] requirements. After the first year, 30 percent of the RECLAIM facilities had not installed properly operating CEM[S]. Although most CEMs are now certified, electronic data reporting requirements were still being violated forty percent of the time by major sources, and eighty percent of the time by small sources.

Id. (footnotes omitted).

139. EVALUATION OF SCAQMD CLEAN AIR INCENTIVES MARKET, *supra* note 136, at 32-33 (noting that RECLAIM lacked a penalty structure with an adequate deterrence effect because electric utilities might be able to compensate for assessed penalties through increased electricity sales).

140. Drury et al., *supra* note 136, at 259-62. VOC emissions are outside of the scope of the program. It is important to note, however, that VOC emissions are covered under a

As Professor Latin indicated, implementation of an incentive-based program is not easy unless all of the preconditions for its success are satisfied. The real explanation for the increasing popularity of market-based emissions controls might be that technology-based command-and-control has reached its full potential; its rigidity, inflexibility, and other inefficiencies make a timely response to changing information and needs unlikely.[141] One such indicator is found in the fact that some prominent environmental groups are now avid supporters of emissions trading and other market-based mechanisms. Environmentalists generally oppose the free market vision of solving environmental problems because they believe environmental pollution is the result of market failures that necessitate governmental intervention in the first place, and that market-based approaches embody the notion of a property right to pollute. However, in the face of mounting criticisms against technology-based, command-and-control environmental regulations, some environmental groups have begun to embrace market-

different inter-source pollution trading program. Under the SCAQMD's Mobile Source Offset Programs, stationary sources can forego some of the on-site emissions reductions that are otherwise required under applicable technology-based regulations by purchasing emission reduction credits from qualifying mobile sources. The programs encourage scrapping of old, high-pollution vehicles; the voluntary repair of on-road motor vehicles; the purchase of clean on-road or off-road vehicles; the electrification of truck stops and tour bus stops to reduce vehicle emissions by engine idling; the purchase of clean lawn and garden equipment; and other pilot credit-generation programs. The South Coast Air Quality Management District, Regulation XVI—Mobile Source Offset Programs, Rules 1605, 1610, 1612, 1612.1, 1613, 1620, 1623, 1631-34. Because motor vehicles are major sources of VOC emissions, most of the credit transactions have involved VOCs. The four large oil refining companies, Chevron, GATX, Ultramar, and Unocal, have reportedly been the major beneficiaries of the trading program. The program has been heavily criticized by California-based environmental groups for creating toxic hot spots in ethnic minority communities. The source of the problem is that the majority of oil refineries are located in neighborhoods in which minorities and other economically disadvantaged people live. Because the toxicity and reactivity of VOCs released from oil refineries may be greater than those from motor vehicles, mobile source offset trading allegedly has exposed minority groups to increased environmental hazards and related health risks while not helping reduce smog formation. The trading of emission reduction credits that pretend to be between the same kind of pollutants in fact has been "inter-pollutant" trading. *See* Drury et al., *supra* note 136, at 252, 255–57.

141. One of the strengths of any cap-and-trade program versus traditional technology-based command-and-control is its flexibility. A regulated firm is allowed to choose any mix of compliance options to meet its reduction target. The program's performance instead is guaranteed by imposing on all covered sources the emissions caps and stringent monitoring and penalty requirements. *See* 42 U.S.C. § 7651c(a)(1)(B) (2000). Under Phase II of the SO_2 Acid Rain Program, the same emissions limit of 1.2 lbs/mm Btu has been applied across the board. Thus, SO_2 allowance trading has had the effect of addressing grandfathering to some extent, which had traditionally been the source of the problem of the ineffectual workings of the CAA's NSPS and NSR programs.

based programs as politically acceptable alternatives to command-and-control, which can result in continuous improvements in environmental quality by imposing more stringent pollution reduction requirements on grandfathered industrial sources at regular intervals.

II. CO_2 (GHG) EMISSIONS TRADING OR A CARBON TAX

A. Suitability and Feasibility

Emissions trading or pollution taxes can work well in the context of global climate change. Sources of CO_2 emissions are ubiquitous. Because of significant cost variations, trading between both high- and low-cost sources presents a real opportunity to maximize efficiency gains. Fortunately, there is no significant problem with monitoring carbon emissions because the carbon content of a fossil fuel can be used as a proxy for expensive real-time monitoring. These and other factors clearly indicate that flexibility mechanisms should be employed as a viable policy tool to achieve a carbon reduction goal in a cost-effective manner.

The fact that carbon capture and sequestration are not yet commercially viable confirms the need for pursuing sustainable energy development: promoting energy conservation and efficiency, and the development and commercial deployment of cleaner, more efficient energy sources and technologies. Future climate change law will help to achieve these goals in a way that current U.S. environmental and energy law have not. These goals are achievable because effective carbon control policy will raise fuel prices and, thus, increase the economic value of energy efficiency and conservation. As a consequence, entry barriers to clean energy technologies will be cleared and technological innovation will be spurred by the elimination of implicit subsidies for existing dirty sources. The key to success is strong political leadership with the wisdom and courage to tell the truth to and persuade the American public about the need for prompt action on climate change.

B. The Benefits of a Comprehensive Approach

As noted above, there are relatively few problems with the calculations of CO_2 emissions; fossil fuel inputs to the economy can be used as a proxy for the direct measurement of CO_2 emissions. Currently, real-time monitoring is economically feasible only for large utility and industrial boilers, including those already subject to the CEMS requirement under the existing SO_2 and NO_X trading programs.[142] Non-CO_2 GHG emissions, on the other hand, raise monitoring and verification problems because many of these emissions are of a diffuse or fugitive nature.

However, the CO_2-only policy exempting other GHGs from reduction requirements does not take full advantage of all the environmental and economic benefits that the comprehensive approach covering all GHGs can offer. First, the exclusive focus on carbon emissions control ignores the lifecycle effects of GHG emissions: reduced CO_2 emissions from a greater use of cleaner fuels can create a leakage problem. Other GHGs are generally more potent global warming gages than CO_2.[143] Therefore, if unaddressed, a shift to other activities that generate non-CO_2 emissions could negate CO_2 reduction benefits outside the trading program.[144] For example, increased natural gas production can lead to increased emissions of methane (CH_4) due to the mismanagement of gas pipeline systems.[145] With relatively small net benefits from their use,[146] increased reliance on biomass-based renewable

142. CAROLYN FISCHER ET AL., RESOURCES FOR THE FUTURE, CLIMATE ISSUE BRIEF NO.10, USING EMISSIONS TRADING TO REGULATE U.S. GREENHOUSE GAS EMISSIONS: BASIC POLICY DESIGN AND IMPLEMENTATION ISSUES 6 (1998), *at* http://www.rff.org/rff/Documents/RFF-CCIB-10.pdf.

143. There are six principal GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Kyoto Protocol, *supra* note 3, Annex A. GHGs "vary in their instantaneous radiative forcing (heat-trapping) ability, reactivity, and residence time in the atmosphere." Richard B. Stewart & Jonathan B. Wiener, *The Comprehensive Approach to Global Climate Policy: Issues of Design and Practicability*, 9 ARIZ. J. INT'L & COMP. L. 83, 86 (1992). Each GHG's radiative forcing ability is compared to that of CO_2 and presented as its global warming potential (GWP). GWP therefore expresses the relative ability of one unit of a GHG to affect climate change over a given period of time, considering both direct and indirect effects. For the GWP of each of the non-CO_2 GHGs, see *Radiative Forcing of Climate Change*, *in* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) WORKING GROUP I, IPCC THIRD ASSESSMENT REPORT: THE SCIENTIFIC BASIS, ch. 6, pt. 12, subpt. 2 (2001), *available at* http://www.grida.no/climate/ipcc_tar/wg1/248.htm; *see also Direct GWPs*, id. tbl. 6.7.

144. Stewart & Wiener, *supra* note 143, at 91.

145. *Id.* at 91–92.

146. Ethanol production involves heavy fossil fuel inputs that are used to ferment and distill corn. Thus, increased use of ethanol does not necessarily reduce fossil fuel usage. Furthermore, ethanol use during summer months increases VOC emissions because it tends to increase the volatility of reformulated gasoline, thus resulting in energy loss as well. *See* Editorial, *The Wrong War*, WASH. POST, Nov. 3, 2003; David L. Greene & Andreas Schafer, *Reducing Greenhouse Gas Emissions from U.S. Transportation*, at 30, box 7 (Report for the Pew Center on Climate Change, May 2003), *at* http://www.pewclimate.org/doc Uploads/ustransp%2Epdf (last visited Sept. 24, 2005); REITZE, *supra* note 2, at 346. Methyl tertiary-butyl ether (MTBE) does not help reduce GHG emissions "[b]ecause of energy losses in converting natural gas, and the carbon content of MTBE itself." Green & Schafer, *supra*, at 30.

fuels, such as corn-based ethanol and other dedicated energy crops, can generate more nitrous oxide (N_2O) emissions if such crops are grown with the heavy use of fertilizers, and the absorptive capacity of sinks can be reduced if the massive cultivation of biomass crops displaces forest lands.[147]

Although reliable cost analyses of reductions of non-CO_2 GHG emissions are not currently available, their close relationships to CO_2 emissions in industrial production processes or mobile source emissions[148] and their greater global warming potential (GWP)[149] suggest that the comprehensive approach could provide greater incentives for industry to explore a cost-effective way of improving energy efficiency or recycling waste energy. Since monitoring technologies and technology for capturing CH_4 emissions from large landfills already exist,[150] recycling of CH_4 emissions can reduce the amount of natural gas used as a heating fuel during winter.[151] The fact that N_2O emissions from industrial sources are difficult to control does not necessarily mean that they should be excluded from reduction requirements. Due to the relatively small number of major stationary sources of NO_X emissions, such as electric utilities and large industrial boiler units, inclusion of these sources could facilitate the development of monitoring and combustion control technology.[152]

With regard to other non-point sources, such as agricultural activities and carbon sinks, for which there is no known scientific

147. Stewart & Wiener, *supra* note 143, at 92.

148. Reduced CO_2 emissions from stationary sources can decrease N_2O emissions during fossil fuel combustion. More energy-efficient electricity generation can reduce emissions of SF_6, which is an ozone-depleting substance with the highest GWP that is used in electrical switchgear. John M. Reilly et al., *Multi-Gas Contributors to Global Climate Change: Climate Impacts and Mitigation Costs of Non-CO_2 Gases* 28 (prepared for the Pew Center on Global Climate Change, Feb. 2003), *at* http://www.pewclimate.org/docUploads/Multi%2DGas%2Epdf. This is also true of N_2O emissions caused by mobile sources.

149. Therefore, the amount of carbon equivalent assigned to other GHGs is greater than that of CO_2 on a per-ton basis, which means that even a low permit price or tax rate per ton of carbon equivalent for non-CO_2 GHG emissions provides a large incentive for reduction efforts. *See* Reilly et al., *supra* note 148, at 32. However, the caveat is that if marginal cost curves are steeper than those for CO_2, efficiency gains from the reduction of an additional unit of non-CO_2 GHGs would disappear quickly after relatively cheap control options are exhausted at earlier stages. *See id.*

150. *Id.* at 34.

151. The state of Missouri is implementing a landfill gas recovery project under which it provides a loan to the local high school using methane gases captured in the nearby landfill as a heating fuel. *See* Pew Center on Climate Change, *Climate Change Activities in the United States: 2004 Update* 16 (2004), *at* http://www.pewclimate.org/docUploads/74241%5FUS%20Activities%20Report%5F040604%5F075445%2Epdf [hereinafter Climate Change Activities].

152. Reilly et al., *supra* note 148, at 34.

method for measurement, government should encourage sustainable management practices using other regulatory means, including education, financial assistance, and conservation programs.[153] Where emissions removals from these sources are applied toward a nation's commitment to GHG reductions under the Kyoto Protocol or the sources are entitled to obtain reduction credits under a future domestic cap-and-trade program, conservative accounting methods should be applied to take into consideration any scientific uncertainty involved.[154] This in turn will offer a powerful incentive for the pursuit of sustainable land-use practices. In short, under the comprehensive approach, climate change policy should comprise the right mix of policy tools and instruments. The right mix will be that which best suits individual circumstances and provides maximum flexibility in compliance depending on the number of covered sources and the economic and technological feasibility of available compliance options.

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153. Vermont is operating a project that is aimed at promoting CH_4 recovery from dairy manure. Wisconsin has a similar program. The North Carolina State University Animal and Poultry Waste Management Center is studying hog waste management technologies that can be used to recover and recycle CH_4 emissions. *See* Climate Change Activities, *supra* note 151, at 17. Georgia has promoted "no-tillage" farming practices by leasing no-till equipment to farmers. *See id.* at 12. Oregon is by far the nation's leader in supporting carbon sequestration projects as a way of facilitating sustainable forest management. Its siting law addresses CO_2 emissions from power plants by requiring utilities to reduce emissions by employing state-of-the-art electricity generation technologies or to fund or contribute to renewable energy projects or reforestation projects. The Oregon Climate Trust funds both domestic (in-state and out-of-state) and foreign reforestation projects that are chosen in a competitive bidding process. *See* Barry G. Rabe, *Greenhouse & Statehouse: The Evolving State Government Role in Climate Change* 30-31 (Policy Report prepared for Pew Center on Global Climate Change, Nov. 2002), *at* http://www.pewclimate.org/doc Uploads/states%5Fgreenhouse%2E-pdf; *see also infra* text accompanying note 311. The Oregon Forest Resource Trust provides financial assistance to landowners in order to give them incentives to "maintain healthy forests on under-producing forest lands." Landowners assume "responsibility for managing the reforestation project based on an agreed-on project plan" and "forego ownership of any carbon offset credits to the Trust," while they can recover up to one hundred percent of the costs incurred and share some of the revenues from timber sales. *See* Climate Change Activities, *supra* note 151, at 12.

154. Stewart & Wiener, *supra* note 143, at 102.

C. An Examination of Design Issues of CO_2 (GHG) Emissions Trading or the Carbon Tax System with an Analysis of the Climate Stewardship Act of 2003 and the EU Emissions Trading Directive

1. Downstream or Upstream?

a. The Need for an Upstream Approach

One of the most important design issues is whether a cap-and-trade program or a carbon tax system should be structured as upstream or downstream, or as a combination of both. From a theoretical standpoint, an upstream cap-and-trade program (or its equivalent carbon tax system) that attempts to control CO_2 emissions at upper points entering into the economy, such as mine mouths, refineries, and natural gas pipelines, is most ideal for two reasons. First, an upstream program would be most effective in reducing GHG emissions because the program is expected to have economy-wide impacts.[155] In other words, industry would have to pass some of the increased costs of raw materials (or production factors) onto consumers. Therefore, it is highly likely that both producers and consumers would respond to changed price signals by turning to green products or clean energy technologies.

Second, since permit allocations (or tax assessments) can be made based on the carbon content of a fossil fuel (and the GWP of each of the non-CO_2 GHGs),[156] an upstream program would involve low administrative costs relative to other approaches. Government can easily monitor and verify GHG emissions by keeping track of fossil fuel inputs to the economy. Thus, given the large number of GHG emission sources and the infeasibility of imposing the requirement for continuous monitoring on all sources, an upstream program can significantly reduce administrative costs associated with monitoring, reporting, and verification.

On the other hand, a downstream approach is not a viable option because it is almost impossible to administer, given the sheer number of regulated sources.[157] Despite its superiority over a downstream approach, the overriding concern is that an upstream approach would face stronger political opposition than other approaches, because it could significantly reduce consumer surplus and

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155. Robert R. Nordhaus & Kyle W. Danish, *Designing a Mandatory Greenhouse Gas Reduction Program for the U.S.*, at iv (Prepared for the Pew Center on Global Climate Change, May 2003), *at* http://www.pewclimate.org/docUploads/USGas%2Epdf.

156. *Id.* at iii.

157. *Id.*

hurt the competitiveness of U.S. industry by "driv[ing] up the costs of [fossil fuels]."[158]

Morgenstern et al. analyzed the short-term economic impact of two different CO_2 reduction policies on 361 manufacturing industries: (1) an economy-wide policy such as a carbon tax or an upstream cap-and-trade program, and (2) a downstream policy covering the electricity industry only.[159] Running linear input-out modeling based on an extensive database of direct carbon use in the 361 manufacturing industries,[160] Morgenstern estimated short-term commodity price increases and both percentage and total production cost increases in response to a one-dollar increase in the price of a carbon permit (or a carbon tax rate) on a per-ton basis.[161]

The essence of Morgenstern's findings was that cost impact would be quite uneven from industry to industry because of significant variations in production factors (energy inputs). Under an economy-wide program, price changes vary by two orders of magnitude among 361 manufacturing industries.[162] The top eight hardest-hit industries would bear more than one-half of the total burden when measured as the cumulative percentage of total cost.[163]

The cost impact analysis of the electricity-only policy looked into increases in electricity prices as well as those in intermediary product prices caused by electricity price increases.[164] The result was that the effects of the economy-wide and electricity-only policies on manufacturing industries would be substantially different. Nine of the ten hardest-hit industries ranked lower under the economy-wide policy than under the electricity-only policy.[165] Eight of the ten hardest-hit industries under the economy-wide policy ranked lower under the

158. *Id.*

159. RICHARD D. MORGENSTERN ET AL., RESOURCES FOR THE FUTURE, DISCUSSION PAPER NO. 02-06, NEAR TERM IMPACTS OF CARBON MITIGATION POLICIES ON MANUFACTURING INDUSTRIES 3 (Mar. 2002), *at* http://www.rff.org/Documents/RFF-DP-02-06.pdf.

160. *See id.* at 3–10.

161. *Id.* at 10, 12. Morgenstern and other researchers calculated production costs, taking into account costs relating to purchased electricity, direct combustion of fossil fuels, and non-energy intermediate inputs. *Id.* at 10. However, the researchers did not consider how a future cap-and-trade or carbon tax program would treat the use of chemical feedstocks in emissions calculations. *Id.* at 10 n.11.

162. *Id.* at 11.

163. *Id.* at 15–16, tbl. 2 and 17, fig. 1. These industries include petroleum refineries, products of petroleum and coal, lubricating oils and greases, carbon black, asphalt paving mixtures and blocks, lime, nitrogenous and phosphatic fertilizers, and asphalt felts and coatings. They make heavy use of petroleum as an intermediate raw material. *Id.* at 12, tbl. 1.

164. *Id.* at 21.

165. *See id.* at 22, tbl. 4.

electricity-only policy. Of these, the ranking of each of the five industries (petroleum refineries, products of petroleum and coal, lubricating oils and greases, asphalt paving mixtures and blocks, and asphalt felts and coatings) was significantly lower; the other three industries ranked the same (lime) or somewhat lower (carbon black, and nitrogenous and phosphatic fertilizers).[166] The researchers considered only price changes, but neither welfare impacts nor production factor substitution and technological changes, which could take place in the long term in response to cost changes.[167]

The study by Morgenstern et al. at least confirmed that industry has much at stake in how a future CO_2 reduction policy is designed. Unless expected uneven economic impact among industries is properly addressed by policy makers, any policy proposal is certain to face resistance from different industries depending on its design features.

Thus, a future upstream program should have the following features designed to address this concern: phase-in requirements; an allowance for early reduction credits; banking and borrowing, opt-in by clean sources, and credits claimed for GHG reductions induced by land-use and forestry activities; exclusion of certain sources with high compliance costs; "adjust[ments] for noncombustion uses of fossil fuel inputs...such as chemical feedstocks";[168] the grandfathering of some portions of the total allowances; and revenue recycling via auctioning or tax reform.

b. A "Large-Source" Downstream Approach and Its Variants

i. A pure large-source downstream approach

One variety of a downstream approach targets only major stationary sources for which well-established regulatory programs are already in place.[169] A four-pollutant bill, which would create a trading program covering SO_2, NO_X, mercury, and CO_2 emissions, represents such an approach; it covers only the electric utility industry and some large industrial boilers, the nation's largest sources of air emissions,

166. *See id.* The authors also compared the relative short- and long-term impacts of 21 industries sharing the same two-digit industry code. They concluded that short-term and long-term impacts would be roughly the same at the two-digit industry code level. *Id.* at 24, 25, tbl. 5. But they pointed out that the weighted mean of percentage cost increases at the two-digit code level hides big differences between four-digit industries within the same two-digit industry. *Id.* at 26, 27, fig. 3.

167. *Id.* at 24.

168. FISCHER ET AL., *supra* note 142, at 6.

169. Nordhaus & Danish, *supra* note 155, at 21-22.

including CO_2 emissions.[170] The bill would be more politically acceptable to the general public than an upstream program because it would not cause price spikes in energy-related products other than electricity.[171]

Four-pollutant trading has several advantages. The electric utility industry and federal and state governments have been accustomed to a cap-and-trade program. Ten years have passed since the SO_2 Acid Rain Program became effective. The OTC NO_X cap-and-trade program has been implemented in northeastern states.[172] Under the 1998 NO_X SIP call, the EPA-administered NO_X cap-and-trade program covering the eastern half of the nation took effect in the summer of 2004.[173] Recently, the EPA published final interstate air quality rules that would strengthen existing SO_2 and NO_X reduction requirements and bring mercury emissions from power plants under control.[174]

The preexisting CEMS monitoring network and electronic database systems can be used to implement CO_2 emissions trading without imposing significant additional costs on regulated utilities. Large industrial sources covered by the EPA's NBP have been in compliance with the same requirements as those for electric utilities under the SO_2 Acid Rain Program. The EPA operates "computerized tracking systems to emissions data for SO_2, NO_X, and CO_2 from electric [utilities]."[175] Additional CO_2 and mercury controls present opportunities to reduce emissions of other persistent air pollutants, including SO_2 and NO_X, in a cost-effective manner.[176] In short, four-pollutant trading is expected to bring positive air quality benefits with minimum cost.

Some of the large industrial sources, for which a relatively accurate GHG emissions inventory has been developed, can also be covered under a cap-and-trade program (or an equivalent carbon tax

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170. S. 556, 107th Cong. (2001), and S. 366, H.R. 2042, 108th Cong. (2003).

171. Nordhaus & Danish, *supra* note 155, at iv.

172. *See* OZONE TRANSP. COMM'N, EPA-430-R-03-900, NO_X BUDGET PROGRAM: 1999-2002 PROGRESS REPORT 5 (2003) [hereinafter OTC NO_X TRADING REPORT FOR 1999-2002]; EPA NBP REPORT FOR 2003, *supra* note 27, at 5.

173. *See supra* text accompanying note 27.

174. *See id.*

175. U.S. EPA, EPA-430-N-03-002, CLEAN AIR MARKETS UPDATE, Issue 4, Summer 2003, at 10 [hereinafter CLEAN AIR MARKETS UPDATE].

176. *See, e.g.*, U.S. EIA, SR/OIAF/2001-05, ANALYSIS OF STRATEGIES FOR REDUCING MULTIPLE EMISSIONS FROM ELECTRIC POWER PLANTS WITH ADVANCED TECHNOLOGY SCENARIOS 77, tbl. 30 (Oct. 2001), *available at* http://www.eia.doe.gov/oiaf/servicerpt/eppats/pdf/sroiaf(2001)05.pdf (estimating that when implemented combined with advanced energy efficiency measures, four-pollutant emissions trading legislation called the Clean Power Act (S. 556), as proposed in 2001 by Senators Jim Jeffords and Joseph Lieberman, would reduce net residential electricity bills per household by $42 per year in 2010 and $203 per year in 2020 when compared with the business-as-usual scenario).

program). The Climate Stewardship Act, proposed by Senators McCain and Lieberman,[177] and a recently issued EU Emissions Trading Directive each adopt a similar approach.[178] The Climate Stewardship Act covers large entities (including public agencies) with combined annual GHG emissions (CO_2, CH_4, and N_2O) of more than 10,000 metric tons of CO_2 equivalent in the electricity, industrial, and commercial sectors,[179] though it is unclear whether emissions should be aggregated at the facility level or at the company level.[180] The Act allows automobile manufacturers to receive tradeable emissions credits, provided they exceed applicable Corporate Average Fuel Economy (CAFE) standards by at least 20 percent.[181] The proposed Act does not provide an exact conversion factor whereby improvements in average fuel economy are translated into a certain number of GHG allowances; rather, the Act directs the Secretary of Transportation, in consultation with the EPA, to determine the conversion factor.[182]

Under the EU Directive, sources exceeding industry-specific production or capacity thresholds specified in the Directive in the following four sectors are covered in the Phase I program, which lasts from 2005 to 2007: (1) production and processing of iron and steel; (2) minerals industries including cement, glass, and ceramic production; (3) electricity and refineries; and (4) pulp and paper.[183] Each member nation has the broad discretion to employ whichever policy tools it chooses with regard to other source categories. The European Union may decide to include other sources in the EU-wide cap-and-trade program in Phase II or thereafter.[184]

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177. S. 139, 108th Cong. (2003), *available at* http://www.theorator.com/bills108/s139.html (last visited Feb. 1, 2006) [hereinafter Climate Stewardship Act].

178. Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (Oct. 25, 2003) [hereinafter EU Emissions Trading Directive].

179. Climate Stewardship Act, § 3(4), (8).

180. *See id.* § 3(7) ("The term 'facility' means a building, structure, or installation located on any [one] or more contiguous or adjacent properties of an entity in the United States.").

181. *Id.* § 313(a).

182. *Id.* § 313(b).

183. *See* EU Emissions Trading Directive, *supra* note 178, Annex I. The EU Directive uses the term "installations" instead of entities or sources. An installation is defined as "a stationary technical unit where one or more activities listed in Annex I are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution." *Id.* art. 3(e).

184. *Id.* art. 30, ¶ (2).

ii. A "sectoral hybrid" approach

The weakness with a downstream approach covering only large stationary sources is that under such an approach GHG emissions from other small sources remain unaddressed.[185] Hence, government needs to institute other regulatory programs targeting these sources. These programs include technology-based equipment or product efficiency standards.[186] This so-called "sectoral hybrid" approach could be feasible because it can "build[] on existing standards programs."[187] To be effective, it is necessary to cap emissions from new equipment and products because "product efficiency standards would not address the intensity of product use or the replacement rate of new products for old, less-efficient products," and would "create[] a bias that encourages uneconomic life extension of older, less efficient equipment."[188]

However, incorporating these sources into a cap-and-trade program could create "double-counting of emission reductions" and other administrative challenges.[189] Safeguards must be established to prevent double-counting and to encourage technological improvements. To bring about real benefits, the sectoral hybrid approach should be accompanied by the establishment of new efficiency standards stringent enough to induce energy conservation. This is an enormous task that will take a great deal of time and entail huge costs. Given that increases in energy prices are the most effective way of encouraging energy conservation by consumers, the upstream approach is the preferred policy option with regard to energy use in consumer products.

iii. A large-source downstream approach with upstream components

There can be a hybrid approach that has both downstream and upstream components. A hybrid approach is more complex to administer than an upstream approach or a pure large-source downstream approach because it must draw a distinction between downstream and upstream flows of fossil fuels, thereby requiring "more complex record keeping and enforcement," and because it must be carefully designed to counter leaking problems.[190]

Roughly speaking, the Climate Stewardship Act partially embodies this hybrid approach; refiners and importers of foreign

185. Nordhaus & Danish, *supra* note 155, at iv.
186. *Id.* at v–vi.
187. *Id.* at vi.
188. *Id.*; FISCHER ET AL., *supra* note 142, at 7.
189. Nordhaus & Danish, *supra* note 155, at vi.
190. FISCHER ET AL., *supra* note 142, at 6.

petroleum products to be used in the transportation sector are required to participate in a cap-and-trade program if they produce or import petroleum products that, when used in transportation, will emit over 10,000 metric tons of CO_2 equivalent, including HFCs, PFCs, or SF_6 emissions.[191] Therefore, despite the 10,000 metric ton ceiling, the Climate Stewardship Act expects to cover over 90 percent of CO_2 emissions and about 80 percent of all U.S. GHG emissions.[192] On the other hand, the EU Directive includes oil refineries as one of the covered industrial categories.[193] Combined CO_2 emissions of sources covered by the Directive are estimated to cover 46 percent of total EU CO_2 emissions.[194]

"The main distinguishing feature of the hybrid approach is that it could be used to allocate emissions permits to large sources of emissions, as was done in the SO_2 program."[195] Certainly, the hybrid approach will make permit allocation processes manageable when compared to the pure downstream approach. But the free allocation of CO_2 allowances to existing sources will put clean new sources at a competitive disadvantage because grandfathered allowances are essentially scarcity rents to existing sources.[196] Policy makers must pay special attention to this equity concern and its ramifications for environmental quality when choosing a main allocation method.

c. Conclusion

In summary, an upstream approach is superior to other approaches if it can properly address distributional impacts.[197] If a pure upstream approach does not overcome expected political opposition because of the approach's potential economy-wide impacts, the second-best approach is the hybrid approach. This approach primarily covers large industrial sources with supplemental features, such as inclusion of upstream components or product efficiency standards that are aimed at

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191. Climate Stewardship Act, §§ 3(4)(B), 311(a)(2)-(3).

192. SERGEY PALTSEV ET AL., REPORT NO. 97 OF MIT JOINT PROGRAM ON THE SCIENCE AND POLICY OF GLOBAL CHANGE, EMISSIONS TRADING TO REDUCE GREENHOUSE GAS EMISSIONS IN THE UNITED STATES: THE MCCAIN-LIEBERMAN PROPOSAL 2 (June 2003), *available at* http://www.rff.org/rff/Events/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=11549 [hereinafter MIT Study].

193. *See* EU Emissions Trading Directive, *supra* note 178, Annex I.

194. JOSEPH KRUGER & WILLIAM A. PIZER, RESOURCES FOR THE FUTURE, DISCUSSION PAPER NO. 04-24, THE EU EMISSIONS TRADING DIRECTIVE: OPPORTUNITIES AND POTENTIAL PITFALLS 4 (Apr. 2004), *available at* http://www.rff.org/rff/Documents/RFF-DP-04-24.pdf.

195. FISCHER ET AL., *supra* note 142, at 6.

196. *See id.* at 9.

197. Nordhaus & Danish, *supra* note 155, at iii- vi.

reducing energy use in consumer products.[198] If a cap-and-trade program is used instead of a carbon tax, its principal allowance allocation method should be revenue-raising auctioning based on the carbon content of fossil fuels. This is also true of a carbon tax. Implementation of a carbon tax program should accompany reductions in distortionary taxes on capital and labor.

If other GHGs are covered, the GWP of each of the regulated non-CO_2 GHGs can be used as the basis for allowance allocations. Whereas the EU Directive covers only CO_2 emissions during Phase I,[199] the Climate Stewardship Act takes the comprehensive approach, proposing to allocate GHG emissions allowances to large downstream sources and refiners or importers of foreign petroleum products whose combined annual GHG emissions exceed 10,000 metric tons of CO_2 equivalent. Therefore, the proposed Act converts other non-CO_2 emissions into a certain amount of GHG emissions using an internationally recognized index in which scientists estimate the relative ability of each of the five non-CO_2 GHGs to affect climate change. As will be discussed *infra* in Section C.3. of this part, a future GHG cap-and-trade program should also contain flexibility features such as banking and offsets in order to help the nation make the smooth transition to a less carbon-intensive society.

2. Allocation Methods: Auctioning or Grandfathering and Its Economic Impacts

a. Economic Studies of Allocation Methods

Burtraw et al. studied the cost-effectiveness and distributional impacts of each of the following three allocation methods in the electricity industry: (1) 100% auctioning; (2) 100% grandfathering; and (3) 100% free allocation based on each producer's market share, a so-called output-based generation performance standard (GPS).[200] Using the

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198. *Id.*

199. *See* EU Emissions Trading Directive, *supra* note 178.

200. DALLAS BURTRAW ET AL., RESOURCES FOR THE FUTURE DISCUSSION PAPER 01-30, THE EFFECT OF ALLOWANCE ALLOCATION ON THE COST OF CARBON EMISSION TRADING 11-12 (Aug. 2001), *available at* http://www.rff.org/rff/Documents/RFF-DP-01-30.pdf. Note that nuclear and hydro-electric power generators are excluded from consideration. *Id.* at 11. The GPS is implemented in three steps. First, the relevant authority calculates the amount of total allowable emissions. Second, it establishes the same emission rate that is applicable to all new and existing sources based on the source's actual electricity generation in a given year "by dividing the cap by the expected generation for that region over a set period of time." Third, it updates allowance allocations periodically, reflecting variations in each of the covered sources' market share of total net electricity generation over time. *See* Ellen Roy, *The Uniform Generation Performance Standard: Connecting Electric Industry Restructuring and Air Quality Improvement*, ELEC. J., Jan./Feb. 1998, at 57.

Haiku model developed by Resources for the Future, they found that 100% auctioning would be 50% more cost-effective than grandfathering or the GPS in terms of total social costs associated with CO_2 reductions.[201]

According to the study, auctioning would raise electricity prices the most but result in the lowest natural gas prices.[202] The GPS would minimize electricity price increases, but it would increase natural gas prices the most because of the highest demand for natural gas induced by GPS policy.[203] The lowest electricity prices result from increased electricity generation because the GPS functions as an output subsidy by rewarding more productive energy sources.[204]

At first blush, it seems that the GPS would be preferable, since it would favor more energy-efficient—hence cleaner—fossil fuel combustion technologies such as combined-cycle gas turbines, in addition to bringing lower electricity prices. However, Burtraw et al. found that it would be less cost-effective than the auctioning approach. The main reason is that the benefits derived from the GPS would not be as great: it "amplifies" existing distortions in current electricity markets resulting from rate regulation and inefficient pricing, thus raising total economic cost.[205] For instance, low electricity prices result in reduced profits and thereby "erode[] the value of existing assets."[206]

In terms of price impact, grandfathering is in the middle between the GPS and full auctioning, with modest price increases in both electricity and natural gas.[207] But grandfathering would greatly reduce consumer surplus and increase producer surplus by substantially increasing profits and asset values, because it constitutes "a substantial transfer of wealth to producers from consumers."[208]

Burtraw et al. concluded that the auctioning approach represents the most cost-effective allocation method; consumers benefit from price discounts in the form of lump-sum annual payments when auction revenue is recycled.[209] In their discussion of the double dividend effect and revenue neutrality, the researchers pointed out that the costs of the auctioning policy would be significantly reduced when combined with reductions in other distortionary taxes.[210] They also suggested that a

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201. BURTRAW ET AL., *supra* note 200, at 28.
202. *Id.*
203. *Id.*
204. *Id.* at 28–29.
205. *Id.* at 29.
206. *Id.* at 30.
207. *Id.* at 28.
208. *Id.* at 29.
209. *Id.* at 30.
210. *Id.* at 29.

portion of the revenue could be used to compensate producers, which implies that auctioning can be phased-in over time, beginning as partial grandfathering combined with GPS initially and "culminating in an auction of all allowances in future years."[211] Furthermore, some of the revenue, or "direct allocation of some allowances, could be directed to finance energy conservation and other benefit programs."[212]

In short, auctioning has several important institutional features that provide maximum flexibility to policy makers while creating an additional revenue stream.[213] Finally, Burtraw et al. observed that major findings in their study would be applicable to other industrial sectors, and that "[the electricity sector] would be expected to contribute two-thirds to three-quarters of the emission reductions" under a cost-effective economy-wide policy.[214]

In another study, Professor Lawrence Goulder found that a carbon tax or CO_2 emissions trading could effectively level costs to industry if a small portion of the revenue collected is returned to some of the hardest-hit upstream industries. At the outset, Goulder noted that grandfathering would have the effect of creating an uneven playing field; downstream users of carbon-containing fossil fuels would bear much more severe burdens than regulated upstream industries, which in some cases benefit from increased profits.[215] This is because most of the cost increases are expected to pass through to downstream industries and consumers.[216] Thus, he argued either for auctioning as the primary method of permit allocation in emissions trading or for a carbon tax system without tax exemptions, whose revenue should be recycled to consumers and the most vulnerable firms to cut labor and corporate taxes.[217]

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211. *Id.* at 30.

212. *Id.*

213. *Id.*

214. *Id.*

215. LAWRENCE H. GOULDER, RESOURCES FOR THE FUTURE DISCUSSION PAPER 02-22, MITIGATING THE ADVERSE IMPACTS OF CO_2 ABATEMENT POLICIES ON ENERGY-INTENSIVE INDUSTRIES 2 (Mar. 2002), *available at* http://www.rff.org/Documents/RFF-DP-02-22.pdf (last visited Nov. 9, 2005) [hereinafter GOULDER I] ("By compelling fossil fuel suppliers to restrict their outputs, the government effectively causes firms to behave like a cartel, leading to higher prices and the potential for excess profit"); *see also id.* at 18 and tbl. 3 (projecting an increase in equity values by a factor of seven).

216. LAWRENCE H. GOULDER, RESOURCES FOR THE FUTURE CLIMATE ISSUES BRIEF NO. 23, CONFRONTING THE ADVERSE INDUSTRY IMPACTS OF CO_2 ABATEMENT POLICIES: WHAT DOES IT COST? 3 (Sept. 2000), *available at* http://www.rff.org/rff/Documents/RFF-CCIB-23.pdf [hereinafter GOULDER II].

217. GOULDER I, *supra* note 215, at 5–7.

Goulder, along with a Dutch researcher named Bovenberg, concluded that a partial grandfathering regime would absorb most of the potential profit losses if only 13 percent of the total revenue were returned to most affected industries based on fossil fuel usage in the form of partial free permit allocation, tax exemptions, or reduced corporate taxes, with resultant cost increases constituting only a small portion of the potential revenue.[218] In arriving at this conclusion, Goulder divided U.S. industry into 13 sectors and estimated changes in after-tax profits between 2002 and 2025 under ten different scenarios (from A1 to C4).[219] These scenarios included repayments to households in the form of either lump-sum annual payments or marginal rate reductions in personal income tax with no revenue recycling to industries, 100% auctioning, 100% grandfathering, partial grandfathering, and carbon taxes combined with corporate tax credits.[220] A $25 per metric ton of carbon tax was used as the basis for calculating cost change.[221]

The study found that coal mining, petroleum refining, electric utilities, oil and gas, and metals and machinery would be most adversely affected by a 100% auctioning policy that does not provide for partial compensation.[222] Lowered marginal personal income tax rates would be economically more efficient than annual lump-sum rebates, as the former would minimize "the distortionary costs of the personal income tax" more effectively.[223] Free allocation of only 13 percent of permits would raise overall economic costs by only 7.4% relative to total cost under 100% auctioning, while offsetting most of the profit losses in these industries.[224] This finding was in a stark contrast to an estimated 87% cost increase under the 100% grandfathering scenario.[225]

Goulder found that a carbon tax system combined with corporate tax credits in the form of lump-sum payments, rather than reductions in marginal corporate tax rates, would increase the efficiency cost of a no-compensation scheme by 1.5% in the coal and oil and gas industries, and by 0.3% when considering only petroleum refining, electric utilities, and metals and machinery.[226]

218. *Id.* at 2.
219. *See id.* tbl. 1.
220. *Id.* at 4–5.
221. *Id.* at 4.
222. *See id.* at 18 and tbls. 1 & 3.
223. *Id.* at 14–15 & tbl. 4.
224. *Id.* at 16.
225. *Id.* at 18 and tbl. 4.
226. *Id.* at 18.

The main reason why efficiency losses from corporate tax reductions are relatively small is two-fold. First, the corporate tax has greater distortionary effects than the personal income tax.[227] Second, it is expected that most of the cost increases would be shifted to downstream industries, but these costs would then be passed down to the consumer.[228] Goulder did not consider labor impacts[229] or compensation schemes for preventing potential profit losses in other industries, though he observed that the amount of required revenues would be small as well.[230]

To summarize, the studies discussed above demonstrate three important issues. First, grandfathering constitutes "scarcity rents" to upstream industries. Second, auctioning (or its carbon tax equivalent) is the most efficient way of burden spreading, since revenue recycling can solve both economic efficiency and distributional equity issues most effectively. Third, by adopting a partial grandfathering scheme (or a carbon tax system combined with corporate tax credits), auctioning (or its carbon tax equivalent) can minimize short-term cost impact on carbon-intensive industries while slightly impacting the program's performance, foregoing only a very small percentage of its revenue.

b. The Dominant Use of Grandfathering

Despite its theoretical superiority, auctioning has never been used in a revenue raising manner anywhere in the world. Instead, grandfathering has persisted as the dominant allocation method. The EU Directive provides that up to five percent of allowances may be auctioned during the first commitment period (and up to ten percent during the second phase).[231] The Climate Stewardship Act proposes the establishment of an emissions cap, which is to be reduced in two phases. During Phase I, which runs from 2010 through 2015, the emissions cap is to be 5,896 million metric tons of CO_2 equivalent; after that period, it is to be reduced to 5,123 million metric tons of CO_2 equivalent.[232] These emissions caps include the amount of actual emissions of non-covered sources in 2000 and in 1990, respectively, in reference to the EPA's 2002 GHG emissions inventory.[233] One tradeable allowance must be held for

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227. GOULDER II, *supra* note 216, at 10.
228. GOULDER I, *supra* note 215, at 18.
229. GOULDER II, *supra* note 216, at 12 (estimating that $2.8 billon would be needed for labor compensation relative to $15 billon required to compensate capital owners).
230. GOULDER I, *supra* note 215, at 19.
231. EU Emissions Trading Directive, *supra* note 178, art. 10.
232. Climate Stewardship Act § 331(a).
233. *Id.*

every metric ton of CO_2 equivalent emitted.[234] Covered petroleum refiners or importers must submit one allowance for every unit of petroleum product they sell for use in the transportation sector that will ultimately emit one metric ton of CO_2 equivalent.[235]

Of total allowances, the maximum number of allowances held by a covered sector is to be equal to its baseline emissions in 1990 and in 2000, during Phase I and Phase II, respectively, based on the EPA's 2002 GHG emissions inventory.[236] The allowable emissions of each entity within the same covered sector are to be equal to its share of the total sectoral emissions in the year preceding the passage of the Act.[237] Hence, the emissions reduction target set by the Act shows that it aims to achieve the GHG stabilization goal under the UNFCCC. In addition, the Act provides for a two-year review of the number of allowances to determine whether it continues to be consistent with the objectives of the UNFCCC, without specifying what action needs to be taken if the number of allowances is found to be inconsistent.[238]

The Climate Stewardship Act provides for a rather complex process of partial auctioning and partial grandfathering essentially comprised of three steps. First, based on six guiding principles,[239] the Secretary of Commerce is directed to apportion allowances between covered sectors for free allocation by the EPA, covered entities claiming early reduction credits, and a Climate Change Credit Corporation for auction,[240] which is to be established as a not-for-profit federal entity.[241]

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234. *Id.* § 311(a)(1).
235. *Id.* § 311(a)(3).
236. *Id.* § 331(a).
237. *Id.* § 3(11)-(12).
238. *Id.* § 336.
239. The Secretary of Commerce shall consider the following six factors:

> (1) the distributive effect of the allocations on household income and net worth of individuals; (2) the impact of the allocations on corporate income, taxes, and asset value; (3) the impact of the allocations on income levels of consumers and on their energy consumption; (4) the effects of the allocations in terms of economic efficiency; (5) the ability of covered entities to pass through compliance costs to their customers; and (6) the degree to which the amount of allocations to the covered sectors should decrease over time.

Id. § 332(b).

240. *Id.* §§ 332(a), 3(11)-(12).
241. Section 351 provides that "[t]he Corporation shall not be considered to be an agency or establishment of the United States Government." *Id.* § 351(a).

> Of the five members comprising the board of directors: No more than [three] members of the board serving at any time may be affiliated with the same political party. The members of the board shall be appointed by the President of the United States, by and with the advice and consent of the Senate and shall serve for terms of [five] years.

But an exact ratio of each category of allowances is unknown. Second, the EPA is then required to allocate allowances to each covered sector and the Climate Change Credit Corporation,[242] with a percentage of allowances going to early reduction units. Third, the EPA distributes allowances to covered entities within the same group, and the Climate Change Credit Corporation auctions off its allocated allowances.[243]

Although the Climate Change Credit Corporation is authorized to administer auctions,[244] it does not remain as the mere auctioneer. It may also purchase allowances and sell them to any natural or legal person in the secondary trading market, but it is prohibited from permanently retiring unused allowances.[245] The Act does not require the Corporation to dispose of all the allowances it holds during any specific compliance period. The Corporation is directed to use the proceeds of allowance trading and auctions to reduce costs to consumers, which would increase as a result of implementation of the Act's GHG reduction requirements. The Corporation is further directed to distribute the proceeds to the extent possible among all regions of the nation in an equitable manner and consider the hardships of low-income families particularly.[246]

The Act illustrates possible methods of financial assistance but does not express a preference or state what mix of methods should be used.[247] It specifically provides for transition assistance to dislocated workers and communities[248] and establishes a specified percentage of the total proceeds to be used for financial assistance purposes, starting at 20 percent in 2010 and declining by two percent each year after that; however, it may not reach zero.[249]

The text of the Act is silent on various allocation-related issues and does not make clear the precise method for recycling auction

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Id. § 351(c).

242. *Id.* § 333(a).

243. The EPA is required to consider the following factors:

> (1) encourage investments that increase the efficiency of the processes that produce greenhouse gas emissions; (2) minimize the costs to the government of allocating the tradeable allowances; (3) not penalize a covered entity for registered emissions reductions made before 2010; and (4) provide sufficient allocation for new entrants into the sector.

Id. § 333(b).

244. Actually, the Act does not use the term "auctions."

245. *Id.* § 352(a).

246. *Id.* §§ 352(b)(1)(B)-(C).

247. *Id.* § 352(b)(1)(A) ("buy-down, subsidy, negotiation of discounts, consumer rebates, or otherwise").

248. *Id.* § 352(b)(2).

249. *Id.* § 352(b)(3).

revenue. It merely delegates the authority to allocate allowances to the executive branch. Thus, there is no way to predict what role the Climate Change Credit Corporation might play in promoting GHG reductions and addressing distributional equity issues.

It appears that financial assistance can be characterized as a transition subsidy rather than as a method of revenue cycling, given that the six guiding principles do not specifically mention the double dividend effect that economists argue revenue recycling generates. This implies that the administrative process would restrict the use of auctioning as a primary allocation method and hence prevent its full potential for enhancing economic efficiency. If that is the case, the Act would function as a de facto grandfathering scheme.

3. Flexibility Features of Emissions Trading

The following features of emissions trading offer maximum flexibility to regulated firms, make possible a smooth transition, and reduce short-term compliance costs: early reduction credits, banking and borrowing, opt-in, and offsets. At the same time, their successful implementation contributes to the accomplishment of both short- and long-term environmental goals by giving firms financial incentives to reduce pollution beyond the required levels.

a. Early Reduction Credits, Banking, and Borrowing

i. Early reduction credits

Early reduction credits differ from banking in that the credits could be claimed for early reductions of pollutants before the compliance period actually begins. The recognition of early reduction credits is especially valuable in the inter-temporal context of climate change. One ton of carbon reduction today has the same effect as it would have in future years. In view of the fact that most GHGs have a very long residence time once emitted, recognition of early reduction credits would bring more environmental benefits.

The success of a climate stabilization policy requires technological solutions and pursuit of sustainable energy development, both of which take considerable time to materialize. As implementation of GHG reduction activity is delayed, its benefits become smaller and compliance costs increase. Allowing for early reduction credits eliminates regulatory uncertainty, induces regulated firms to pursue low-cost reduction opportunities early on, and provides them with lead time to achieve environmental comparability by making adjustments to production processes through experimentation and innovation. In this way, it can reduce overall social costs of GHG reductions.

Implementation of early reduction programs could raise credibility issues, however. To ensure that claimed early reductions reflect real progress, government must establish a reliable verification program.

The Kyoto Protocol does not allow the use of early reduction credits, except in the CDM context.[250] Under the Climate Stewardship Act, a covered entity can request that the EPA allocate allowances for emissions reductions registered with the national GHG database prior to Phase I for its use in the current year during any compliance period.[251] Non-covered entities may also opt to register early GHG reductions.[252] Entities can also claim allowances for actual emissions reductions if they contribute to a net increase in carbon sequestration capability outside their facilities.[253]

The proposed Act provides for another mechanism designed to encourage early action. If a covered entity carries out a voluntary agreement with the EPA under which it agrees to cut its GHG emissions to 1990 levels by 2010, it is entitled to receive bonus allowances.[254] Early action allowances are completely fungible. Thus, they can be sold to other entities or banked for future use without being subject to any restrictions.

Notably, the Act requires that the emissions cap not change. Allowances awarded for early action increase the number of allowances that can be allocated to early reduction units while reducing the total number of allowances available to other covered units. It should be noted, however, that there is uncertainty about the total size of early action credits, since it is to be determined by the Secretary of Commerce. If most of the registered early reductions are automatically translated into allowances for use in subsequent years, early action incentives would work successfully as intended, because covered entities will engage in reduction activities prior to Phase I in hopes of getting a larger allocation.[255]

Early reduction credits can be claimed for emissions reductions achieved after 1990. Therefore, early action programs favor entities whose historical emissions have declined for reasons other than sincere

250. All CDM projects that began prior to the year 2000 may obtain CERs if they are submitted for registration to the Executive Board before December 31, 2005, and the crediting period may start prior to the date of registration but not earlier than January 1, 2000. *See* Marrakesh Accords, *supra* note 20, Add., pt. 2, vol. II, at 23.

251. Climate Stewardship Act, §§ 334(1)(B), 334(2).

252. *Id.* § 203(a)(2).

253. *Id.* § 203(c)(2)(B)(ii).

254. *Id.* § 335(a).

255. *See* MIT Study, *supra* note 192, at 8.

reduction efforts.[256] If both covered and uncovered entities, for which reliable historical emissions data do not exist, were allowed to obtain early reduction credits under generous government policy, claimed reductions would not reflect real environmental benefits.

The Climate Stewardship Act imposes voluntary reporting requirements on entities that apply to receive early action credits. Entities are required to submit to the EPA an annual emissions report beginning in any preceding calendar year before the specified date.[257] They must submit to the EPA, for inclusion in the registry, all information on any entity-wide emissions reduction activities, including detailed information about any project or activity that has allegedly resulted in entity-wide GHG emissions reductions or actual increases in net sequestration outside their facilities.[258]

All information must be reported in accordance with measurement and verification methods and standards to be developed by the EPA under the Act[259] and must be verified by the EPA to make sure that claimed reductions reflect actual progress. The amount of reduced GHG emissions must be determined relative to the applying entity's historical emissions after accounting for any increases in "indirect emissions from imported electricity, heat, and steam" and actual increases in net sequestration.[260] Entities may either "obtain independent third-party verification" or "present the results of the third-party verification" to the EPA for approval.[261]

It does not appear that early reduction programs under the Act contain significant loopholes. As pointed out above, credibility issues may or may not arise, depending on the EPA's generosity in approval of early reduction credits. If the EPA applies strict rules in the verification process, it is expected that early action may be deterred, especially on the part of non-covered entities.

ii. Banking and Borrowing

Under the SO_2 Acid Rain Program, banking of early reduction credits resulted in over-compliance by a wide margin during Phase I.[262] Emissions of SO_2 from Phase II units have exceeded annual allowance

256. *Id.*
257. Climate Stewardship Act, § 203(a)–(c).
258. *Id.* § 203(c)(2)(B)(i)–(ii).
259. *Id.* § 203(c)(3).
260. *Id.* §§ 203(c)(1)(C)(i), 203(c)(3).
261. *Id.* § 203(c)(5).
262. *See supra* text accompanying note 78.

allocations as electric utilities have begun to use banked allowances.[263] But the actual SO_2 emissions have been much lower than total allowable emissions and, most importantly, have continued to decline over time.[264] Concerns about hot spots have not been realized thus far.[265] This indicates that banking encourages continuous reductions by regulated firms that want to cushion against permit violations in future years, and that early compliance makes it possible for firms to find low-cost

263. U.S. ENVT'L PROT. AGENCY, EPA-430-R-04-009, ACID RAIN PROGRAM: 2003 PROGRESS REPORT 4, fig. 2 (2004).

264. *See id.*

265. Several studies also confirmed that allowance trading has served to cool, rather than create, hot spots, mainly because largest emissions reductions have come from the highest emissions sources. *See, e.g.*, Byron Swift, *Allowance Trading and SO_2 Hot Spots – Good News from the Acid Rain Program*, 31 ENV'T REP. 954 (2000); A. DENNY ELLERMAN, MIT'S CTR. FOR ENERGY & ENVTL. POLICY RESEARCH, WORKING PAPER NO. 2003-015,ARE CAP-AND-TRADE PROGRAMS MORE ENVIRONMENTALLY EFFECTIVE THAN CONVENTIONAL REGULATION? (2003), *available at* http://web.mit.edu/ceepr/www/2003-015.pdf. According to the EPA's own analysis of trading patterns during Phase I, most activities took place within the approximately 200-mile radius. U.S. EPA, GIS Analysis: Geographic Mean Centers of SO_2 Allowance Trading Activity 1995-1999: Plants Acquiring Allowance for Compliance, Beyond Each Year's Allocation; Plants Supplying these Allowances, (Oct. 28, 2002), *at* http://www.epa.gov/airmarket/cmap/trading.html. Byron Swift recently concluded that the SO_2 allowance allocation method based on historical heat input, not on historical emissions, may help partly explain why disproportionately significant reductions have been achieved by midwestern sources, since it "results in dirty plants receiving far fewer allowances in comparison to their past emissions than cleaner plants of a similar size." Byron Swift, *Emissions Trading and Hot Spots: A Review of the Major Programs*, 35 ENV'T REP. 1020, 1035 (2004). The OTC made a similar finding with regard to its NO_x cap-and-trade program. After analyzing changes in average and peak daily NO_x emissions from CAA Title IV units in the region and in ambient NO_x levels on the days with the highest emissions from these units before and after implementation of the trading program, the OTC preliminarily concluded that NO_x trading did not seem to have contributed to creating hot spots. OTC NO_x TRADING REPORT FOR 1999-2002, *supra* note 172, at 8. Consistent with the conclusion of the OTC's progress report, the EPA's progress report analyzing the performance of its NBP in participating states also confirmed that NO_x trading did not create temporal spikes in NO_x emissions, observing that the emissions trend in OTC states from 1997 through 2003 showed that "a seasonal trading program [could] reduce peak daily emission levels" as well as average daily emissions. EPA NBP REPORT FOR 2003, *supra* note 27, at 13-14. Because excessive banking could create localized hot spots in urban areas, the "progressive flow control" mechanism has been used to deter over-reliance by sources on banking of unused allowances under both the OTC NO_x cap-and-trade program and the EPA's NBP. Progressive flow control is triggered when the total number of banked allowances from all sources exceeds ten percent of the annual regional NO_x budget for the next compliance period. *See* OTC NO_x CAP-AND-TRADE MODEL RULE, *supra* note 27, at 20. Once it is triggered, a flow control ratio is calculated by dividing ten percent of the annual budget by the number of all banked allowances. *Id.* at 21. The resultant flow control ratio then applies to all sources with banked allowances. In other words, the ratio indicates the percentage of banked allowances that can be used at a one-for-one ratio; the remaining percentage indicates the number of banked allowances that can be used at a two-for-one ratio in the next compliance period. *Id.*

compliance options for pollution reductions without significantly restricting output. Banking of GHG reductions does not create "hot spots" because climate change is not a local phenomenon. The possibility of increased emissions in subsequent years can be effectively dealt with by making periodical downward adjustments to the emissions cap.

The non-availability of feasible post-combustion controls on GHG emissions means that climate policy actually constitutes restrictions on production output. Banking allows firms to increase emissions in response to short-term high demand in the marketplace. It "improve[s] efficiency when regulatory targets are such that marginal control cost is rising over time faster than the relevant rate of interest."[266] Therefore, "[u]nder these circumstances, some [allowances] are more valuable when used to offset future abatement costs than if they are used today."[267]

Borrowing adds flexibility to implementation of the emissions trading program. Borrowing allows for long-term investments in technological innovation without "excessive capital obsolescence," considering the fact that "the composition of energy-using capital is more flexible in the longer term than in the shorter term, and [that] tougher short-term requirements provide relatively less opportunity to embed technical improvements over time."[268] If it turns out that technological solutions to GHG reductions cannot be developed in the near term, borrowing would function as a buffer against price volatility in the GHG allowance trading market.

One of the criticisms of borrowing is that it can "retard some induced innovation and learning-by-doing" anticipated to take place in the near future "by lowering energy prices below what would have occurred with tighter standards."[269] This concern would not materialize if more stringent requirements are phased-in in a timely manner and if some of the revenue produced from implementation of the borrowing program is directed to support research and development activity.

Under the EU Directive, each member nation has the discretion to decide whether and how banking and borrowing will be permitted. It may prohibit the use of banking in the first compliance period (from 2005 to 2007) but is required to allow banking beginning in the second

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266. CAROLYN FISCHER, SUZI KERR & MICHAEL TOMAN, RESOURCES FOR THE FUTURE CLIMATE ISSUE BRIEF NO. 11, USING EMISSIONS TRADING TO REGULATE U.S. GREENHOUSE GAS EMISSIONS: ADDITIONAL POLICY DESIGN AND IMPLEMENTATION ISSUES 5 (June 1998), *available at* http://www.rff.org/rff/Documents/RFF-CCIB-11.pdf.

267. *Id.*

268. *Id.*

269. *See id.* at 6.

period, which corresponds to the first commitment period under the Kyoto Protocol.[270]

The Climate Stewardship Act allows unlimited banking[271] and limited borrowing. A covered entity can borrow future allowances based on "anticipated reductions in emissions in a future calendar year."[272] The Act authorizes the EPA Administrator to borrow credits in reliance on an entity's promise of anticipated emissions reductions that:

> (1) are attributable to the realization of capital investments in equipment, the construction, reconstruction, or acquisition of facilities, or the deployment of new technologies—
> (A) for which the covered entity has executed a binding contract and secured, or applied for, all necessary permits and operating or implementation authority;
> (B) that will not become operational within the current calendar year; and
> (C) that will become operational and begin to reduce emissions from the covered source within [five] years after the year in which the [borrowed] credit is used; and
> (2) will be realized within [five] years after the year in which the credit is used.[273]

A ten-percent annual interest rate is applied to each credit until the year the reduction is actually made,[274] and the maximum borrowing period is limited to five years.[275] If the covered entity fails to achieve the promised reductions, its allowance requirements must be increased by the amount of borrowed credits, plus borrowing costs, and it is barred from using any borrowed credits to meet the increased purchase requirements.[276]

The Act's borrowing program is well designed to induce emissions reductions in time and to prevent delays in compliance with reduction requirements. There is a high possibility that the program's highly prescriptive nature would lead to underutilization, because industry will consider the Act's borrowing requirements burdensome. But this cannot be described as a significant design flaw and is not likely

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270. *See* EU Emissions Trading Directive, *supra* note 178, art. 13 and pmbl. ¶ (9).
271. Climate Stewardship Act, § 315(d).
272. *Id.* § 314(a).
273. *Id.* § 314(b).
274. *Id.* § 314(c).
275. *Id.* § 314(d).
276. *Id.* § 314(e).

to increase compliance costs since covered entities can significantly reduce short- and long-term costs using other features of the Act's emissions trading program, including unlimited banking and international emissions trading.

b. Opt-In Requirements: Promises and Pitfalls—The Need for Sophisticated Monitoring Requirements

Opt-in allows non-covered units to voluntarily participate in emissions trading. Thus, compliance costs to covered units may be reduced if the number of opt-in units is large enough to have a wide cost-spreading effect. It can also induce faster improvements in environmental quality over the long run as more and more units choose to comply with reduction requirements.

The experience with the SO_2 Acid Rain Program teaches us that the problem of strategic arbitrage or high transaction costs must be prevented to ensure the successful implementation of an opt-in program. The major beneficiaries of the opt-in program were large electric utilities. Many electric utilities obtained extra allowances for the emissions reductions made in opt-in units or permanently retired units under their control.[277] While these claimed reductions have had a minimal impact on emissions increases exceeding the statutory cap during Phase II,[278] they appear to have suppressed allowance prices by creating an oversupply of tradeable allowances in the first several years of Phase I.

On the other hand, the participation of industrial cogeneration units and small electric utilities has been low. Industrial facilities have abstained from opting-in to the SO_2 allowance trading program due to high costs involving the establishment of baseline emissions levels and the installation and maintenance of the CEMS.[279] In the case of small utilities, the "thermal energy" requirement has prohibited them from selling unused allowances after shutting down some of the old units within their control.[280] While it is designed to prevent leakage, the

277. A. Denny Ellerman et al., *Emissions Trading in the U.S.: Experience, Lessons, and Considerations for Greenhouse Gases* 19 (prepared for the Pew Center on Global Climate Change, May 2003), *available at* http://www.pewclimate.org/docUploads/emissions%5Ftrading%2Epdf.

278. *Id.* (stating that "'anyway emissions reductions' accounted for less than two percent of total emissions over the first ten-year period of Phase II").

279. *Id.* at 18-19.

280. *See* 42 U.S.C. § 7651i(f) (2000); 40 C.F.R. § 72.2 (2005) (defining thermal energy as "the thermal output produced by a combustion source used directly as part of a manufacturing process but not used to produce electricity"). *See also* Am. Mun. Power-Ohio v. EPA, 98 F.3d 1372, 1373 (D.C. Cir. 1996) (upholding the EPA's regulatory definition of thermal energy).

requirement has discouraged the participation of small municipal utilities because they would have to purchase allowances for use in new units in the trading market if they retire old units after opting-in.

In short, an opt-in program creates trade-offs. It allows large covered sources, for which a real-time monitoring system is already in place or whose emissions can be easily monitored without incurring significant costs, to easily spread costs at the company level; however, allowances claimed for emissions reductions taking place in their opt-in units may not represent real improvements in environmental quality. In essence, they are nothing but free rents to these sources. On the other hand, while it is certainly true that a careful case-by-case certification should be required of opt-in units owned by small sources in order to prevent the problem of paper credits and possible emission increases in their non-opt-in units, stringent enforcement discourages voluntary participation by these units.[281] More simple and flexible rules need to be developed to reduce these tradeoffs to a minimum.

The EU Directive does not contain opt-in features, largely because each member nation can freely implement a national opt-in program within its borders. Under the Climate Stewardship Act, an uncovered entity may opt-in to the system and, if it chooses to do so, is required to comply with monitoring, reporting, and verification requirements applicable to other covered units.

The proposed Act requires that, "[n]ot later than July 1st of each calendar year beginning more than [two] years after the date of enactment," each entity, including both covered and opt-in units, must submit to the EPA an annual emissions report showing its entity-wide GHG emissions in the preceding calendar year at the facility level. Every participating entity must record and report all relevant GHG emissions, which include (1) "indirect emissions from imported electricity, heat, and steam"; (2) "process and fugitive emissions"; and (3) "production or importation of greenhouse gases," "as the Administrator determines ...may be practicable and useful for the purposes of this Act."[282]

Monitoring and verification rules are to be issued by the Secretary of Commerce "not later than [one] year after the date of enactment," and should mandate the use of a continuous monitoring system or any other equivalent system that "is determined by the Secretary to provide information with the same precision, reliability, accessibility, and timeliness as a continuous emissions monitoring

281. Ellerman et al., *supra* note 277, at 20.
282. Climate Stewardship Act, § 203(c)(1) (2003).

system provides."[283] Furthermore, the Climate Stewardship Act directs the Secretary of Commerce to establish

> standardized measurement and verification practices for reports made by all entities participating in the registry, taking into account: (i) protocols and standards in use by entities desiring to participate in the registry as of the date of development of the methods and standards...; (ii) boundary issues, such as leakage and shifted use; (iii) avoidance of double counting of greenhouse gas emissions and emission reductions; (iv) protocols to prevent a covered entity from avoiding the requirements of this Act by reorganization into multiple entities that are under common control; and (v) such other factors as the Secretary, in consultation with the [EPA] Administrator, determines to be appropriate.[284]

The EU Directive makes the use of continuous emissions monitoring optional and allows member nations and covered sectors to choose emissions factors whose application is "coupled with fuel use or production data to calculate their emissions."[285] The Directive requires that each permit shall contain "monitoring requirements, specifying monitoring methodology and frequency."[286] Emissions calculations must consider activity data, emissions factors, and oxidation factors.[287] "Default [emissions] factors are acceptable for all fuels except for non-commercial ones." For refinery products, IPCC default values may be used.[288] Default oxidation factors developed under the relevant EU directive should be used, "unless the operator can demonstrate that activity-specific factors are more accurate."[289] An additional oxidation factor must be used "if the [applicable] emissions factor does not take account of the fact that some of the carbon is not oxidised."[290] In principle, emissions calculations must be made "for each activity, installation, and for each fuel."[291]

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283. *Id.* § 204(a)(1)-(a)(2)(A).
284. *Id.* § 204(a)(2)(B).
285. KRUGER & PIZER, *supra* note 194, at 5.
286. EU Emissions Trading Directive, *supra* note 178, art. 6, ¶ 2(c).
287. The following equation should be used: total CO_2 emissions = activity data x emission factor x oxidation factor. *Id.* Annex IV.
288. *Id.*
289. *Id.*
290. *Id.*
291. *Id.*

The proposed EU guidance on monitoring procedures provides for "different 'tiers' of methodologies with different degrees of assumed accuracy."[292] The highest tier methodology for "general combustion activities," such as direct fossil fuel combustion, allows only a maximum permissible uncertainty of plus or minus one percent.[293] Higher tiers generally require a facility-specific emissions factor to be used "for the batch of fuel for which it was intended to be representative."[294] On the other hand, the lowest tier methodology permits the use of standardized, general emissions factors listed in the appendix of the guidance, allowing a maximum permissible uncertainty of plus or minus 7.5 percent.[295]

The chosen tier methodology must reflect maximum accuracy that is "technically feasible and does not lead to unreasonably high costs."[296] "The monitoring methodology shall be changed if this improves the accuracy of the reported data, unless this is technically not feasible or will lead to unreasonably high costs."[297] Under the proposed guidance, covered sources may propose facility-specific methodologies to the competent national authority. The operator of a covered source may petition to use the next lower tier if he demonstrates "to the satisfaction of the competent authority that the highest tier approach is technically not feasible or will lead to unreasonably high costs."[298] To improve monitoring accuracy, a covered source may also propose a change to the tier methodology applicable to them due to (1) a change in available data, (2) errors found in data that were the basis for choosing the currently used methodology, or (3) the request by the competent national authority for a change in methodology.[299] Waivers from use of the top tiers do not lead to adjustments in emissions calculations.

The guidance addresses process sources, whose emissions are defined as "[GHG] emissions...occurring as a result of intentional and unintentional reactions between substances or their transformation, including the chemical or electrolytic reduction of metal ores, the thermal decomposition of substances, and the formation of substances

292. KRUGER & PIZER, *supra* note 194, at 18.

293. European Union Commission, Commission Decision of 29 January 2004 Establishing Guidelines for the Monitoring and Reporting of Greenhouse Gas Emissions Pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Doc. No. C(2004) 130, Annex II (Jan. 29, 2004).

294. *See generally id.*

295. *Id.*

296. *Id.* Annex I ¶ 4.2.2.1.4.

297. *Id.* Annex I ¶ 4.2.

298. *Id.* Annex I ¶ 4.2.2.1.4.

299. *Id.* Annex I ¶ 4.2.

for use as product or feedstock."[300] The procedures employed to sample and determine the composition of relevant material or to derive a process-specific emission factor should be based on European Committee for Standardization (CEN) standards, International Organization for Standardization (ISO) standards, or equivalent national standards, in descending order.[301]

Where no applicable standards exist, procedures can be carried out in accordance with "industry best practice guidelines."[302] The laboratory used to determine the representative composition data or emission factor "shall be accredited according to EN ISO 17025 ('General requirements for the competence of testing and calibration laboratories')."[303] "The determination of the process emission factors and composition data for "batches of material shall follow generally accepted [industry] practice for representative sampling."[304] The operator must prove that the derived process emission factor or composition data "are representative [of actual operations at his facility] and free of bias."[305]

The required use of the CEMS contributes to the integrity of a cap-and-trade program and reduces its overall costs by saving administrative costs associated with government enforcement and litigation. However, mandating the use of the CEMS for all sources will be neither technologically feasible nor economically justified. While the concurrent use of emissions factors or other indirect emissions calculation methods will be inevitable, a broader use of these imperfect calculation methods could weaken GHG reduction goals and create enforcement problems. This is one of the significant disadvantages of a downstream approach versus an upstream approach. To ensure accountability and induce technical improvements in emissions calculations, conservative accounting rules and centralized verification procedures need to be enforced.

For instance, under both the EU Directive and the Climate Stewardship Act, the use of third-party certification is permissible. Third-party certification may help to reduce administrative costs. But certification costs are likely to become another economic burden to industry[306] and can also create a dispute over standards and methods of verification between the government and an entity. Some have pointed

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300. *Id.* Annex I ¶ 2(o).
301. *Id.* Annex I ¶ 10.2.
302. *Id.*
303. *Id.*
304. *Id.*
305. *Id.*
306. KRUGER & PIZER, *supra* note 194, at 19.

out that "verifiers...may have an incentive to provide lower cost, less stringent verification to compete."[307] As a general matter, these and other potential monitoring and enforcement problems are present in various features of a downstream cap-and-trade program such as the EU Directive and the Climate Stewardship Act.

Non-covered entities will respond to the cost-and-benefit equation that will be influenced by the rigor of government enforcement policy. They will likely participate in a cap-and-trade program only if they are certain that low-cost reduction opportunities will abound in their facilities, so that resulting benefits outweigh related costs. Non-covered entities owned by firms with economies of scale that are capable of shifting production lines between facilities will likely choose to opt-in.

c. Offsets and International Emissions Trading: Credibility Issues

Offsets are project-based GHG reduction credits. Under carbon offset trading, a covered source can claim credits by funding carbon reduction activities such as carbon sequestration projects, based on carbon removals, or by engaging in renewable energy projects, based on avoided fossil fuel usage. Therefore, carbon sinks and renewable energy sources participate in emissions trading indirectly. JI and the CDM under the Kyoto Protocol, Oregon's siting law, and Texas's renewable portfolio standard (RPS) policy[308] are all examples of offset trading.

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307. *Id.*

308. The most effective policy tool for increasing the market share of renewable energy technologies is a renewable portfolio standard (RPS). In many cases, if not all, the RPS takes the form of a "market-based" strategy because it is usually accompanied by a credit trading mechanism. It thus provides flexibility to electric utilities in complying with the standard requirement and rewards the most efficient, price-competitive renewable energy technologies. The RPS, first developed by the American Wind Energy Association, in essence is a variant on a cap-and-trade program that is designed to spur the development of renewable energy sources in the electricity marketplace. Under the RPS, a covered utility is required to make a certain percentage of its annual electricity sales come from renewable energy. It can satisfy this percentage requirement by developing renewable energy sources on its own, by purchasing renewable energy from third-party sources, or by financing renewable energy projects. Compliance with the requirement can be determined by checking the number of renewable energy certificates that hold a certain number of renewable energy credits (REC) at the end of a given year. The standard method for calculating the size of one credit is based on electricity generation output. The utility subject to the RPS can compare the relative costs of the following two options: (1) self-generation and (2) acquisition of RECs from third-party sources. In this way, the utility can minimize overall compliance costs by choosing a cheaper option, and price-competitive renewable energy sources can boost its sales significantly. The general public can benefit from improved air quality and reliable electric supplies. Hence, the RPS is the most powerful and effective policy tool for accelerating the development of renewable energy sources for it is a market-based mechanism that has the potential to enhance public policy

Carbon offset trading raises problems associated with establishing a baseline inventory and monitoring and verification of claimed reductions, especially with regard to afforestation and reforestation projects due to scientific uncertainty over how to gauge GHG removal capacity by carbon sinks. In order for land use, land use change, and forestry (LULUCF) activities to be effective in enhancing the nation's GHG removal capacity in a real sense, comprehensive, long-term sustainable land use management plans and strategies should be established and implemented simultaneously at the national level. Otherwise, GHG removals induced by sink-creating activities will be partially or wholly nullified by destructive forest management and farming practices that increase GHG emissions, which take place outside of the carbon sequestration projects (the problem of "leakage").

Other important relevant environmental goals, such as biodiversity, should also become an integral part of a forest-related carbon sequestration project. Monoculture plantations preoccupied with the sole goal of achieving as many carbon removals as possible in a speedy and cost-effective manner can easily compromise the health of entire ecosystems, which, in some cases, constitute the economic and cultural bases for indigenous peoples. Hence, forest and agricultural management needs to be carried out in a manner that enhances the overarching goal of sustainable development.[309]

One good example of sustainable forest management is the state of Oregon's siting and forest management programs. In Oregon, proceeds from offset trading are used to promote afforestation and

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goals with minimum cost to society. Texas's RPS is one prime example of a standard RPS that is ideally designed. *See* TEX. UTIL. CODE ANN. § 39.904 (Vernon 1999). The successful implementation of the state's RPS led to a "wind rush" in that state; 187 megawatt (MW) of total wind power capacity installed in 1999 had grown to 1,101 MW by January 2002. AM. WIND ENERGY ASS'N., INVENTORY OF STATE INCENTIVES FOR WIND ENERGY IN THE U.S.: A STATE BY STATE SURVEY 105 (2002), *available at* http://www.awea.org/policy/documents/inventory.PDF. Texas is behind only California in wind power generating capacity installed, and it is expected to become "the nation's largest renewable energy supplier" in coming decades. *See* Rabe, *supra* note 153, at 13. Encouraged by its RPS program's performance, Texas has recently enacted new legislation that will increase the current renewable energy requirement in two phases after 2010. S.B. 20, 2005 Leg., 79(1) Sess. (Tex. 2005).

309. Under the Marrakesh Accords, the definition of "forest management" is modified to incorporate the goal of sustainable forest management and to balance other important environmental goals such as biodiversity: "a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner." Marrakesh Accords, *supra* note 20, vol. I, at 58.

reforestation both in and out of state, as well as in foreign countries.[310] In addition, some of the carbon sequestration projects being implemented in foreign countries are designed to provide financial incentives for indigenous peoples to engage in sustainable forest management practice, which can further biological and cultural diversity and help find a cure for diseases.[311]

The mandated use of conservative accounting methods or setting a percentage limit on the use of credits can be a prescription for resolving verification problems. Either approach can provide a disincentive to exaggerate project results on the part of project participants. At the same time, it encourages public and private efforts to enhance the ability to measure GHG emission reductions by sinks. It is important to note, however, that, as in the case of opt-in requirements, too strict government accounting and certification rules could prevent carbon sequestration projects from being implemented in the first place by creating unacceptably high transaction costs. Therefore, it is necessary to strike "a delicate balance between making the accounting system as simple and transparent as possible to minimize transaction costs, and creating enough rigor to ensure the environmental integrity of projects."[312]

In the case of renewable energy projects, numerous problems attendant on the implementation of carbon sequestration projects do not arise. This is because the amount of avoided fossil fuel combustion can be used as a proxy for the amount of carbon emissions removed. In the alternative, the direct participation of renewable energy sources in emissions trading could be proposed. Direct allocations of allowances to renewable energy sources would function as a much more powerful tool

310. Oregon explicitly makes CO_2 reductions a priority in its siting decisions. Oregon law requires that, in order to obtain a site certificate, any proposed new or expanded power plant must demonstrate that its net emission levels will not exceed 0.675 pounds per kWh of electricity generated. OR. REV. STAT. §§ 469.300(9), 469.320, & 469.503 (1993); OR. ADMIN. R. 345-024-0550 (1999). A proposed new or expanded facility can satisfy this obligation either by employing cleaner energy technologies in accordance with the applicable emissions standard or by purchasing CO_2 offsets through contracting out to carbon mitigation projects. OR. REV. STAT. § 469.503(2)(c)(A)-(B). Otherwise, the applying facility owner has another option to fund sequestration projects by paying $0.57 for each ton of CO_2 emissions removed. *Id.* § 469.503(2)(c)(C).

311. For example, the Oregon Climate Trust has sponsored an Ecuadorian carbon sequestration project in collaboration with the Jatun Sacha Foundation and Conservation International and carried out a carbon mitigation project together with Seattle City Light, a municipally owned electric utility for Seattle. *See* Rabe, *supra* note 153, at 31-32.

312. David J. Hayes & Nicholas Gertler, *The Role of Carbon Sequestration in the U.S. Response to Climate Change – Challenges and Opportunities*, 32 ENVTL. L. REP. 11,350, 11,355 (2002).

for accelerating the commercial development of renewable energy technologies.[313] Thus, a future GHG emissions trading program could be designed to allow renewable energy sources to directly participate in allowance trading by setting aside some portion of the total allowances to them; the preferred allocation method is the distribution of allowances based on electricity generation (output-based) or a "renewable set-aside" requirement.[314]

Alternatively, nationwide RPS policy can be a perfect substitute. RPS policy will boost investments in renewable energy technologies and displace carbon-intensive fossil fuel technologies. According to one study, a cap-and trade program or a carbon tax system would be more effective than the RPS-only policy in reducing GHG emissions.[315] As its percentage requirement becomes more stringent, the RPS is expected to impact natural gas-fired generation and nuclear power more than coal-fired generation.[316] Therefore, a combined policy is advised.

Lastly, international emissions trading offers opportunities to take advantage of low-cost reduction opportunities available in foreign countries. Under the Kyoto Protocol, for instance, each Annex B country may engage in international emissions trading with another Annex B country and carry out JI or CDM projects in any contracting party to obtain reduction offsets. If developing countries agree to assume GHG reduction obligations under the Kyoto Protocol in the future, their commitments to GHG reductions will further increase an emissions trading program's potential for cost reductions.

The possible problems with international emissions trading include paper credits, the deterrence of long-term technological improvements, and antitrust concerns. One way of counteracting these problems is to impose a cap on the number of allowances that can be claimed for GHG reductions in foreign countries. The international community must also establish a standardized emissions inventory and monitoring system in order to build trust in the international GHG allowance trading market and to reduce transaction costs. It should also promote technology transfers and provide financial assistance to developing countries for capacity-building.

The EU Directive sets an initial cap on the use of offsets from JI and the CDM at six percent of total allowable emissions at the EU

313. *See* WOOLEY, *supra* note 86, at 17.

314. *Id.*

315. *See* Karen Palmer & Dallas Burtraw, Electricity, Renewables, and Climate Change: Searching for a Cost-Effective Policy 61-62 (Resources for the Future Report 2004), *at* http://www.rff.org/rff/Documents/RFF-RPT-Renewables.pdf (last visited Oct. 28, 2005).

316. *See id.* at 29-38.

level.[317] Offsets from JI and the CDM can also be used to meet a member nation's GHG emissions reduction target under the Kyoto Protocol, beginning in 2008.[318] Furthermore, the EU Directive provides for a review of the cap to determine whether it should be raised to eight percent in the next phase.[319]

During Phase I of the Climate Stewardship Act, a covered entity may meet up to 15 percent of its emissions reduction requirements by choosing one of the following compliance options: participation in the international emissions trading market, claim or purchase registered net increases in sequestration at home and abroad, purchase certified GHG reductions from non-covered entities, or borrow reduction credits from the EPA.[320]

A covered entity opting-in to the accelerated participation program can satisfy up to 20-percent of its reduction requirements using these alternative means of compliance, excluding borrowed credits.[321] A covered entity may be exempt from the reduction requirements for any amount of certified GHG emissions if "the emission is deposited in a geological storage facility approved by the EPA Administrator," and if "the entity agrees to submit tradeable allowances for any portion of the deposited emission that is subsequently emitted from that facility."[322] The proposed Act does not provide for direct allocation of allowances to renewable energy sources, cogeneration sources, or waste treatment facilities.

A covered entity that registers a net increase in carbon sequestration is required to submit relevant information to the EPA every five years, which is sufficient to allow the Agency to determine the permanence of that increase based on measurement and verification methods for sequestration projects under accounting rules to be issued by the Secretary of Commerce.[323] The Act directs the Secretary of Commerce, in coordination with the Secretary of Agriculture, the Secretary of Energy, and the Administrator of the EPA, to issue

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317. *See* Proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanism [SEC(2003)785], § 3.1, *available at* http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=52003PC0403&model=guichett.

318. *See id.* § 3.3.

319. *See id.* § 3.1.

320. Climate Stewardship Act § 312(b).

321. *Id.* § 335(a)(2). The percentage limit is to be reduced to ten percent during Phase II. *Id.* § 312(c).

322. *Id.* § 311(c).

323. *Id.* § 371(a).

sequestration accounting rules for all classes of sequestration projects and to update the rules "at least once every [five] years."[324]

Under the Act, general criteria for sequestration accounting regulations are as follows:

> (1) If the range of possible amounts of net increase in sequestration for a particular class of sequestration project is not more than 10 percent of the median of that range, the amount of sequestration awarded shall be equal to the median value of that range.
> (2) If the range of possible amounts of net increase in sequestration for a particular class of sequestration project is more than 10 percent of the median of that range, the amount of sequestration awarded shall be equal to the fifth percentile of that range.
> (3) The regulations shall include procedures for accounting for potential leakage from sequestration projects and for ensuring that any registered increase in sequestration is in addition to that which would have occurred if this Act had not been enacted.[325]

The Secretary of Commerce, in coordination with the Secretary of Agriculture, must establish measurement and approval standards for various types of carbon sequestration practices and technologies, including soil and forest management and geological storage.[326]

The Climate Stewardship Act also sets several conditions for the domestic use of GHG allowances purchased on the international trading market. In order for a covered entity to use allowances produced in another nation's trading market, the following conditions must be met:

> (A) the Secretary [of Commerce] certifies that the other nation's system for trading in greenhouse gas emissions is complete, accurate, and transparent and reviews that determination at least once every [five] years;
> (B) the other nation has adopted enforceable limits on its greenhouse gas emissions which the tradeable allowances were issued to implement; and
> (C) the covered entity certifies that the tradeable allowance has been retired unused in the other nation's market.[327]

324. *Id.* § 371(b), (d).
325. *Id.* § 371(c).
326. *Id.* § 204(a)(2)(D).
327. *Id.* § 312(b)(1).

It is important to note, however, that the United States must ratify the Kyoto Protocol in order to provide opportunities for domestic firms to trade allowances in the international emissions trading market; the current Kyoto regime denies any non-party access to the international emissions trading market or to project-based credit-trading with entities in a contracting party.[328]

4. Emissions Reporting and Allowance Tracking Systems and Public Access

The viability of an emissions trading program hinges on its ability to reduce transaction costs and gain public confidence in the trading market by ensuring transparency and accountability. In addition to establishing an accurate monitoring system, this goal can be achieved by maintaining uninhibited information flows that are publicly available and accessible. Real-time monitoring and access to information and data on emissions trading and emissions of covered pollutants are essential to achieving that goal.

For example, under the New Hampshire NO_x emission trading program, the EPA has developed the Emissions and Allowance Tracking System (EATS).[329] The EATS is an Internet-based automated information tracking system. "In 2002, 100 percent of emission data and almost 80 percent of allowance transfers were submitted electronically."[330] Each ton of allowance traded is given a unique serial number. An online management system such as EATS "enabl[es] market participants to identify potential buyers and sellers."[331] Regulated firms can regularly report emissions and allowance transactions data electronically. The general public can access all available information and data via the Internet.

Next generation data systems such as EATS are integrated database systems performing multi-functions. The current SO_2 and NO_X registries "provide data access tools that allow interested persons to develop customized queries of the data that are of most interest."[332] There are no confidentiality requirements for the data. Systems such as EATS also perform "automated quality checks on every emission submission" to ensure that each covered source's total emissions accurately match its allowance holdings.[333] The EPA has recently been working on developing a more flexible, interoperable system that "can

328. *See* Bonn Agreements, *supra* note 19, at 43.
329. CLEAN AIR MARKETS UPDATE, *supra* note 175, at 11.
330. *Id.* at 10.
331. *Id.* at 11.
332. *Id.*
333. *Id.* at 10.

accept additional pollutants and sectors if [existing trading] programs are expanded or added in the future" and "reduce data redundancy and administrative effort and costs," *e.g.*, by integrating emissions and allowance data reporting.[334]

Under the Climate Stewardship Act, the EPA is directed to construct a GHG emissions database system and to make information in the system open and "accessible to the public, including in electronic format on the Internet."[335] With respect to a GHG emissions database system, the Act provides that

> the Administrator shall take into consideration a broad range of issues involved in establishing an effective database, including—(A) the appropriate allowances for reporting each greenhouse gas;
> (B) the data and information systems and measures necessary to identify, track, and verify greenhouse gas emissions in a manner that will encourage private sector trading and exchanges;
> (C) the greenhouse gas reduction and sequestration methods and standards applied in other countries, as applicable or relevant;
> (D) the extent to which available fossil fuels, greenhouse gas emissions, and greenhouse gas production and importation data are adequate to implement the database; and
> (E) the differences in, and potential uniqueness of, the facilities, operations, and business and other relevant practices of persons and entities in the private and public sectors that may be expected to participate in the database.[336]

The proposed Act requires the EPA to

> publish an annual report that—
> (1) describes the total greenhouse gas emissions and emission reductions reported to the database during the year covered by the report;
> (2) provides entity-by-entity and sector-by-sector analyses of the emissions and emission reductions reported;

334. *Id.* at 11.
335. Climate Stewardship Act § 203(c)(6).
336. *Id.* § 203(c)(8).

(3) describes the atmospheric concentrations of greenhouse gases; and
(4) provides a comparison of current and past atmospheric concentrations of greenhouse gases.[337]

Not later than two years after enactment, the EPA must establish by regulation "a comprehensive system for greenhouse gas emissions reporting, inventorying, and reductions registration."[338] The Act requires that the EPA balance two competing policy goals in designing the system: a new system should ensure "completeness, transparency, and accuracy" of submitted information while minimizing compliance costs involved in emissions measurement and reporting.[339] Such a system must verify and track claimed emissions reductions using unique serial numbers given to account holders.[340] As with the SO_2 Acid Rain program, the EPA is expected to require covered entities to electronically submit emissions reports and data about allowance transfers by integrating a new database system with the EATS to the extent maximum possible.

The EU Directive also provides for an electronic allowance tracking and registry system. The European Commission's regulation contains detailed provisions with regard to the operation and implementation of this system. The European Commission will operate an independent allowance "transaction log."[341] Each member nation is required to develop its own national registry of GHG emissions and allowance transactions.[342] Thus, there will be two concurrent registry systems within the European Union.

The transaction log operated by the EU Commission will serve as the temporary communication link between national registries until the establishment of the communication link[343] and will perform "automated checks...for all processes concerning allowances, verified emissions, accounts and Kyoto units to ensure that there are no

337. *Id.* § 203(d).
338. *Id.* § 201(c)(1).
339. *Id.* § 201(c)(2)(A).
340. *Id.* § 201(c)(3).
341. *See* Commission Regulation (EC) No .../2004 of xx/xx/2004 for a Standardized and Secured System of Registries Pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision 280/2004/EC of the European Parliament and of the Council, art. 5, xx/xx/2004, *at* http://umwelt.lebensministerium.at/filemanager/download/8056/ (last visited Oct. 25, 2005) (draft) [hereinafter Draft EU Registry Guidelines].
342. *Id.* art. 3.
343. *See id.* art. 6.

discrepancies."[344] Each national registry must take the form of "a standardised electronic database."[345] The national registry administrator is required to correct any inconsistency detected by the transaction log, and, if the administrator fails to do so, the central administrator charged with operating the transaction log system must stop all processes within the system "concerning any of the allowances, accounts or Kyoto units which are the subject of the earlier inconsistency to proceed."[346] A member nation or the European Union may join together with other member nations or the European Union to develop a common registry, "provided that its registry remains distinct."[347]

As required by the Marrakesh Accords, each national registry must contain one operator holding account, one retirement account, and cancellation and replacement accounts for each covered source.[348] Each account is assigned a unique account identification code, the alphanumeric identifier specified by the account holder, and an account holder identification code.[349] All transactions between national registries must be made in accordance with standardized protocols and procedures.[350] Information exchanged during transactions and communications should have its own input and response codes that must be contained in national registries.[351]

The Directive provides that each national registry shall contain one verified emissions table, one surrendered allowances table, and one compliance status table.[352] The operator of a covered entity must submit an annual emissions report to the national registry. Once verified by the competent national authority, data and information about an entity's emissions should be entered into the section of the verified emissions table designated for that entity.[353] Each national registry and the transaction log must make emissions and allowance data publicly available through a website within a time frame specified in the Directive.[354]

However, information disclosure is subject to confidentiality requirements. In principle, all information relating to allowance

344. *Id.* art. 28, ¶ 1. This requirement applies to each national registry. *Id.* art. 31.
345. *Id.* art. 3, ¶ 1.
346. *Id.* art. 28, ¶ 2.
347. *Id.* art. 4.
348. *Id.* pmbl., ¶ 4; *see* Marrakesh Accords, *supra* note 20, pt. 2, vol. II, at 61-62.
349. Draft EU Registry Guidelines, *supra* note 341, art. 26.
350. *Id.* pmbl., ¶ 7.
351. *Id.* art. 25.
352. *Id.* art. 24, ¶ 1.
353. *Id.* art. 51, ¶ 1.
354. *Id.* art. 9, ¶¶ 1-2. *See also id.* Annex XVI.

transactions must be kept secret "for any purpose other than the implementation of [the] Regulation...or national law."[355] The use of information requires the prior consent of the account holder "except to operate and maintain those registries in accordance with the provisions of [the] Regulation."[356] A government entity cannot compel account holders to disclose price information.[357]

In short, the EU's registry system is rather complex to administer because it aims to coordinate operations of different national registries. The complexities of the system also partially reflect the fact that it is designed as part of an international emissions trading program in which all contracting parties to the Kyoto Protocol will ultimately participate.

5. Penalties and Accountability

In addition to rigorous monitoring, reporting, and verification requirements, stiff penalties should be imposed under a cap-and-trade program to deter permit violations. A responsible person should be designated to enhance accountability. Both the Climate Stewardship Act and the EU Directive contain penalty provisions. For example, under the Climate Stewardship Act, a violating entity must pay a civil penalty to the EPA, the amount of which should be "equal to [three times] the market value (determined as of the last day of the year at issue) of the tradeable allowances that would be necessary for that covered entity to meet those requirements on the date of the emission that resulted in the violation."[358] Beyond this, the Act does not provide for any more stringent penalties, such as requiring violating sources to surrender allowances by the amount of excess emissions in the next compliance period.

The EU Directive requires a violating source to pay a penalty for excess emissions of 40 Euro per ton of CO_2 in the first phase and 100 Euro per ton of CO_2 in the second phase, respectively, and to surrender allowances in a number equal to the excess emissions in the following year.[359] The Directive requires that the names of operators of noncomplying sources be published.[360] It also provides that authorized account representatives be designated. Every account holder must appoint one primary and one secondary authorized representative for

355. *Id.* art. 10, ¶ 1.
356. *Id.* art. 10, ¶ 2.
357. *Id.* art. 9, ¶ 5.
358. Climate Stewardship Act § 372.
359. EU Emissions Trading Directive, *supra* note 178, art. 16, ¶¶ 3–4.
360. *Id.* art. 16, ¶ 2.

each account.[361] Each member nation and the Commission may permit account holders to nominate one additional authorized representative.[362] Each verifier must appoint at least one authorized representative for the purpose of verifying emissions data and information.[363]

The EU Directive's penalty provisions are more ideally designed when compared to those of the Climate Stewardship Act. The Directive specifically identifies responsible parties within a regulated entity and provides for stiff penalties that give regulated entities strong incentive to comply. In contrast, the Climate Stewardship Act does not require violating sources to surrender allowances. Moreover, the amount of penalties is not based on a fixed sum, but rather is set in terms of an allowance's market price prevailing at the end of the compliance period. Therefore, the Climate Stewardship Act's penalty provisions need to become more stringent such that industry has enough incentive to comply.

III. AN ECONOMIC ASSESSMENT OF THE CLIMATE STEWARDSHIP ACT

The Climate Stewardship Act represents "a significant step forward" in reducing the nation's GHG emissions.[364] Although it falls short of pursuing the Kyoto reduction target, the Act's goal of stabilizing U.S. GHG emissions at 1990 levels is much more aggressive than that of President Bush's Clear Skies Initiative.[365] Further, the Act adopts a more comprehensive approach than the EU Emissions Trading Directive. The EU's Directive targets only 46 percent of EU-wide CO_2 emissions by covering only CO_2 emissions from four major industrial sectors, excluding all other GHG emissions from its coverage.[366] In contrast, the

361. Draft EU Registry Guidelines, *supra* note 341, art. 23, ¶ 1.

362. *Id.* art. 23, ¶ 2.

363. *Id.* art. 23, ¶ 3.

364. WILLIAM A. PIZER & RAYMOND J. KOPP, RESOURCES FOR THE FUTURE, SUMMARY AND ANALYSIS OF MCCAIN-LIEBERMAN—"CLIMATE STEWARDSHIP ACT OF 2003" S. 139, INTRODUCED 01/09/03, at 1, 4 (2003), http://www.rff.org/rff/Core/Research_Topics/Air/McCainLieberman/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=4452 [hereinafter RFF ANALYSIS OF THE CLIMATE STEWARDSHIP ACT].

365. The Clear Skies Initiative is aimed at reducing the nation's carbon intensity. Carbon intensity is "the ratio of greenhouse gas (GHG) emissions to economic output"; President Bush's plan aims to reduce carbon intensity by 18 percent in the next ten years. *See* Press Release, The White House, Global Climate Change Policy Book (Feb. 2002), *at* http://www.whitehouse.gov/news/releases/2002/02/climatechange.html.

366. According to one study, the EU emissions trading scheme would not be as cost-effective as it would be when it includes all industrial sectors in the program's coverage. Christoph Böhringer et al., *Assessing Emission Allocation in Europe: An Interactive Simulation Approach*, ZEW Discussion Paper 04-40 (2004), *at* http://ssrn.com/abstract=560881

Act will bring most of the nation's CO_2 emissions and some emissions of other GHGs under control.

The Climate Stewardship Act is a bold, laudable, and inspiring move, but the possibility of its enactment seems very remote in view of the current political resistance to cost-increasing legal measures in the United States. The Act, first introduced in January 2003 by Senators McCain and Lieberman and voted on by the full Senate in October 2003,[367] failed to pass the Senate with a vote of 43 to 55.[368] On March 30, 2004, its House version was reintroduced by Congressmen Wayne Gilchrest and John Olver, who represented a bipartisan group of Representatives.[369] The same bill was reintroduced in both chambers of Congress in early 2005.[370]

Perhaps the Climate Stewardship Act represents a second-best solution for the United States in addressing the problem of climate change. The Act's relatively modest goal of achievement over a ten-year time period would be more politically acceptable, since its implementation would probably entail relatively low economic costs. Only a few analyses of the Act's possible impacts on the U.S. economy are currently available. They are summarized as follows:

(1) Energy Information Administration (EIA): (i) average allowance prices: $79 per metric ton of carbon equivalent (about $22 per metric ton of CO_2 equivalent) in 2010 and $221 per metric ton of carbon

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(download from "SSRN Electronic Paper Collection" hyperlinks). This study found that the aggregate implementation costs of the EU emissions trading program as currently designed would be "[ten] times higher than under an efficient trading scheme and [six] times higher than for purely domestic abatement action." *Id.* at 18. The reason, the authors explained, is that the EU emissions trading program would shift abatement costs to non-covered sectors by not including all sectors and by allocating CO_2 allowances to covered sectors without charge. *Id.* at 18-19. Another study compared changes in EU-wide overall compliance costs that would be incurred by covered sectors, depending on the availability of JI and CDM-related credits, *i.e.*, at what percentage is the use of offset credits limited. Note that the EU Directive limits the use of offsets at six percent during the first implementation period. It found that an estimated CO_2 allowance price under the unlimited offset scenario would be as low as twice that expected under the no-offset scenario, saving six billion Euros. However, the Directive projected that the impact of the current limit on the use of offsets on compliance costs would be minimal. *See* KRUGER & PIZER, *supra* note 194, at 27-29, 44, tbl. 4 (summarizing the results of a study by P. CRIQUI & A. KITOUS, KYOTO PROTOCOL IMPLEMENTATION: (KPI) TECHNICAL REPORT: IMPACTS OF LINKING JI AND CDM CREDITS TO THE EUROPEAN EMISSIONS ALLOWANCE TRADING SCHEME (2003)).

367. Climate Change Activities, *supra* note 151, at 5.

368. *Id.*

369. *See* Pew Center on Climate Change, Gilchrest-Olver Climate Stewardship Act: Greenhouse Gas Cap-and-Trade Bill Introduced in U.S. House of Representatives, *at* http://www.pewclimate.org/_policy_analyses_g_o.cfm (last visited Sept. 24, 2005).

370. Climate Stewardship Act of 2005, H.R. 759, 109th Cong. § 342 (2005).

equivalent (about $61 per metric ton of CO_2 equivalent) in 2025; (ii) average offset prices: $52 per metric ton of carbon equivalent (about $14.4 per metric ton of CO_2 equivalent); (iii) increases in delivered fossil fuel prices to covered entities: 31 percent (petroleum products), 79 percent (natural gas), and 485 percent (coal); (iv) increases in consumer gasoline and electricity prices: 27 percent (gasoline) and 46 percent (electricity); (v) macroeconomic impact and the income effect: 0.7 percent loss in real GDP and a $47 decrease in disposable person income; (vi) expected changes in energy production and consumption patterns: sharply declined coal use, modest increases in natural-gas-derived electricity generation, and a big boost in nuclear power and renewable energy (electricity sector); gradually reduced petroleum use, increased fuel economy, and declined petroleum imports (transportation).[371]

(2) Massachusetts Institute of Technology (MIT): (i) average allowance prices: $92 per metric ton of carbon equivalent (about $25.5 per metric ton of CO_2 equivalent) in 2010, $117 per metric ton of carbon equivalent (about $32.5 per metric ton of CO_2 equivalent) in 2015, and $147 per metric ton of carbon equivalent (about $41 per metric ton of CO_2 equivalent) (without considering the effects of offset credits); $62 per metric ton of carbon equivalent (about $17 per metric ton of CO_2 equivalent) in 2010, $81 per metric ton of carbon equivalent (about $22.5 per metric ton of CO_2 equivalent) in 2015, and $103 per metric ton of carbon equivalent (about $28.6 per metric ton of CO_2 equivalent) (assuming the availability of cost-effective non-CO_2 credits);[372] (ii) macroeconomic impact and the income effect: 0.07–0.25% (2010) and 0.11–0.40% (2020) (GDP loss); $50–175 (2010) and $100–350 (2020) (per household income loss);[373] (iii) changes in fuel consumption patterns: a modest increase in natural gas consumption rate versus coal consumption, and a small reduction in gasoline consumption (compared to the reference case).[374]

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371. U.S. EIA OFF. OF INTEGRATED ANALYSIS & FORECASTING, U.S. DEP'T OF ENERGY, ANALYSIS OF S. 139, THE CLIMATE STEWARDSHIP ACT OF 2003 at 2-4 (2003) [hereinafter EIA ANALYSIS OF THE CLIMATE STEWARDSHIP ACT]. Prices and costs were calculated based on 2001 dollars, except that real GDP and disposable personal income were expressed in 1996 dollars. Cost estimates spanned a 25-year time frame.

372. Prices and costs were calculated based on 2001 dollars. The MIT research team projected average allowance prices under scenarios 5 and 7. In scenario 5, it was assumed that GHG emissions reduction targets would be phased-in as scheduled, that unlimited banking would be allowed, and that all GHG emissions would be covered. Effects of credits and offsets from uncovered sources were not considered. In scenario 9, it was assumed that cost-effective credits and offsets would be available from domestic sources. MIT Study, *supra* note 192, at 17, tbl. 4; *Id.* at 20, tbl. 5.

373. *Id.* at 27.

374. *Id.* at 24, tbl. 7.

(3) Resources for the Future (RFF): (i) average allowance prices: $14 per metric ton of CO_2 equivalent (assuming it is constant); (ii) increases in consumer fossil fuel prices: nine percent (gasoline), 20 percent (natural gas), and 100 percent (coal); (iii) expected loss in real GDP: 0.01%.[375]

Of the three analyses, the EIA report is the most rigorous, but it presents the most pessimistic view of the impacts of the Climate Stewardship Act, predicting that total U.S. GHG emissions would reach 2000 levels by 2025.[376] However, in arriving at its findings, the EIA did not consider the potential effects of net increases in carbon sequestration capacity in the United States and allowance and credit purchases in the international GHG emissions trading market.[377] The EIA also assumed that improvements in energy-saving technologies would have little impact on overall costs of the Act's implementation.[378] As a result, these seemingly unrealistic assumptions led to somewhat overestimated cost figures.

On the other hand, the RFF analysis borrowed many of its projections from the EPA's estimates. It assumed that "1.3 billion metric tons of domestic reductions [would be] available at $14 per metric ton of CO_2 in 2010," and that covered entities "then [would] continue with this level of annual reductions in the future."[379] The RFF cited the EPA's estimates by stating, "the cost of these reductions to the U.S. economy would be around $9 billion annually but, depending on the availability of international and noncovered domestic reductions, the cost could be [ten] times higher or lower."[380] The authors implied that the cost estimates could be lowered further given the possibility of a supply of relatively cheap foreign allowances and credits and expected technological advances.[381]

Running its Emissions Projections and Policy Analysis Model (EPPA)[382] with data inputs from available national energy consumption data and economic indices, the MIT team engaged in a quite reasonable analysis of the cost impact of a variety of scenarios. Of the modeling results, it is noteworthy that welfare loss would be minimal. The explanation provided by the authors was that GHG reduction policy

375. RFF ANALYSIS OF THE CLIMATE STEWARDSHIP ACT, *supra* note 364, at 3–4.
376. EIA ANALYSIS OF THE CLIMATE STEWARDSHIP ACT, *supra* note 371, at 2.
377. *See id.*
378. *See id.* at 4.
379. RFF ANALYSIS OF THE CLIMATE STEWARDSHIP ACT, *supra* note 364, at 3.
380. *Id.* at 4.
381. *Id.*
382. For a general explanation of the MIT EPPA General Equilibrium Model, see MIT Study, *supra* note 192, at 12–14.

would influence the world oil market, "causing oil prices to fall when oil consumption is restrained."[383] The MIT team predicted that coal use would not decline significantly.[384] It was implied in the entire report that the availability of low-cost options, such as offset purchases from non-covered sources and the market penetration of clean energy technologies, would result in much less fuel switching in the energy market than expected.

Assuming that foreign allowances would be available in the future, the MIT team observed that cheap foreign allowances would cause average allowance prices to fall significantly, while stating that expected welfare gains from international trading would not be as great as usually predicted.[385] The MIT team also modeled the potential effects of improvements in average fuel economy in the transportation sector.[386] While predicting that improvements in fuel efficiency would further lower average allowance prices, the team observed that an abundant supply of offsets from sequestration projects generated by lenient government policy could "[squeeze] out other credits sources..., dropping to near zero the value of these credits for more efficient vehicles."[387]

CONCLUSION

As a result of Russia's ratification,[388] the Kyoto Protocol entered into force on February 16, 2005.[389] However, it is clear that the Protocol will not be effective in curbing GHG emissions without U.S. participation. During the first commitment period, negotiations on the participation of key developing countries are scheduled to take place. It is expected that developing countries will be given the freedom to choose a baseline year and a national GHG reduction target, as provided for in the draft Article 9 of the original negotiating text of the Kyoto Protocol.[390]

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383. *Id.* at 18.

384. *See id.* at 24–25.

385. *Id.* at 22.

386. For modeling results see *id.* at 26, tbl. 8.

387. *Id.* at 26.

388. On November 5, 2004, Russian President Putin ratified the Kyoto Protocol. Editorial, *Kyoto Ratification*, WASH. POST, Nov. 6, 2004, at A22. Russia's ratification triggered the 55% ceiling as required by Article 25, Paragraph 1, of the Protocol. *Id.*

389. Shankar Vedantam, *Kyoto Treaty Takes Effect Today*, WASH. POST, Feb. 16, 2005, at A4.

390. Then-Chairman Raul Estrada of the Seventh Conference of Parties, held in Kyoto, Japan, in December 1997, came up with the final draft protocol during the negotiation meetings, which contained a draft Article 9 that would have given developing countries an

What is missing from the scene is U.S. leadership. The non-participation of the United States in the Kyoto Protocol will not only lead to the Protocol's failure to attain its goals but will also produce resistance from developing countries to international attempts to impose on them mandatory GHG emission reduction obligations. The irony is that U.S. insistence on developing country participation as a precondition for its ratification of the Kyoto Protocol will likely face the same response from developing countries.

What distinguishes the United States from other advanced nations in the climate change debate is its tendency to stress short-term costs rather than long-term benefits. For the most part, this is driven by the fear that climate policy could turn out to be disastrous for the nation's economy in view of energy over-consumption patterns at home. The dominance of an economic way of thinking in U.S. public-policy-making tends to add more fuel to the cost debate over domestic climate change policy.

As the authors of the studies summarized in the previous section conceded, an assessment of the long-term economic impact of the Climate Stewardship Act or any other similar legislation cannot be accurate given the considerable uncertainty concerning assumptions of economic growth rates and future legal developments both at home and abroad. Such an analysis also cannot adequately capture the synergistic effects that climate change policy would produce within the energy sector.

A so-called "shallow and deep" approach,[391] advocated by some mainstream economists, overlooks the fact that delayed GHG reduction efforts would increase overall long-term compliance costs and could make sluggish (or even freeze) the pace of improvements and

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option to accept legally binding emissions reduction targets and to choose both the baseline year and the level of emissions reductions to be achieved. However, the draft Article 9 was deleted from the final text of the Kyoto Protocol due to strong opposition from developing countries led by China. *See* Michael R. Molitor, *The United Nations Climate Change Agreements*, *in* THE GLOBAL ENVIRONMENT: INSTITUTIONS, LAW, AND POLICY 226-27 (Norman J. Vig & Regina S. Axelrod eds., 1999); HUNTER ET AL., *supra* note 66, at 630.

391. This approach posits that, given the expected minimal short-term climate stabilization benefits of implementation of the Protocol's initial GHG reduction targets, adopting relatively modest reduction goals first and then setting more ambitious goals in an incremental, flexible manner would provide ample lead time for many nations to build their capacities to stabilize GHG emissions and to mitigate (or adjust to) global climate impacts. *See, e.g.*, ROBERT N. STAVINS, RESOURCES FOR THE FUTURE, CAN AN EFFECTIVE GLOBAL CLIMATE TREATY BE BASED ON SOUND SCIENCE, RATIONAL ECONOMICS, AND PRAGMATIC POLITICS 8-10 (2004), http://www.rff.org/rff/Documents/RFF-DP-04-28.pdf; Henry R. Linden, *The U.S. Can No Longer Stay on the Sidelines in Formulating a Rational Global Climate Change Policy*, ELEC. J., Oct. 2001, at 80-84.

innovations in less carbon intensive, more efficient energy technologies, which have long suffered from the existing legal system's failure to embody sustainability concerns. More importantly, such an approach fails to recognize that addressing global climate change requires fundamental changes in human behavior, not just technological fixes.

Inducement of a change in behavioral patterns takes time, because humans often stick to conventional values and old customs even in times of tumultuous societal change. For over two centuries, humans have been addicted to fossil-fuel-based energy and the convenience and pleasure it affords them. Unless accompanied by aggressive efforts to reduce GHG emissions, any climate change policy may face ever-stronger political opposition from industry and the general public, who want to perpetuate their vested interests built into existing socio-economic structures. This is one of the reasons why inaction or reliance on voluntary approaches is not a prudent policy path, and why we should ambitiously pursue the goal of a less carbon-intensive society despite expected high short-term compliance costs.

Recently, crude oil prices have reached record highs. This should be an alarming sign to the fossil-fuel-based world economy, indicating that fossil fuels have already begun to be in short supply. We have a moral obligation to pass a clean environment and economic prosperity down to future generations. As stewards of the Earth, we also have the duty to take care of other species that have suffered from human intrusions due to excess industrial pollution. Climate change policy cannot be a one-fits-all solution to curbing increased fossil fuel combustion, causing greater environmental harm as the developing world becomes industrialized.

As the analyses of the Climate Stewardship Act show, climate change policy can be implemented in a cost-effective manner. When combined with a variety of effective policy tools in other policy areas, climate change policy would have minimal impacts on the economy while bringing much greater long-term benefits to society in the form of reduced pollution and accompanying greater environmental quality and health benefits, as well as other long-term economic benefits such as energy security and enhanced international competitiveness.

On January 1, 2005, the European Union began to implement its emissions trading program. Although all national allocation plans have not yet been approved by the EU Commission at this time,[392] the detailed

392. According to EU-provided information, the EU Commission has partially or conditionally approved the allocation plans of Austria, Germany, the United Kingdom, Finland, France, and Spain. National allocation plans submitted by other member nations were fully approved by the Commission prior to the implementation of the EU-wide CO_2

scheme of the European Union's emissions trading system will soon emerge. The European Union's experimentation with a CO_2 emissions trading system will provide important lessons to the rest of the world with respect to the future implementation of both U.S. and international GHG emissions trading programs. As Europeans gain confidence in the effectiveness of emissions trading in reducing GHG emissions, future climate change debate will be revolutionized. Hopefully, the resulting international consensus on prompt climate action will move modern civilization closer to achieving the ultimate goal of sustainable development.

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emissions trading program. *See* Press Release, European Union, Questions & Answers on Emissions Trading and National Allocation Plans, Apr. 3, 2004, *at* http://europa.eu.int/rapid/pressReleasesAction.do?reference=MEMO/04/44&format=HTML&aged=1&language=EN&guiLanguage=en.