UNITED STATES CLIMATE POLICY:

USING MARKET-BASED STRATEGIES TO ACHIEVE GREENHOUSE GAS EMISSION REDUCTIONS

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I. Introduction

A. Climate Policy: A Comprehensive Portfolio

As set forth in chapters X, X and X of this report, unwanted climate change is resulting from the emissions of greenhouse gases (GHG) into the atmosphere by human activity. To avoid the serious and potentially catastrophic environmental, economic and health consequences associated with an increasing global temperature, global emissions of GHGs must be slowed, stopped and reduced. There is no silver bullet for emission reductions; it will require changes in energy policy, sustainable development, as well as market-based policies for reducing GHG emissions. Therefore, a climate change policy is more accurately defined as a portfolio of policies largely aimed at reducing GHG emissions. Some proposals can be implemented immediately at little or no cost,[1] while others will require structural changes to our economic and energy systems and changes in the way we think and live.

Pricing carbon through, for example, a cap-and-trade program or a tax on emissions, is thought to be one of the most effective and efficient potential mechanisms for reducing GHG emissions currently known to policy makers.[2] The prevailing wisdom is that there is no other single policy effect that promises to deliver as steep a curve in emissions for as large a part of the total emission inventory as pricing emissions.[3] Pricing is the way to get both the short-term gains through efficiency and the longer-term gains from investments in research and switching to cleaner fuels.[4]

The significance of this component of climate policy should not be understated; without the ability to price carbon, it is unlikely that we be able to contain global temperature changes within an acceptable range.[5] However, it is not a silver bullet; emissions pricing is only one part of a climate change policy which should include a portfolio of policies. Historically it has taken an average of 10 to 12 years for the federal government to implement a rule or policy of such scope and magnitude.[6] Because it could take a decade or more for a cap-and-trade system to start having a profound impact on emissions, it would be wise to simultaneously adopt a portfolio of policies that will have more immediate impact.[7] Further, we must also accept that a pricing policy can take us only part of the way. It would be hard to make an emissions pricing policy, as it is currently conceived, reach individual motorists or every sector of the economy.[8] Companion policies would need to be part of a comprehensive climate change policy—regulations that works on transport, buildings, appliance efficiency and smart growth.[9] In this way the climate change policy would capture low hanging fruit which can impact emissions sooner and at a much lower cost. For example, energy efficiency measures can help slow the pace at which the risk from global warming increases, but it cannot reverse the trend alone. In the very long term the world's economy needs a technological transformation, moving from deriving 90% of its energy from fossil fuels today to being largely free of emissions from fossil fuels by 2100.[10]

This portfolio of policies is the basis for this book. For example, energy efficiency and energy technology and the movement from a carbon based economy is addressed in Chapter X, Energy Security;

emission reductions by the federal government are addressed in Chapter 6, Federal Emissions Management Program; changes to the building industry to increase efficiency are addressed in Chapter 7, Rebuilding America; reducing emissions from the transportation sector through increased CAFE standards and increased mass transit are addressed in Chapter 8, Low-Carbon Mobility; the potential for preserving carbon sinks and reducing emissions though better management of our natural resources is addressed in Chapter 9, Natural Resource Stewardship. The focus of this present chapter is on the development of an emissions pricing policy within the context of a comprehensive climate change policy.

Although this book is written in chapters, addressing various components of climate policy separately, these components work together and are inextricably linked. These linkages are explored in the relevant chapters. For example, the proposed emissions pricing here would raise revenues which could be used to promote technology development and deployment and create market incentives that would make new technologies more feasible and increase private investment in these technologies.

B. Emissions Pricing

Global warming can be seen as a classic "market failure," and many economists, environmental experts and policy makers agree that the single largest cause of that failure is that in most of the world, there is no price placed on emitting carbon dioxide (CO_2) into the atmosphere.[11] It is increasingly clear that there is a considerable cost to CO_2 emissions.[12] Setting a real price on carbon emissions is the single most important policy step to take.[13] Pricing is the way to get both the short-term gains through efficiency and the longer-term gains from investments in research and switching to cleaner fuels.[14]

A pricing mechanism has the direct effect of limiting emissions because of a specific cap or because of the increased cost of emissions in the case of a tax. However, the pricing mechanism will also have long term structural implications. Higher prices for emissions associated with our current energy structure will provide a clear economic incentive for development and deployment of alternative energy technologies. Moreover, continuing reductions in the availability of emission permits as permit levels are reduced ensures a growing market space for renewable and a robust expectation that that market will expand. Investment will flow into alternative energy and costs will decline with increasing scale, research and development and learning by doing. Similarly rising energy prices will stimulate energy efficiency technologies and investments throughout the economy and energy efficiency innovations.[15]

Pricing carbon or other GHGs, by itself, will not be sufficient to bring forth all the necessary innovation, particularly in the early years.[16] However, only with some sort of federal policy in place, bringing about the pricing of carbon emissions, it will become clearer what carbon clean-up or fuel-switching activities affected companies will need to undertake and on what sort of timetable.[17]

C. The Energy Context

Any discussion of climate policies should include a discussion of the problems presented by our present reliance on fossil fuels and burgeoning global energy demand. Climate change cannot be addressed without also addressing the issue of energy. In devising strategies to mitigate climate change, these climate-related energy issues must play a prominent role in the decisional calculus. The following discussion briefly canvasses a few of the major climate-relevant energy issues.

The manner and extent to which increasing global energy demand can be met within the framework of sustainable development presents the greatest global environmental challenge of the 21st century. The world is rapidly approaching the end of the age of oil, and yet we are woefully unprepared for the environmental, socioeconomic, and geopolitical consequences of this transition. As set forth in the following discussion, the need to appreciate the extent to which the issue of climate change is really an issue of energy security is premised upon four widely recognized phenomena.

First, the undeniable energy context—often unappreciated in discussion of climate change—is that today's current primary global power consumption of about 12 terawatts (TW) will reach around 30 TW by 2040.[18] Other forecasts indicate that total global energy consumption will expand by 71% between 2003 and 2030.[19] A significant and troubling part of this projected increase in energy demand will occur in developing countries that rely primarily upon the combustion of hydrocarbons such as coal to produce the electricity necessary to meet their energy needs.[20]

We note that as a result of the increasing reliance of developing countries on fossil fuels—particularly coal, the most carbon-intensive of fossil fuels—despite lower projected energy consumption levels than that of the industrialized nations, CO_2 emissions from developing countries are projected to exceed those of the industrialized nations soon after 2010.[21] According to the most recent projections by the International Energy Agency, China is expected to overtake the U.S. as the largest emitter of CO_2 *before* 2010.[22]

Second, oil and gas are finite and non-renewable natural resources. Oil and gas are not as abundantly available as coal. Moreover, because the demand for oil and gas far exceeds the supply of those countries that rely most heavily upon them, these countries are compelled to import oil and gas from politically volatile parts of the world. This phenomenon exposes many developed countries to shortages of vital energy sources. However, despite the looming specter of global warming and increasingly tight energy markets,[23] virtually all projections indicate that under current policies and trends fossil fuels will remain the dominant source of energy throughout the foreseeable future. The IEA forecasts that between 2004 and 2030, fossil fuels will account for 83% of the overall increase in global energy demand.[24]

Third, even appreciating the 1974 Agreement on an International Energy Program (IEP), the 1992 United Nations Framework Convention on Climate Change (UNFCCC), and perhaps the Energy Charter Treaty of 1994 (ECT), the global response to the energy crisis has been unsatisfactory. In this context, the Kyoto Protocol of 1997 responds to the danger of global warming caused by anthropogenic actions and requires reductions of GHG emissions. Unfortunately, Kyoto essentially disregards the need to find alternative sources of energy that can supply the burgeoning energy needs of the world.

Fourth, the search for smart energy that is plentiful, efficient, and accessible to replace or supplement our present environmentally damaging fossil fuel sources will involve new technological developments and creative assumptive frameworks dealing, *inter alia*, with energy production, distribution, delivery, storage, conversion, end-uses, and environmental protection. These technologies and assumptive frameworks need to be assessed and expressed in a manner which facilitates and secures global, national, and multinational corporate responses. There are no showstoppers waiting in the wings. Development and deployment of sustainable energy technologies on an unprecedented scale is needed.[25]

II. Two Strategies Dominate the Discussion: A Cap-and-Trade System and an Emissions Tax[26]

An emissions tax is a fee charged on each ton of CO_2 emitted into the air. (For other GHGs you would use an equivalent carbon dioxide warming potential.) Key to the tax mechanism is getting a significant price into the system to create the incentive to go out and look for solutions.[27] Cap-and-trade has the same goal as a tax, putting a price on CO_2 emissions, but goes about it differently. A limit, or cap, is placed on overall emissions, with polluters allocated permits. Then, companies able to go below their emission targets would be allowed to sell their unused "permits to pollute" to companies that could not. Both mechanisms are cost-effective, (as opposed to government regulation); the resulting emission level is obtained at the lowest possible cost.[28] However significant differences exist in regard to other aspects of the mechanisms.

Under a cap-and-trade system, total emissions will exactly equal the number of permits. This has two important implications. First, emissions are more tightly controlled under the cap-and-trade mechanism. Under a tax, costs are more tightly controlled. Second, under a cap-and-trade system there is no incentive for emission reductions in excess of the cap. Under an emissions tax, all emission reductions less costly than the marginal cost of the tax will be taken.[29] One author estimates that the tax approach will generate five times the net expected benefit associated with the most prudent quantity control. That is, because of uncertainties in setting targets, on average the carbon tax achieves more reductions than a quantity target.[30]

The appeal of a quantitative target is that it is straightforward measure of environmental progress as well as compliance. A quantitative target guarantees a fixed level of emissions.[31] However, the cost associated with quantity controls will be high or low depending on future reduction costs as well as the future level of uncontrolled emissions.[32] Costs under a carbon tax should fluctuate much less than costs under a quantity control.[33] One of the key policy issues is thus whether quantity control or price control is the priority.[34] In basic terms, a tax will lead to uncertain emission consequences, and a cap-and-trade system will lead to uncertain cost consequences. However, it is not clear that this is such a black and white proposition, as mechanisms such as banking and borrowing of reductions can offset or minimize cost fluctuations in a cap-and-trade system.[35]

From an economic perspective, a tax is clearly the most efficient mechanism and has the significant advantage of potential reductions beyond the target.[36] However, it will not guarantee emission levels at or below a desired target in all cases. Even advocates of an emission tax agree that when we reach a point where the stock (concentration of gases in the atmosphere as opposed to annual emissions) must be stabilized, a switch to quantity controls will be appropriate.[37] In fact, quantity controls derive their desirability from a situation where strict limits are important, when dire consequences occur beyond a certain threshold. The tax is appropriate under the assumption that it is acceptable to allow the stock of GHGs to grow in the interim, that there is some room to rearrange emissions over time, and that a short-term quantity control on emissions is unnecessary.[38]

There are a number of other issues to consider when deciding between the two mechanisms, such as political advantages and disadvantages, tampering and manipulation, timing and the bandwagon effect, and fundamental beliefs regarding taxes and the ownership of the revenues from emissions. However, the foundations of these arguments are not quite as clear-cut as they appear on their face.

Governments can use allocations to essentially buy political support since permits are the equivalent of cash which can deflect anger over higher costs.[39] Big polluters, who will have to invest most to clean up, could be granted extra allowances in the early years of the program to subsidize their investments.[40] Further funds from allocations that are sold or auctioned can be used to mitigate some of the equity issues that arise from sectors or populations that undergo a disproportionate share of the costs or burden of the policy. However, some criticize this aspect of the cap-and-trade system as being too easily subject to manipulation or political tampering. There appears to be ample room for such a concern.[41] However, as with much policy, the devil is in the details. The proposals must be strictly tied to targets and equities maintained so that unfair advantages are not given (see Policy Goals below). On the other hand, although many economists advocate a tax as the clearest price signal to the energy market place and less susceptible to political tampering and market manipulation,[42] at least one expert points out that an emissions tax is also susceptible to political tampering.[43]

There is typically steep political opposition to a policy framed in terms of a tax.[44] This stems from the fundamental argument regarding whether the value of a permit to emit GHGs is a private or public asset and/or the fundamental opposition to the transfer of revenue to the government. Among others, the business community typically opposes such transfers. However, it is not clear that this is more than a psychological barrier. Under the vast majority of proposed cap-and-trade proposals part or all of the allowances would be sold or auctioned and those proceeds would be the equivalent of a transfer of revenue to the government. Further, under a number of emission tax proposals, the revenues would be used to offset other strategic tax reductions, thus the effect under a taxing mechanism could be zero net transfer to the government.

Taxes raise revenues and these funds can be used to support the other components of a climate change policy. Cap-and-trade systems, as they are being proposed, also raise revenues through the sale or auction of allowances. Further, under both mechanisms the revenues can be targeted for similar purposes, (e.g., to offset equity issues or support research and development or deployment of the new technologies necessary to move to a low-carbon economy). However, if there is any allocation at zero cost, which most cap-and-trade proposals include, an inefficiency is introduced into the revenue-raising mechanism. Taxes promote a more efficient collection and recycling of the revenues from emission restraints.[45]

There is clearly a bandwagon effect for the cap-and-trade system. With only a few exceptions, the pricing proposals getting the most attention are cap-and-trade (see Sections IV and V). Given the lag time in the deeper effects of a policy of this magnitude and the time constraints that are becoming clearer with improved scientific findings, policy makers should consider the time it would take to re-channel support and momentum from a cap-and-trade system.

The point is made that the U.S. has a successful historical experience upon which to model an emissions cap-and-trade program. In the U.S. caps and trading have a record of success in combating acid rain, which is caused by sulfur dioxide emissions from fossil fuel power plants.[46] The GHG cap-and-trade mechanism in many proposals is a market-based gas reduction program along the lines of the trading provisions of the current acid rain reduction program established by the 1990 Clean Air Act Amendments.[47] However there are significant differences between sulfur dioxide emissions and GHG emissions and some economists recommend a different approach.[48] The challenge of controlling carbon or GHG emissions is far greater than sulfur. CO_2 is a pervasive byproduct of the economy, and the polluters many and varied.[49] Once emitted, CO_2 is long-lived in the environment.[50] On the other hand, we are not without a successful history in using taxes in international regimes to promote some policy or goal. Further, the dangers of quantity as compared to price approaches have been shown frequently when quotas are compared to tariffs in international trade intervention.[51]

On an international scale, cap-and-trade has become the primary pricing mechanism for GHGs and the core of the vast majority of climate policies that have been implemented globally (see Section IV(C)). It may be difficult to incorporate a taxing mechanism into an international scheme that has progressed to the level that it has and overcome the vested interests that now exist.[52] Although at least one author speaks of harmonized prices, fees or taxes as a method of coordinating policies among countries,[53] it is not clear that momentum can be re-channeled on the international scale as well. The same point arises with hybrid systems, e.g. a cap-and-trade system with a safety valve.

III. Establishing Policy Targets

A. The Approach to Setting Meaningful Targets

There are three steps to establishing meaningful emission reduction targets.[54] First, policy makers must establish the level of risk deemed tolerable or intolerable. Setting limits for policy purposes is a complex task and can only partially be informed by science; it inherently involves normative judgments. This judgment is necessarily a social and political one. There are different approaches and an interpretation is likely to rely on scientific, ethical, cultural, political and/or legal judgments to arrive at what may constitute unacceptable impacts on the climate system, food production, human health, ecosystems or sustainable economic development.[55] Based on scientific assessment, this translates to an overall target for some metric that summarizes the state of global warming, [56] increasing temperature being the most popular.[57] This is a key point. By establishing an acceptable ceiling for temperature increase policy makers are establishing the changes in terms of sea level rises, species extinctions, human health impacts and significant weather changes that are acceptable for U.S. and global populations.[58] See chapter X for a correlation of temperature increases with global impact. Second, working from the target, using the best scientific data available, one must establish the total level of heat trapping gases that can be concentrated in the atmosphere (stabilization level) in order to remain below this target. This is based on scientific assessment. Third, one must establish the plan that will ensure GHG concentrations remain within the stabilization target, i.e. the GHG emission reduction path required. This should include an emission reduction strategy with short, mid and long term targets. Further, GHG gases are emitted globally and have a global effect. U.S. reduction strategies must be assessed in conjunction with predicted global emissions. Based on this three tiered approach and some additional principles, discussed below, the following is the proposal for the emission targets of a comprehensive climate change policy.

Target Recommendations

Based on associated risks in regard to climatic consequences, the maximum allowable temperature increase should not exceed more than ~1°C, relative to the year 2000. To ensure the 1°C threshold is not exceeded, heat trapping gas and aerosol concentrations should be stabilized so that their net radiative effect is less than 450 parts per million (ppm) CO_2e. Attainment of the 450 ppm target should be achieved using the following emissions reduction strategy: (1) begin front-end load reductions immediately in developed countries, and by 2050 reduce GHG emission levels of developed countries to 80-90% below their respective 1990 levels; (2) ensure developing countries are on track to meeting similar emission reduction targets later in the century, with a more aggressive timeframe for high- and mid-income developing countries; and (3) include intermediate targets consistent with this strategy and a framework for revising targets based on predefined criteria.

Pursuant to the UNFCC, described below in Section IV, the global community has been attempting to establish the level of tolerable risks for some time. The UNFCC has the objective "to achieve stabilization of GHG concentrations" at a level preventing "dangerous anthropogenic interference" (DAI) with climate. Climate change constituting DAI is undefined.[59] The decision here will have fundamental implications for emission reduction pathways, the feasibility, timing and scale of adaptation required and for the magnitude of unavoidable losses.[60] For example, based on IPCC results from the Fourth Assessment, a 2°C above pre-industrial limit on global warming would imply that emissions peak within the next decade and be reduced to less than 50% of today's level by 2050; a 4°C limit, would imply that emissions may not have to peak until well after mid century and could still be well above 2000 levels in 2100. The latter limit would have higher levels of adaptation costs and unavoidable losses, but carry lower mitigation costs than the former.[61]

Over the past two decades several expert groups have sought to define levels of climate change that could be tolerable or intolerable, or characterized by different levels of risk.[62] For example, the Advisory Group on Greenhouse Gases (AGGG) in the late 1980's determined that a 2°C increase was "an upper limit beyond which the risks of grave damage to ecosystems, and of non-linear responses, are expected to increase rapidly." In 2006, others in the scientific community reached conclusions in a similar direction, "that global warming of more than 1°C, relative to 2000, will constitute "dangerous" climate changes as judged from likely effects on sea level and extermination of species.[63] From an economic perspective the Stern Review found that in order to minimize the most harmful consequences of climate change, concentrations would need to be stabilized below 550 ppm CO_2 equivalent, and that delay in reducing emissions "would be costly and dangerous."[64] The conclusion of recent research conducted jointly by NASA and the Columbia University's Earth Institute is that a CO_2 level exceeding 450 ppm is dangerous, and a 1°C rise in temperature would be highly disruptive. This study was co-written by 48 scientists in the United States and France.[65]

B. Summary of Targets in Selected Proposals

The following table summarizes selected GHG policy targets and emission reduction strategies:

Table 1. *Selected GHG Policy Targets and Emission Reduction Strategies*[66]:

Organization	Stabilization Rate (maximum atmospheric concentration)	Short and Mid-Term Targets	2050 Target	Description of Reduction Strategy
USCAP		100-105% of 2006 levels within 5 years of rapid enactment (RA) 90-100% of 2006 levels within 10 years of RA 70-90% of 2006 levels within15 years of RA	60-80% below 2006 levels	
NCEP		2006 levels by 2020 15% below 2006 by 2030		Begin reductions immediately with moderate targets
Stern Review	450-550 ppm		25% below 2006 levels (for 550 ppm) 70% below 2006 levels (for 450 ppm)	Emissions peak in next 10-20 yrs. then cut rates at 1-3% per yr. (for 550ppm) Emissions peak in next 10 yrs., then fall at more than 5% per yr. (for 450 ppm)
Doniger	450 ppm	Emissions decline by 1.5% per yr. from 2010-20 2.5% per yr from 2020-2030 3.2% per yr from 2030-2050	60-80% below 2006	Prompt start with annual emission reductions that gradually ramp up to 3.2% per year
NASA/Columbia Research	Ceiling may be lower than 450 ppm	Mean CO_2 growth declines from 1.7 ppm/yr at 2000 to 1.3 ppm at 2050	Mean CO_2 growth at 1.3 ppm	Initially stabilize CO_2 emissions and begin to achieve significant reductions before mid-century

California		2000 levels by 2010 1990 levels by 2020	80% below 1990 levels	
RGGI		2005 levels by 2015 10% reduction of 2005 levels by 2019		
McCain-Lieberman Bill		Capped at 2004 levels from 2012-19 1990 levels from 2020-29 22% below 1990 levels from 2030-49	60% below 1990 levels	
Oliver-Gilchrest Bill		Capped at 2004 levels from 2012-19 1990 levels from 2020-29 33% below 1990 levels from 2030-49	70% below 1990 levels	
Bingaman-Specter (draft)		Emissions reduced by 2.6% per unit GDP from 2010-21 Reduced by 3% per unit GDP from 2022 onward		
Sanders-Boxer Bill		Emissions reduced to 1990 levels from 2010-20 Reduced to 80% below 1990 levels thereafter	80% below 1990 levels	
Kerry-Snow Bill		Emissions reduced to 1990 levels from 2010-20; Reduced 2.5% per year from 2021-30 Reduced 3.5% per year from 2031-50	62% below 1990 levels	

C. Basis for Proposed Targets

The conclusions for the reduction path in this report are based on the following rational. There is consensus, based on scientific data, that emission reductions must begin sooner rather than later.[67] Postponing decisions regarding global warming will come at a great cost.[68] Heat-trapping emissions are cumulative, and delaying the decision to reduce emissions will only worsen the problem and make the task of solving it much harder. To illustrate this point, Doniger et al. include an analysis of two scenarios that avoid atmospheric concentrations higher than 450 ppm: one with an early start and one with a delay of a serious start. If reductions start soon we can stay on the 450 ppm path with an annual reduction rate that gradually ramps up to 3.2% per year; if we delay a serious start for 20 years we must take a jump to 8.2% reductions per year. The path with the early start requires early action but it also provides important economic benefits. It will create certainty needed for efficient planning of long-lived capital investments. It will be less costly and more predictable than a pathway dependent on crash reductions later on.[69] The longer we delay embarking on a downward trajectory of emissions, the harder and more flawlessly and the scheme will have to work later on.[70]

The fourth assessment report from the IPCC, which evaluates scientific findings only through 2005, does not give us the luxury of waiting 10 to 12 years for cap-and-trade to kick in.[71] Further, scientists with more recent findings sound a more strident alarm, warning that we are perilously close to a point of no return.[72] More experts are beginning to speak of a "tipping point"—a point where we will be powerless to do anything.[73] Tipping points can occur during climate change when the climate reaches a state such that strong amplifying feedbacks are activated by only moderate additional warming.[74] As the tipping points pass, there is an acceleration, potentially uncontrollable, of emissions of vast natural sources of GHGs.[75]

The timing and trajectory of emissions reduction should be calibrated toward a long-term stabilization goal that balances risks of damage from climate change against the feasibility and cost of a rapid transformation of the energy system. A long term cap creates the certainty needed for efficient planning of long-lived capital investments. It will also be less costly and more predictable than a pathway dependent on crash reduction later on. The possibility of revisiting and fine-tuning the long-term target introduces much less uncertainty than if the long-term target is left entirely undefined for another decade.[76] Energy company executives and investors in alternative energy projects agree that there needs to be a policy framework and priorities for the long term, at least 15 years, for stability.[77]

Flexibility in adjusting targets is necessary to adapt to new and emerging information about both abatement cost and climate risks. Flexibility is also required to enable the U.S. to participate effectively international negotiations. Such negotiations would make more aggressive targets in the U.S. contingent on similar or matching actions in other key countries.[78] It is reasonable to take stock periodically to ensure that others are taking reciprocal action. A regular review should be made of the targets and policies every 5 or 10 years based on current science, economics and the state of international cooperation.

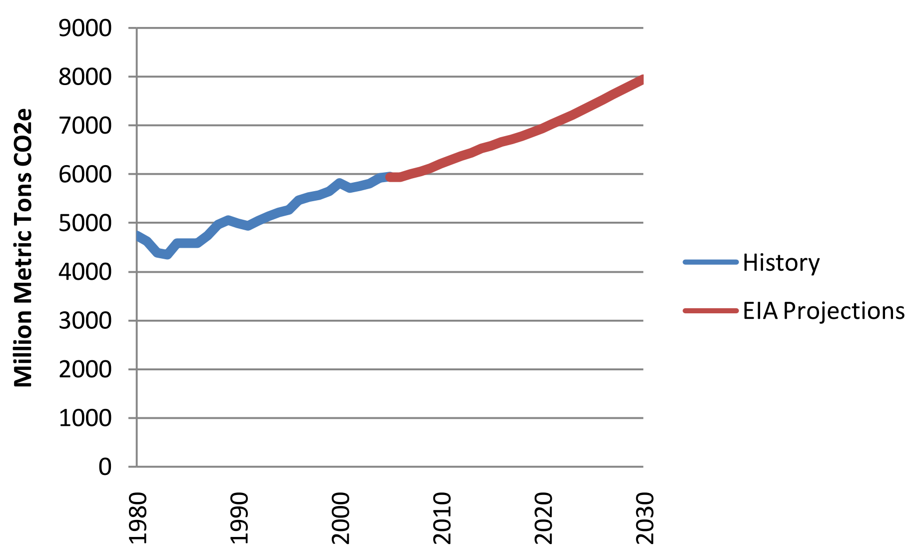
Finally, irreversibility is an important aspect of decisions regarding climate change policy. The climate system's response to anthropogenic forcing is likely to be irreversible over human timescales and many damages are likely to be irreversible.[79] Expressed in a variety of ways, leading authorities recommend erring on the cautious side—e.g., "Uncertainty is an argument for a more, not less, demanding goal, because of the sizes of the adverse climate-change impacts on the worst-case scenarios."[80]

IV. Status of Policies and Programs

A. National Policy: Vacuum

In 1992, the United States ratified the United Nations Framework Convention on Climate Change (UNFCCC), which called on industrialized countries to take the lead in reducing the six primary GHGs to 1990 levels by the year 2000. The six GHGs are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.[81] For more than a decade, a variety of voluntary and regulatory actions have been proposed or undertaken in the U.S., including monitoring of power plant carbon dioxide emissions,[82] improved appliance efficiency, and incentives for developing renewable energy sources. However, carbon dioxide emissions have continued to increase (*see* Chart 1).[83]

Chart 1. *U.S. GHG Emissions, 1980 – 2030*[84]



In 2001, President George W. Bush rejected the Kyoto Protocol, which called for legally binding commitments by developed countries to reduce their GHG emissions.[85] He also rejected the concept of mandatory emission reductions. Since then, the Administration has focused U.S. climate policy on voluntary initiatives to reduce the growth of GHG emissions. For over a decade, climate change and GHG emission have been an issue in Congress.[86] To date, a comprehensive climate change proposal has not passed.

B. State and Local Policies

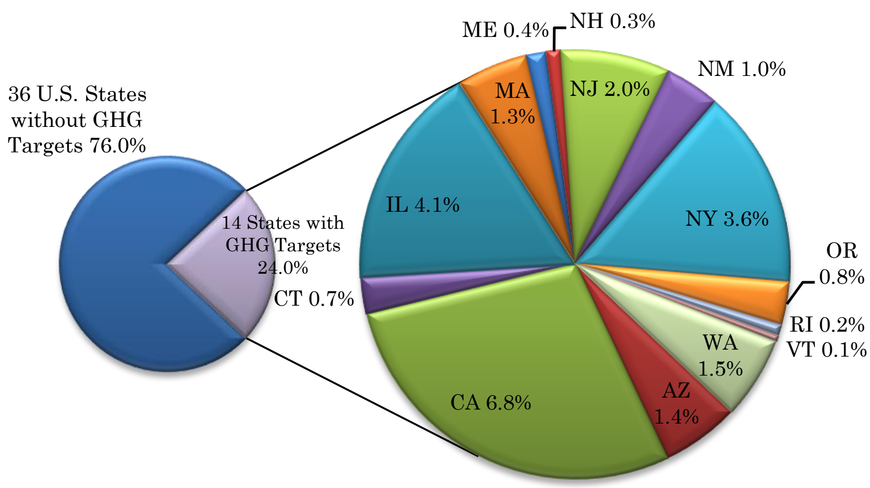
Recent years have seen a dizzying profusion of policy initiatives from U.S. sub-federal entities designed to reduce their respective emissions of GHGs. Across much of the country, advisory groups,[87] task forces,[88] action teams,[89] councils[90] and commissions[91] on climate change are springing to life. Businesses, cities, and states are proclaiming commitments to achieving reduction targets for GHG emissions.[92] Regional climate change initiatives—involving all levels of government (notwithstanding the federal one) and civil society—are populating the political landscape at an increasing pace.[93] In short, if we were to peer beneath the federal lid to see just what sub-federal actors are doing with respect to climate change, there would be no shortage of things to watch.

Galvanized in part by a lack of vigorous federal engagement[94] on the issue of climate change—as well as a desire to capitalize on market opportunities, efficiency savings and so forth—a growing number of states have instituted climate change policies designed to reduce greenhouse gas emissions. There are a number of plausible reasons for pursuing climate change policies at the state rather than federal level. For instance, relative to the nation as a whole the geographic scale of states can present a more manageable forum for policy development.[95] State-level climate policies are also, quite arguably, more capable of catering to the specific needs of individual states, as well as exploiting opportunities peculiar to states and regions. States generally have the authority to regulate what the federal government does not; and in many instances, they also have the authority to exceed existing federal standards.[96] Frequently, states have more direct control—or influence—over entities responsible for GHG emissions. There is also a crescendo effect at work here. As more states adopt policies to address climate change, there is more opportunity for increasing the efficacy of those policies through coordination and complimentary programs at regional and even international levels. This in turn makes it more attractive for states that have yet to enact such policies to do so. Within the context of clean energy policies, the development of regional systems for tracking renewable energy credits—and the ability of such systems to facilitate the operation of state renewables portfolio standards—is one such example. With respect to climate change, the development of the still nascent Regional Greenhouse Gas Initiative, which will enable the regional trade of GHG emissions credits, is another such example.

Of course, there are at least two sides to every coin. And while state-level climate policies do present certain advantages relative to federal policies, there are serious disadvantages to a climate policy regime restricted solely to the domain of states. By enacting a patchwork of policies that are similar in character but nonetheless quite often very different in detail, state-level efforts can lead to a complex, inefficient and costly regulatory environment for those seeking to do business in multi-state jurisdictions.[97] Additionally, without a uniform national regulatory regime, there is a risk that actors will engage in a "race to the bottom" by locating in states that have not enacted stringent or any regulatory restrictions. Indeed, for states faced with economic woes, the prospect of such a race can itself be motivation for not adopting regulatory restrictions.[98]

Viewed from a global perspective, state efforts to reduce GHG emissions have the potential to strongly impact worldwide emission trends. In 2002 the U.S. share of global GHG emissions was approximately 23%—making it by far the number one GHG emitter.[99] If we compare CO_2 emissions from U.S. states to other national jurisdictions (and exclude the U.S. from this comparison), they would constitute 34% of the world's top 50 emitters of CO_2. In 2001 Texas was the world's sixth largest emitter of CO_2 and California the thirteenth. If Pennsylvania, Ohio, Florida, Illinois, Indiana and New York were considered a single country, their combined CO_2 emissions in 2001 would make them the world's third largest emitter.

Chart 2. *Comparison of U.S. CO_2 Emissions and CO_2 Emissions for U.S. States with GHG Reduction Targets*[100]



Thus, while the U.S. has hitherto repudiated the binding cap-and-trade approach of the Kyoto Protocol, climate mitigation efforts by many U.S. states can nonetheless have an effect equal to or even greater than that of many parties to the Kyoto Protocol.

Of the 41 states that have completed GHG inventories, 28 of these states have also completed climate action plans designed to identify and assess practicable measures for reducing GHG emission through public and private sector programs and policies. Informed by a diverse array of individual economic, resource and political issues, state climate action plans adopt a wide range of approaches in their efforts to reduce GHG emissions.[101]

The 28 states with climate action plans produce almost half of the nation's total GHG emissions;[102] and include 10 of the top 17 state GHG emitters (see Table 2).[103] According to analysis done by the U.S. EPA in 2001 (which at that time dealt with a total of 20 state climate action plans), 14 of these plans have options that could—if fully and successfully implemented—result in annual GHG reductions of 100 million metric tons of carbon equivalent (MMTCE) by 2020.[104] To put this figure in perspective, according to the U.S. Energy Information Agency's most recent estimates, by 2020 total U.S. CO_2 emissions will equal 1,941 MMTCE.[105] Thus, the 100 MMTCE reduction projected by the EPA would equate to 5.1% of this amount.

Out of the 28 states that have adopted climate action plans, 14 of these states have taken the not insignificant step of committing to specific time-bounded quantitative targets for GHG emissions reductions; and have designed their respective climate action plans to enable the attainment of these targets.

Table 2. State GHG Emissions Targets

State	GHG Emissions Target
Arizona	2000 levels by 2020; 50% below 2000 by 2040
California	2000 levels by 2010; 1990 levels by 2020; 80% below 1990 levels by 2050
Connecticut	1990 levels by 2010; 10% below 1990 levels by 2020
Illinois	1990 levels by 2020; 60% below 1990 levels by 2050
Maine	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2003 levels in the long term
Massachusetts	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% < 1990 levels in the long term
Minnesota	15% below 2005 levels by 2015; 30% below 2005 levels by 2025; 80% below 2005 levels by 2050
New Hampshire	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term
New Jersey	1990 levels by 2020; 80% below 2006 levels by 2050
New Mexico	2000 levels by 2012; 10% below 2000 levels by 2020; 75% below 2000 levels by 2050
New York	5% below 1990 levels by 2010; 10% below 1990 levels by 2020
Oregon	Stabilize by 2010; 10% below 1990 levels by 2020; 75% below 1990 levels by 2050
Rhode Island	1990 levels by 2010; 10% below 1990 levels by 2020
Vermont	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term
Washington	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term

C. Internationally

Numerous countries are engaging—in various ways and to differing degrees—in programs designed to reduce their respective emissions of GHGs. The vast majority of these programs are cap-and-trade systems. This Chapter limits its review of international instruments to the two major climate change multilaterals—the UNFCCC and the Kyoto Protocol—and the European trading system that has emerged as a result of the Kyoto Protocol. There are parallels between the structure of the European Union and its member countries and the U.S. federal government and its constituent states. These parallels make the structure, rules and experiences of the EU trading system of particular relevance to efforts to design a national U.S. cap-and-trade system.

1. The UNFCCC and the Kyoto Protocol

The international market for GHG emissions can be traced to the United Nations Framework Convention on Climate Change (UNFCCC), adopted in Rio De Janeiro, Brazil in 1992. [106] The UNFCCC called upon industrialized Parties to reduce their GHG emissions to 1990 levels by the year 2000.[107] In 1995, the Parties reviewed the progress made under the UNFCCC and concluded that the non-binding mandate to reduce GHG emissions to 1990 levels would not accomplish the Convention's objective of atmospheric stabilization.[108] Rather, these soft commitments were deemed too aspirational and vague to effectuate a substantial global reduction of GHGs.[109]

Pursuant to the UNFCCC, the Kyoto Protocol was negotiated in December 1997.[110] The Protocol entered into force on February 16, 2005 with Russia's ratification of the treaty. The addition of Russia pushed the total emissions of countries that had acceded to the treaty beyond the coverage threshold amount of 55% of global GHG emissions.[111] The United States and Australia are two notable Parties who have, as yet, failed to ratify the Protocol.[112] The Protocol divides its Parties into two categories. The first category of parties are referred to as Annex I countries. These are developed countries who were members of the Organization for Economic Co-operation and Development (OECD) in 1992.[113] Of the 164 signatory states,[114] 37 Annex I countries are included in the Protocol's Annex B, and are therefore prescribed quantified limits and reduction obligations for Kyoto's first commitment period, which stretches from 2008 until 2012.[115] The United States is included in Annex B with a commitment to reduce CO_2 emissions to 93% of 1990 levels even though Congress has not accepted this commitment by ratifying the Protocol.[116] The second category of countries are those in the developing world, referred to generally as non-Annex I countries.[117] Non-Annex I countries do not have emission reduction obligations.[118]

Annex I countries have committed to reduce their GHG emission by 5.2% from 1990 levels by the end of the first compliance period through domestic and international action.[119] However, due to growth in emissions in most countries between the negotiation of the Protocol and its entry into force, much higher reductions are now required before to meet for these countries to meet their reduction obligations by 2012, the beginning of the second compliance period.[120]

2. European Union Emissions Trading Scheme (EU ETS)

The fifteen member-states of the European Union existing when the Kyoto Protocol was signed committed to an 8% reduction in GHGs collectively.[121] However, by 2000 many of these countries were having difficulty meeting their Kyoto targets despite significant reductions by the United Kingdom and Germany.[122] Concomitantly, the EU established a range of measures, most notably the European Union Emissions Trading Scheme (EU ETS) to facilitate the reduction goals under Kyoto.[123] The EU ETS was launched on January 1, 2005 and covers nearly 12,000 installations in twenty-five nations and six major industrial sectors.[124] These current installations represent 45% of the EU's total carbon emissions.[125] The ten nations admitted to the EU in May 2004 are not covered by the EU target but nevertheless have their own reduction targets that in most cases require a 6 to 8% reduction of GHG emissions.[126] The EU ETS Directive, 2003/87/EC, agreed to in 2003, provides a framework for the system, specifying the attributes of nation-based emissions trading platforms.[127]

The EU ETS is a downstream, company-level, CO_2 trading system where emissions credits are assigned to point sources of GHG emissions such as power plants, oil refineries, coke ovens and large production facilities.[128] This is the opposite of an upstream system that regulates industries that are responsible for taking the first steps in the energy production process, including businesses engaged in mining and drilling for oil. The EU ETS creates tradable carbon emission allowances known as European Union Allowances ("EUAs").[129] These allowances are not printed, but rather held in electronic registries established by the member-states and overseen by a Central Administrator for the EU.[130] The Administrator tracks each transaction in the Community Independent Transaction Log for any irregularities.[131] Pursuant to EU ETS, member-states must develop national allocation plans ("NAPs"), providing procedures and desired quantities for EUA allocation.[132] NAPs may be rejected by the European Commission if they do not meet the requirements of the directive or if they are not rigorous enough to achieve reduction targets under the EU's burden sharing agreement for Kyoto.[133]

In the first commitment period, stretching between 2008 and 2012, a participating government is required to allocate 95% of initial EUAs for free, while 5% can be sold or auctioned.[134] Most countries have chosen to adopt a method of "grandfathering," where EUAs are provided freely in a quantity based on an installation's historical emissions output.[135] Additionally, instead of allocating all EUAs for the beginning of the commitment period, member-states can also choose to reserve some allowances for new CO_2 emitters.[136] Once established in a NAP, the total combined allocation plus the allocated reserve acts as a cap and cannot be augmented except through purchase of further allowances from other participants in the market.[137] The linking directive through EU ETS allows Certified Emissions Reductions created through Kyoto to be fungible with EUAs.[138] ERUs will also be accepted by the EU ETS starting in 2008.[139] However, excess AAUs, like those held by Russia, are not accepted by EU ETS participants.[140]

a. Organization & Compliance

EU ETS is organized around an annual cycle that distributes yearly allowances and requires an accounting of granted EUAs, purchased EUAs, CERs and ERUs (allowed in 2008) against the total emissions of the installation.[141] Installations have four months after the end of the year to comply with the previous year's obligations.[142] If an installation does not meet its obligation through reduction measures and the purchase of EUAs, it must pay damages of €40 per excess ton of CO_2 plus surrender the missing allowances in the next year.[143] The penalty will rise to €100 per excess ton of CO_2 during the next EU ETS commitment period that corresponds with the first Kyoto commitment period of 2008 to 2012.[144]

The EU ETS system is subject to country caps or baselines that are relative to each country's target under Kyoto.[145] Growth of the cap is allowed for economic expansion, but only during allocation at the beginning of the commitment period.[146] Most NAPs do not compensate for reduction that occurred before the first commitment period.[147] Furthermore, banking of EUAs between commitment periods is not allowed in most NAPs because of the problem of adding a greater burden to future Kyoto commitment periods.[148] To deal with new participants in the market a "new entrants reserve" is freely distributed on a "first-come, first-served" basis to new installations in most NAPs.[149] Also, in most NAPs, if an installation closes, the allowance for that installation is added to the "new entrants reserve."[150] However, some counties allow transfers of EUAs from closing plants to other installations owned by the same operator.[151] With the strict requirement that total allotments to each country only be supplemented through the purchase of additional EUAs and Kyoto units, a scarcity of emissions allowances has been introduced into the market that will drive prices through simple supply and demand economics.[152]

b. Carbon Price

Many factors affect the price of carbon, including the severity of emissions caps, the supply of project-based emissions credits like CERs, relative fuel prices between carbon intensive and cleaner energy sources, weather variations and other regulatory features.[153] At this early stage in the market, any increase in gas prices causes EUA prices to increase due to greater incentives for installations to switch to less expensive, more carbon intensive coal power.[154] In its first year, the ETS traded a total volume of 363 million tons of CO_2 with prices reaching as high as €30/ton.[155] In 2006, EU ETS volumes rose every month.[156] However, in May 2006 the price of EUAs crashed on reports that many member-states had set extremely high emission caps so as to protect their affected industries.[157] These protective actions resulted in an excess allotment on a continent-wide basis, 100 million tons of CO_2 higher than actual emissions occurring during the first year of the EU ETS.[158] As of March 2007 the price of an EUA was hovering around one euro, down from seven Euros at the end of 2006 and nearly €40/ton earlier in 2006.[159]

Along with the market crash, resistance to sufficient emission reductions by some countries has been problematic.[160] Presently, the EU plans to censure nine nations for failing to submit their National Allocation Plans by the June 2006 deadline.[161] Of the 19 NAPs submitted by October 2006, only five countries established acceptable carbon caps, leaving 130 million tons of CO_2 to be cut.[162] NAPs are currently being revised to scale back allocations in an attempt to stabilize the price of carbon.

Debates have arisen between stakeholders in the EU ETS concerning the structure of the fledgling market. Reports show that switching fuel away from carbon-based fuels is profitable between a $35-55 USD price for carbon, highlighting the need for a robust price signal in the EU ETS.[163] Furthermore, a stable price signal is needed to allow firms to make decisions involving their energy use and product line.[164] Companies must be encouraged to adopt more efficient production methods and to begin producing less carbon intensive products.[165] Uncertainty in the market also creates obstacles for establishing liquidity in the CO_2 allowance market.[166]

c. Streamlining the EU ETS

Notwithstanding the uncertainties in the EU ETS, a survey of stakeholders including governments, companies and non-profits released in November 2005 provides that nearly half of the companies surveyed "price in" the value of CO_2 allowances and 70% plan to in the future.[167] That is, consumers are bearing the cost of increasingly complex GHG regulation. Half of the companies replied that the EU ETS has "a strong or medium impact on decisions to develop innovative technology.[168] Companies, government bodies and non-governmental organizations ("NGOs") rank longer term issues as the most important with respect to the development of EU ETS.[169] Stakeholders believe that topics related to uncertainty in the market, including reduction targets, allocation rules, rules for new entrants and rules for closures are the most important.[170] Companies desire longer allocation periods to allow for greater stability in the market and to provide a longer term in which to invest in long term technologies.[171] The inclusion of other industries such as the chemical industry and aviation industry is also seen as a priority for stakeholders.[172] Predictably, companies favor the grandfathering system utilized in the first compliance period, while NGOs and government bodies desire more auctioning.[173] All stakeholders believe that the rules for new entrants and closures should be harmonized across Europe.[174] However, companies and governments believe that new entrants should be required to pay a fee for units from the new entrants reserve, as opposed to NGOs and a majority of companies who would prefer to keep allowances until the end of the compliance period for closing facilities.[175] All stakeholders desire transparency during the initial stages of the EU ETS and a clear monitoring system.[176] As emissions markets develop beyond the initial incentive-creating benchmarks, performance will be more easily measured.[177]

Due to problems with market fluctuations and complaints by stakeholders, the European Commission is considering addressing the weaknesses of the EU ETS by changing the rules.[178] The commission has signaled that it will reject NAPs that are too lenient and move to regulate sectors like air transport that were left out of the initial program.

V. What Is Being Considered in Terms of a U.S. Policy

A. Legislative Proposals

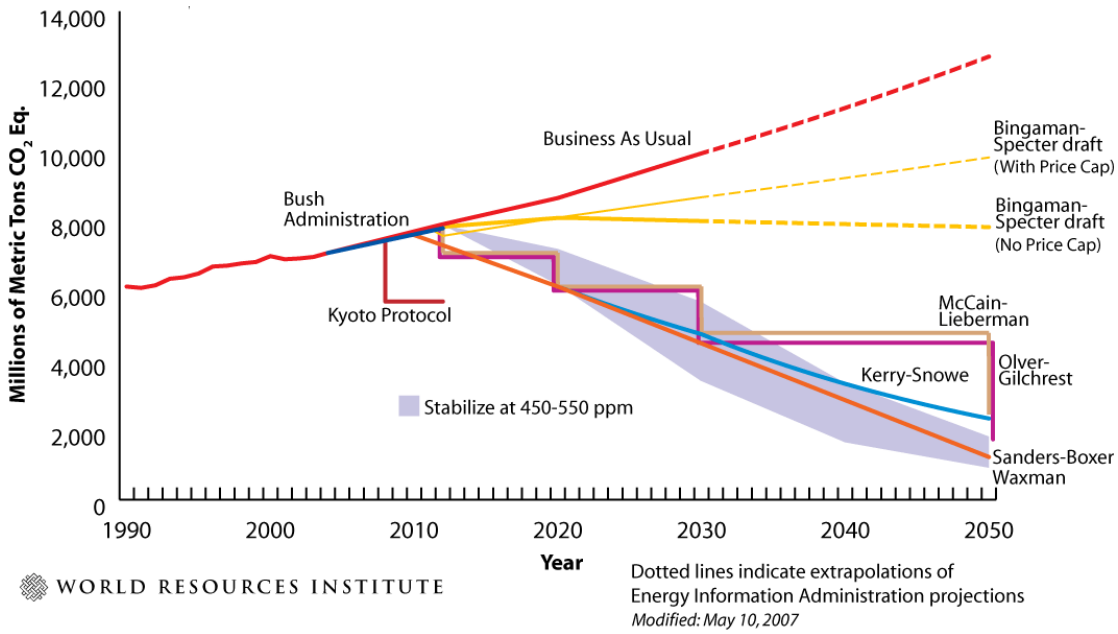
A number of bills to advance policies designed to reduce GHGs have been introduced in the 110th Congress. By late March of 2007, there were over 86 proposals that addressed some aspect of climate change policy, e.g., changes in energy policy; the promotion, development, deployment and use of new energy technologies; implementing emission pricing. Some are quite limited, advancing only one specific proposal, while some are more comprehensive, incorporating the complementary portfolio approach.[179]

These bills have been described as generally following three tracks: (1) improve the monitoring of GHG emissions to provide a basis for research and development and for an potential future reduction scheme; (2) enact a market-oriented GHG reduction program along the lines of the trading provisions of the current acid rain reduction program established by the 1990 Clean Air Act Amendments; and (3) enact energy and related programs that would have the added effect of reducing GHGs (for example, requiring electricity producers to generate a portion of their electricity from renewable resources, a renewable portfolio standard.[180] Although all three tracks are necessary—improved monitoring, emissions pricing and revisions to our energy strategy—for a comprehensive GHG policy, the weight of authority points to pursuing all three concurrently. We are beyond the point where further study, alone, is an option; it is clear there needs to be a pricing mechanism for GHG emissions and because of the lag time in enacting such as significant change in policy and the expected impact on emissions it must be implemented soon.

Seven bills have been introduced in the 110th Congress that would impose controls on emissions of GHGs through pricing; six are cap-and-trade systems and one is an emissions tax.[181] The Congressional Research Service has prepared a detailed side-by-side comparison of the key provisions of the six cap-and-trade bills.[182] Some of the key provisions are as follow: (1) all six cover the same six GHG emitting gases included in the Kyoto Protocol; (2) S.317, introduced by Senator Feinstein, covers only fossil-fired electric generating facilities (the others are much broader in respect to entities covered); (3) none of the bills include the safety valve provision, although S.309, introduced by Senator Sanders, includes a national security emergency provision and S.317 includes an option to borrow against future reductions and increase international credits that can be used; (4) five permit banking of allowances, while the sixth, S.309 does not prohibit it; (5) all six address early reduction efforts in some manner; (6) all six provide for public sale/auction of some of the allowances in some manner; and (7) all six provide for revenue recycling in some manner.

Below is a graphic comparing the predicted emissions trajectories of the proposed bills. Note that the Bingaman discussion draft is modeled on recommendations from the National Commission on Energy Policy (NCEP); and the NCEP still proposes a safety valve, so the graph "with price cap" more accurately reflects the trajectory of their proposal.[183] The bill proposed by Bingaman is based on an upstream cap-and-trade system and the proposal sponsored by Senators McCain and Lieberman embodies a mixed cap-and-trade located partly upstream and partly midstream.[184] The Boxer/Sanders - Waxman Bills deliver reductions of sufficient depth to stabilize emissions at 450 ppm in the atmosphere. As can be seen from the emissions projections, even if strongest cap and trade measure becomes law in 2009-10, unless implementation is pursued with unusual urgency, it could be 2020 before deep reductions are fully implemented.[185]

Chart 3. *Comparison of Economy-Wide Climate Change Proposals in 110th Congress, 1990-2050*



It should be noted that with respect to the above chart, the lines indicate projected worldwide emissions based on all developed countries pursuing the same policy and with developing countries coming online shortly thereafter. The projections based on the NCEP proposals do not meet the 450-550 ppm stabilization range altogether, and the shortfalls are quite pronounced. Two of the proposed bills rise significantly above the range starting around 2030 and rely upon a sharp drop in emissions at 2050 (McCain and Oliver). Only one of the bills is predicted to stabilize at 450 ppm by 2050 (Sanders-Boxer); none are predicted to stabilize below 450 ppm.

B. Proposals by Key Groups

There are literally hundreds of proposals in circulation regarding comprehensive U.S. climate change policies.[186] We chose to highlight two here because they represent coalitions between industry and environmental groups that have received much national attention. Both include pricing mechanisms and both pricing mechanisms chosen are cap-and-trade. The goals and targets for these proposals are included in the comparison chart in Section III(B) above. Also note, that the proposals of NCEP are included in the Bingaman-Specter draft trajectory (with price cap) on the graph above in Section V and it shows that the emissions projection for this proposal is far from the 450-550 ppm stabilization range target. One author has described the NCEP proposal as "industry-friendly" and "noticeably weak."[187] However, these proposals represent baselines or standards and provisions to which some major players have acceded. For example, even the NCEP coalition proposes auctioning at least 50% of the allowances rather than grandfathering all emissions; and USCAP has fairly aggressive targets.[188]

The NCEP is self described as a diverse and bipartisan group of leaders from business, government, academia, and the non-profit community, that formed to develop consensus recommendations for future U.S. energy policy. They issued their first report in December 2004 after 3 years of effort. In April 2007 they issued a report with updated recommendations.[189] Included in their portfolio of policy proposals is a recommendation for Congress to implement a mandatory, market-based program to limit economy-wide U.S. GHG emissions: (1) targets are defined, however, a safety valve is included beginning at $10 per ton of CO_2 equivalent emissions and emission offsets are included; (2) roughly half of allowances are auctioned or used to invest in advanced technologies and mitigate impacts on low-income consumers, half are distributed to affected industry; (3) point of regulation is at or near primary fuel producers or suppliers; and (4) it includes linkage to international action.

The United States Climate Action Partnership (USCAP), self described as a business and NGO partnership, issued their recommendations for a national climate action policy in January 2007. Within their portfolio of proposals they also recommend a mandatory market based system for reducing GHG emissions: (1) create a domestic cap-and-trade program with specific near, mid and long term targets; (2) implement a hybrid upstream and downstream approach, requiring fossil fuel producers to be covered by allowances that equal the emissions released when the fuel is combusted and large stationary sources to be covered; (3) allocate a significant portion of allowances free to capped entities and economic sectors particularly disadvantaged by the program with free allocations to the private sector phased out over time; (4) permit offsets and other cost control measures such as a safety valve, borrowing and/or strategic reserves; (5) establish a national inventory and registry of emissions; and (6) begin international engagement and linkage immediately.

VI. Conclusions

Based on efficiencies, it may be unwise to ignore an emissions tax as a policy mechanism for addressing climate change. However, it will come down to a policy decision regarding timing—are we at the point where quantity is the primary concern; a cost benefit analysis—what is the risk to gain the efficiencies of a tax based mechanism; confidence in re-channeling momentum in a timely manner; and the implications in regard to international linkages and integrating state, regional and local policies. Even if efficiencies of an emissions tax outweigh the benefits of a cap-and-trade system, a cap-and-trade system may be the best choice; this may be the cost of prior inaction.

Current scientific projections strongly support action now and aggressive emission reduction targets. Further, the lack of a climate change policy for U.S. emissions has strong implications for international emission obligations as well. Without GHG emission reduction policies in developing countries, the reduction actions taken by the U.S. will have little effect on the global problem. However, developing countries will likely not join in international schemes or implement their own reduction strategies without decisive action by the U.S., currently the largest GHG emitter. Every year we do not act is another year that capital investments are made both here and abroad which will affect emission levels for decades. For example, China will build more coal-fired plants in the next two decades than the U.S. and Europe put together. Once constructed these plants will last for 50 years.[190]

Inaction on an international level can no longer continue. Almost without exception, every current proposal for climate change policy includes international linkages as a component. Therefore, policy makers must consider how a U.S. climate change strategy will interconnect with other national and international efforts. Also, aggressive efforts must be made to put developing countries onto an emission reduction path. Based on historical efforts, global international agreements may not be the most effective near term strategy. Efforts made on a bilateral or multilateral (with limited participants) basis should be considered as well as instruments that might not be considered as conventional.

VII. Proposals and Descriptions of Proposals

A. Guiding Principles for U.S. Climate Policy

Meaningful Targets. Does the approach envisioned set meaningful reduction targets with mechanisms in place to ensure those targets are met regardless of any "horse trading"? As used here, the term "meaningful" refers to a GHG reduction target that is: (1) based on a thorough evaluation of what constitutes acceptable risks vis-à-vis climatic impacts; (2) utilizes the best scientific evidence available to translate (within an acceptable probability range) the identified risks into a maximum allowable temperature increase; (3) determines, with as much certainty as possible, the level at which atmospheric concentrations of GHGs must be stabilized to ensure that the maximum allowable temperature increase is not exceeded, as well as the timeframe in which this level must be achieved; (4) establishes an atmospheric GHG concentration target based on the identified stabilization level and timeframe; and (5) identifies an emission reduction trajectory designed to meet that target within the required timeframe. Using the above criteria, we recommend the following:

- Based on associated risks in regard to climatic consequences—risks that we are not willing to take—the maximum allowable temperature increase should not exceed more than ~1°C, relative to the year 2000.
- To ensure the 1°C threshold is not exceeded, heat trapping gas and aerosol concentrations need to be stabilized so that their net radiative effect is less than 450 parts per million (ppm) CO_2e.
- Attainment of the 450 ppm target should be achieved using the following emissions reduction strategy: (1) begin front-end load reductions immediately in developed countries, and by 2050 reduce GHG emission levels of developed countries to 80-90% below their respective 1990 levels; (2) ensure developing countries are on track to meeting similar emission reduction targets later in the century, with a more aggressive timeframe for high- and mid-income developing countries; and (3) include intermediate targets consistent with this strategy and a framework for revising targets based on predefined criteria.

Flexibility. Does the approach envisioned provide a means for modifying targets and policies based on improved science, new data, changed circumstances, or the requirements of international agreements?

Equity. Does the approach envisioned acknowledge and promote the legitimate right of developing countries, pursue economic growth and improve standards of living within the context of sustainable development? Does the approach reflect the fact that the largest share of atmospheric concentrations of GHGs originated in developed countries; and that developed countries should take the lead in combating global climate change?

Economic Efficiency. Does the envisioned approach provide for the realization of targets in a fashion that is as economically efficient as possible? Does the approach maximize cost savings, job development and economic growth?

Diverse and Creative Approaches. Is the envisioned approach capable of facilitating and taking into account diverse and creative approaches to reducing GHG emissions?

Transparency and Accountability. Does the envisioned approach provide mechanisms for monitoring and verifying progress? Does the approach embody uniform criteria for measuring and evaluating performance?

International Linkages. Is the envisioned approach capable of being linked with prospective international systems?

B. Achieving Goals through Cap-and-Trade

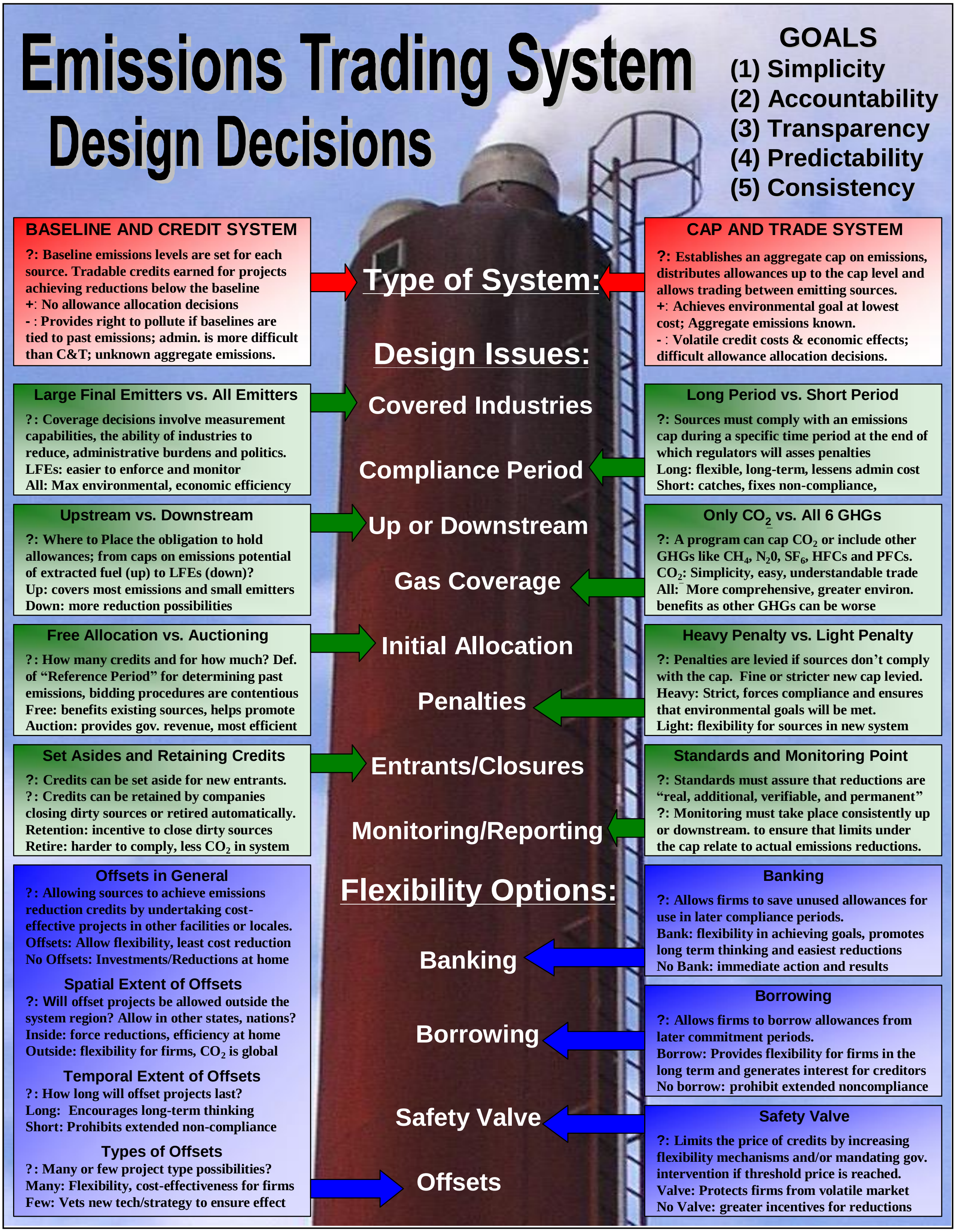
1. Design Options: Overview

Emissions trading is merely one component of a larger regulatory framework. However, emissions trading systems themselves are comprised of a host of characteristics and unique features (See Figure 1 for the basic elements of an emissions trading system). The most fundamental component of an emissions trading system is the type of emissions trading system being employed. While cap-and-trade and baseline-and-credit systems are the most common, other hybrid systems that involve a complimentary carbon tax, energy efficiency standards or auto emissions standards are possible. Furthermore, a rate-based program may be utilized, where credits are earned for reductions per unit of economic output rather than per ton of CO_2. More complicated systems could more fairly distribute the burden of reductions, but the complexity of such programs could render them cost prohibitive. A regulator must also address the coverage and extent of the program. An emissions trading program can be limited to large installations or extended to include a variety of economic sectors. A related question is whether the program will be an "upstream" program, requiring fuel suppliers to surrender allowances equating to the carbon content of the fuels they provide, or a "midstream" program, regulating traditional sources of emissions or even consumers directly. Regulators must also determine whether all six of the traditional GHGs (carbon dioxide, nitrous oxide, methane, sulfur hexafluoride, perfluorocarbons and hydrofluorcarbons) will be covered by the program. These decisions will determine where the burden of reductions will be placed and will have dramatic effect on the strategies used to achieve these reductions.

Other decisions specifically affect cap-and-trade programs. One rather contentious issue concerns whether allowances should be freely given to firms in an amount reflecting past emissions, a process called "grandfathering," or whether allowances should be auctioned, providing money for other regulatory incentives. A hybrid of the two approaches is also possible. Firms generally favor grandfathering while regulators prefer the auctioning system. Another important decision involves the penalty that will be levied if an installation does not comply with their cap. Some systems require the non-complying firm to make up for the excess emissions in the next compliance period, or pay fines in an amount greater than the cost of allowances on the market and be subjected to prosecution if they knowingly violate requirements. Aside from these difficult decisions, other administrative judgments must be made concerning the length of time installations have to comply with their targets and the rigor of monitoring systems to track GHG emissions and award credit.

Other design decisions involve the delicate balance between environmental protection and economic efficiency. Many programs are designed to allow firms flexibility in the methods that they use to achieve their GHG reduction targets. "Banking" allows firms to retain unused credits for use or trade in later compliance periods. "Borrowing" allows firms to undertake long-term projects that will achieve reductions after the compliance period is over by allowing the firm to borrow credits from later compliance periods. One of the most important flexibility mechanisms is the "offset," which allows firms to commission emission reduction projects at other facilities or in other states, thereby receiving a credit for the amount of emissions reduced, which can then be used against the facilities own reduction goal. Regulators must take into account questions of “leakage,” a term that relates to the fact that emissions reductions in a regulated sector or area may lead to increases of emissions elsewhere. Furthermore, regulators must ensure that offset projects are “additional,” or would not have happened without the investment of the firm in the market for offsets.

Figure 1. Design Options for a Cap-and-Trade System



2. Options for Action

Point of Regulation: Upstream or Midstream

- A U.S. national cap-and-trade system should utilize an "upstream" approach that limits the sale of fossil fuels in the U.S.—whether from imported sources or domestic production. A national "midstream" cap-and-trade system on industrial entities and large power stations would encompass 50% of all CO_2 emissions in the U.S., and thus provide less certainty relative to the probability of meeting a given GHG reduction target. In contrast, the more comprehensive nature of upstream approach would provide greater assurance of meeting a given GHG reduction target.

Sectoral Coverage

- If configured as an upstream system, the comprehensive nature of the cap-and-trade program will ensure that GHG emissions from virtually every sector of the U.S. economy are addressed. A mid-stream cap-and-trade system should, at a minimum, be designed to cover the emissions of large power generators and heavy industries. While the coverage over U.S. GHG emissions by a midstream system would be less than that of an upstream system, a midstream system could work in concert with instruments designed to cover additional sectors, such as the use of CAFE standards to reduce GHG emissions from the transportation sector.

Types of Emissions Covered (CO_2 vs. All 6 Major GHGs)

- While CO_2 is the most prevalent GHG (see Figure 2), a cap-and-trade system—whether upstream or midstream—should be designed to cover all six major GHGs: carbon dioxide; methane; nitrous oxide; hydrofluorocarbons; perflourocarbons; and sulfur hexafluoride.

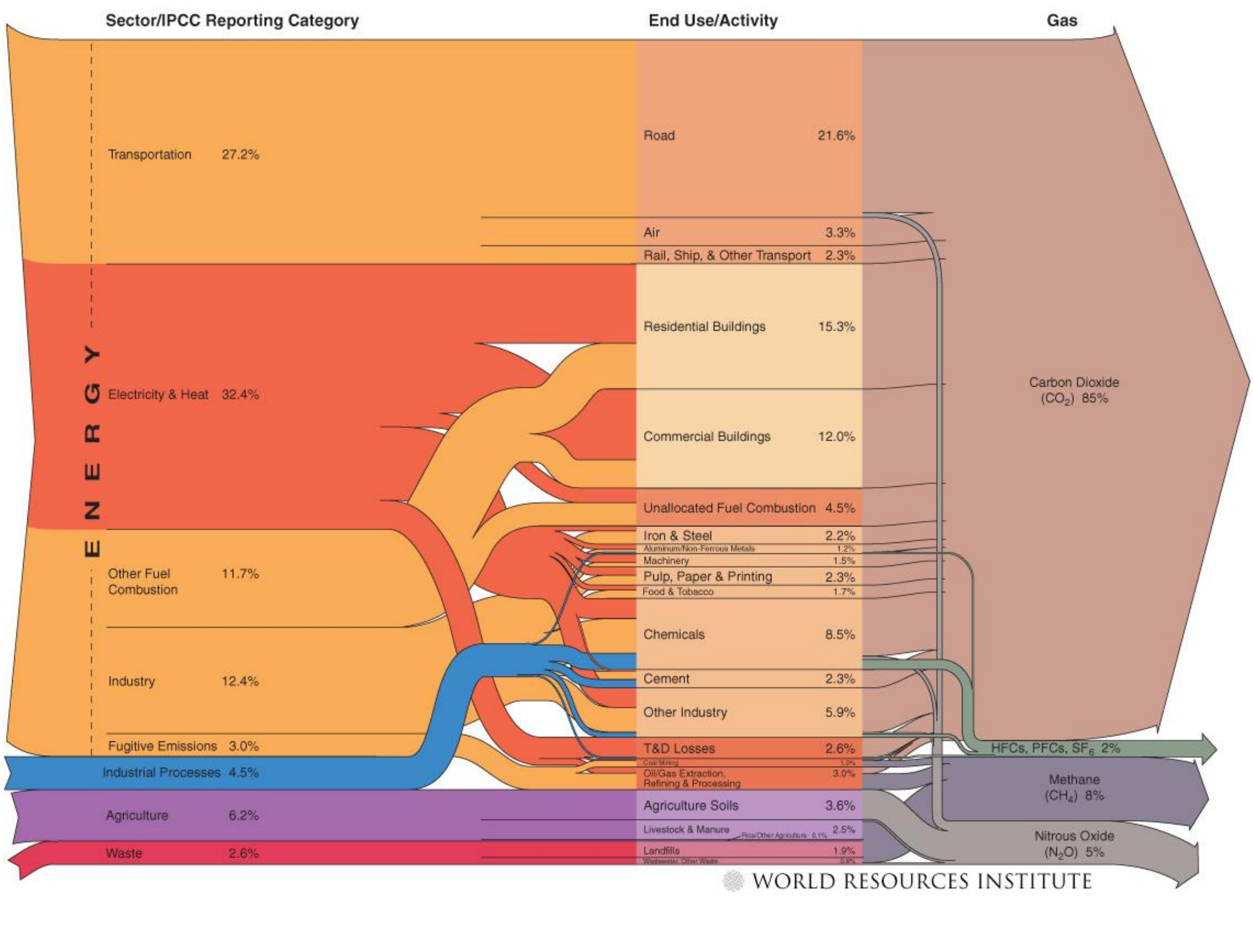
Metric for Calculating GHGs: Global Warming Potential

- To maximize possibilities for developing linkages and synergies with international systems, a U.S. national cap-and-trade system should utilize the concept of Global Warming potential (GWP) to determine how much a given mass of GHGs is estimated to contribute to global warming. GWP is a relative scale which compares the gas in question to that of the same mass of CO_2 (whose GWP is, by definition, 1). Just as radiative forcing provides a simplified means of comparing the various factors that are believed to influence the climate system to one another, GWPs are one type of simplified index based upon radiative properties that can be used to estimate the potential future impacts of emissions of different gases upon the climate system in a relative sense. GWP is based on a number of factors, including the radiative efficiency (heat-absorbing ability) of each gas relative to that of CO_2, as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years) relative to that of CO_2. The IPCC provides the generally accepted values for GWP, which changed slightly between 1996 and 2001. An exact definition of how GWP is calculated is to be found in the IPCC's 2001 Third Assessment Report. The GWP is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace substance relative to that of 1 kg of a reference gas, where TH is the time horizon over which the calculation is considered; a_x is the radiative efficiency due to a unit increase in atmospheric abundance of the substance (i.e., $Wm^{-2}\,kg^{-1}$) and $[x(t)]$ is the time-dependent decay in abundance of the substance following an instantaneous release of it at time t=0.

$$GWP\,(x) = \frac{\int_0^{TH} a_x \cdot [x(t)]\,dt}{\int_0^{TH} a_r \cdot [r(t)]\,dt}$$

The denominator contains the corresponding quantities for the reference gas (i.e. CO_2). The radiative efficiencies a_x and a_r are not necessarily constant over time. While the absorption of infrared radiation by many GHGs varies linearly with their abundance, a few important ones display non-linear behavior for current and likely future abundances. For those gases, the relative radiative forcing will depend upon abundance and hence upon the future scenario adopted. Since all GWP calculations are a comparison to CO_2 which is non-linear, all GWP values are affected. Assuming otherwise as is done above will lead to lower GWPs for other gases than a more detailed approach would.

Figure 2. *U.S. GHG Emissions Flow Chart*



Cap-and-Trade: Balancing Flexibility and Certainty

A great fear for many is that costs will fluctuate unexpectedly in the short-run, much as natural gas prices have spiked in recent years. Setting a long-term emissions cap opens the door to an innovative way to avoid short-term cost volatility. Firms could be allowed to borrow emission allowanced from future years, using them early in times of unexpected cost pressure, and paying them back when short-term spikes recede.

Most current legislative proposals already allow firms to make reductions in advance when prices are lower than expected and to bank allowances for future use. Borrowing would open the opposite possibility. In the absence of borrowing, firms can comply only with current or banked allowances. Allowance prices thus reflect the current marginal cost of compliance, and the price can spike in response to short-term conditions (e.g., a delay in bringing on a new technology, or a surge in economic activity). Borrowing will let firms use emissions allowances from future years, stabilizing prices against unexpected short-term fluctuations. The long-term cap will be maintained because borrowed allowance will be repaid, with interest, be releasing fewer emissions later when short-term pressures are relieved.

An alternative is the "safety-valve" approach. Under this approach the cap would be broken and, for example, the government could sell more allowances if the price per ton exceeded a designated level. Although the valve may close in future years, the excess emissions that occur while the valve is open will never be recouped. Likewise, proposals allowing unlimited "offsets" (emission reductions not covered by the cap have the potential to break the cap) if credits are rewarded for actions taking place anyway.

Flexibility via Banking and Borrowing, Offsets, or Safety Valves

- The system should enable entities under the cap to shift their obligations across periods through "banking" and "borrowing" of permits. Temporal limits should be set on both features ("use-them or lose them").
- Under a so-called "safety valve" the government offers to sell allowances in unlimited amounts at a fixed price (though perhaps at levels increasing over time). To ensure certainty in meeting the original cap, the system should be designed without a safety valve feature.
- The program should incorporate the use of emission offsets to provide additional flexibility in meeting reduction requirements. Emission offsets refer to verified emission reductions achieved by entities that are outside the cap-and-trade program. The primary benefit of emission offsets is that they help lower the cost of reducing emissions. With the availability of emission offsets, entities covered by the cap could purchase low-cost emission reductions from outside the cap as a means of complying with their emission limit. To ensure that offsets do not compromise the emission reduction goal of the program, they should only be included if they are real or additional, quantifiable, excess to any regulatory requirement, permanent and enforceable.

Ensuring the Validity of Emission Offsets

To ensure that offsets do not compromise the emission reduction goal of the program, they should only be included if they are real or additional, quantifiable, excess to any regulatory requirement, permanent and enforceable.

- **Real or Additional**: Real or additional emission reductions are those that have actually occurred, not emissions that could have been emitted but were not or are avoided emissions. This means that the emission reductions result from actions taken that are beyond the course of normal activity such that the emission reductions are not considered "business as usual." For example, activities that are cost effective even the absence of getting paid for emission reductions would not be considered "additional."
- **Quantifiable**: Quantifiable means that the amount of the emission reductions can be measured with reasonable certainty. Quantification requires that: a baseline set of conditions can be defined; the emissions associated with the baseline conditions can be measured; the alternative set of conditions that will exist due to the project can be defined; and the emissions associated with the alternative set of conditions can be measured. The emission reduction is the change in emissions from the baseline to the new conditions caused by the emission reduction project.
- **Regulatory Surplus**: Emissions reductions must be surplus of any requirements by local, state or federal regulations or measures contained in a regional air quality plan or government commitment or agreement.
- **Enforceable**: Enforceable means that the reductions can be independently verified and are legally binding. Offset projects thus must be accessible to inspection by appropriately authorized federal or state staff. Penalties for noncompliance or nonperformance need to be determined and assessed.
- **Permanent**: Permanent means that the life of the emission reductions is reasonably established and commensurate with the proposed use of the offsets. Projects should be "irreversible"; that is, the reductions achieved should not be subject to backsliding or vulnerable to changes in external conditions.

Allocation of Allowances

- Allocations of emission allowances should be used strategically in combination with targeted performance standards. A portion of allowances should be auctioned off or sold with the federal government using the funds to encourage technology deployment, offset inequities and reduce "distortionary" taxes.

Using Resources Wisely: Options for Allocation of Allowances

Emissions allowances will be worth hundreds of billions of dollars over the life of a program. It is a common misperception that regulated companies will be grievously hurt unless they receive all the emission allowances they need free of charge. In reality, firms can be expected to pass most compliance costs on to consumers, and only a fraction of those costs will fall on shareholders. If regulated industries got all their allowances free, they would receive an asset worth as much as seven times the real cost of compliance, resulting in substantial windfall profits. One group of authors recommends the following allocation: 50% allocated to helping businesses and consumers (particularly energy-intensive industries and lower-income families) reduce their energy bills through adopting currently available energy-saving technology and competitive renewable energy sources; 25% allocated to companies that accelerate deployment of strategic new technologies needed for long-term emission reductions in key sectors. The remaining emission allowances can be allocated to meet other key needs. The NCEP recommends auctioning off at least 50% of the available allowances.

International Linkages

- It is important for the U.S. and other developed countries to negotiate with large developing countries such as China, India, Mexico and Brazil for their significant participation and cooperation in the next phase of GHG emission reduction. Emissions from those countries are large and growing. Over time, unless they are reduced, it will be impossible to achieve global climate stabilization at any relatively safe level. International schemes are largely cap and trade using carbon or carbon equivalent denominations. Since a U.S. cap and trade systems would also operate with permits denominated in tons of carbon equivalent, they will be fully tradable internationally.

C. Achieving Goals through a GHG Tax Program

As with a cap-and trade system, there are many potential design options to be considered when constructing a GHG tax program. The constellation of design options chosen will determine the extent to which administrative practicality, environmental efficacy, cost-effectiveness, distributional equity, and political viability are (or are not) embraced by the program.

1. Design Options: Overview

The design of a GHG tax program implicates many of the same fundamental issues as the design of a cap-and-trade system. As we have noted above, the way in which a GHG tax program is configured will determine the extent to which administrative practicality, environmental efficacy, cost-effectiveness, distributional equity, and political viability are (or are not) satisfactorily addressed by the program. The following are a few of the more primary, "high-level" design options relevant to a GHG tax program (see Figure 3 for a summary of these design options).

Covered GHGs

- A GHG tax program can be configured to cover (1) only CO_2, (2) all GHGs; or (3) a variable combination depending on certain temporal or circumstantial trigger mechanisms. To greater certainty in meeting GHG reduction targets, a GHG tax program should be designed to cover all six major GHGs: carbon dioxide; methane; nitrous oxide; hydrofluorocarbons; perflourocarbons; and sulfur hexafluoride.

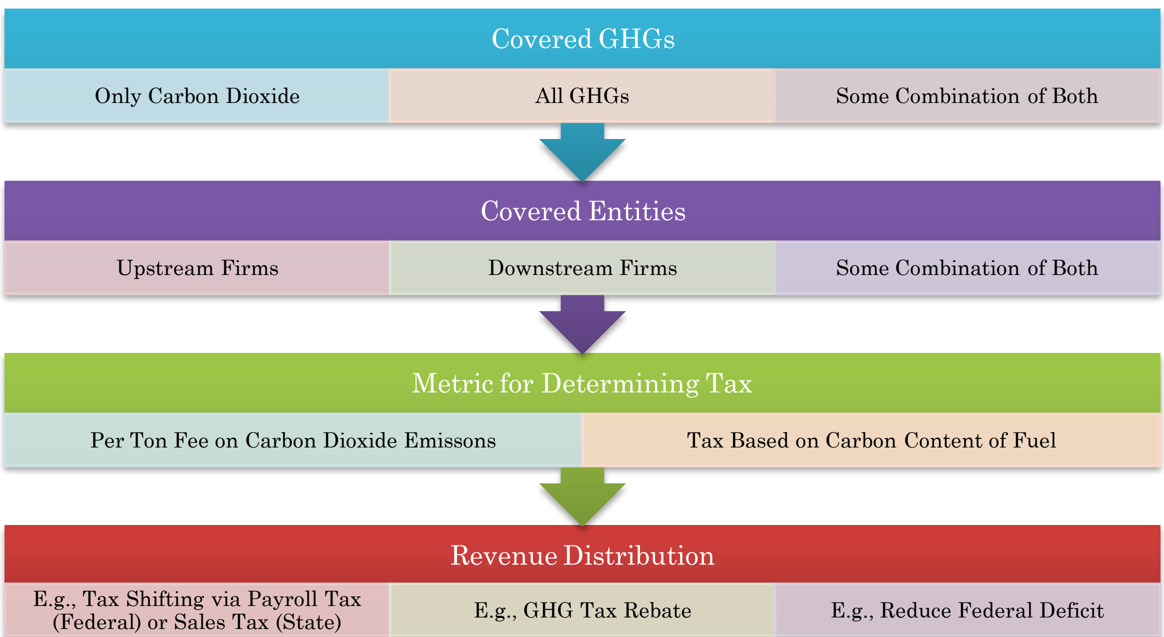
Covered Entities & Metric for Determining Tax: Upstream & Carbon Content Preferred

- In designing a GHG tax program, it is necessary to initially determine whether the program will cover upstream firms, downstream firms, or some combination of both. A downstream program would likely take the form of a tax on CO_2 and certain other GHG emissions. However, enforcement of a downstream GHG tax would require accurately monitoring the emissions of each firm subject to the tax—a daunting prospect that would almost certainly ensure that the tax would not encompass all the millions of sources of CO_2 in the U.S. economy. An upstream GHG tax would take the form of a tax on the carbon content of fuels sold into the energy system. In terms of administrative practicality, an upstream program could be applied to a few thousand firms that produce, refine and market fuels. The tax on these firms would lead to higher prices for carbon-intensive fuel and higher prices for energy. The program thus could effectively regulate the entire energy system, providing downstream firms with incentives to switch fuels, increase energy efficiency, and reduce energy use.

Revenue Distribution Linkages

- A GHG tax program will automatically transfer funds from covered firms to the public revenue. These funds should be used to accomplish a variety of goals, such as: (1) enhancing the revenue base; (2) limiting the overall tax burden placed on covered firms through revenue recycling; and (3) reducing taxes elsewhere in the economy.

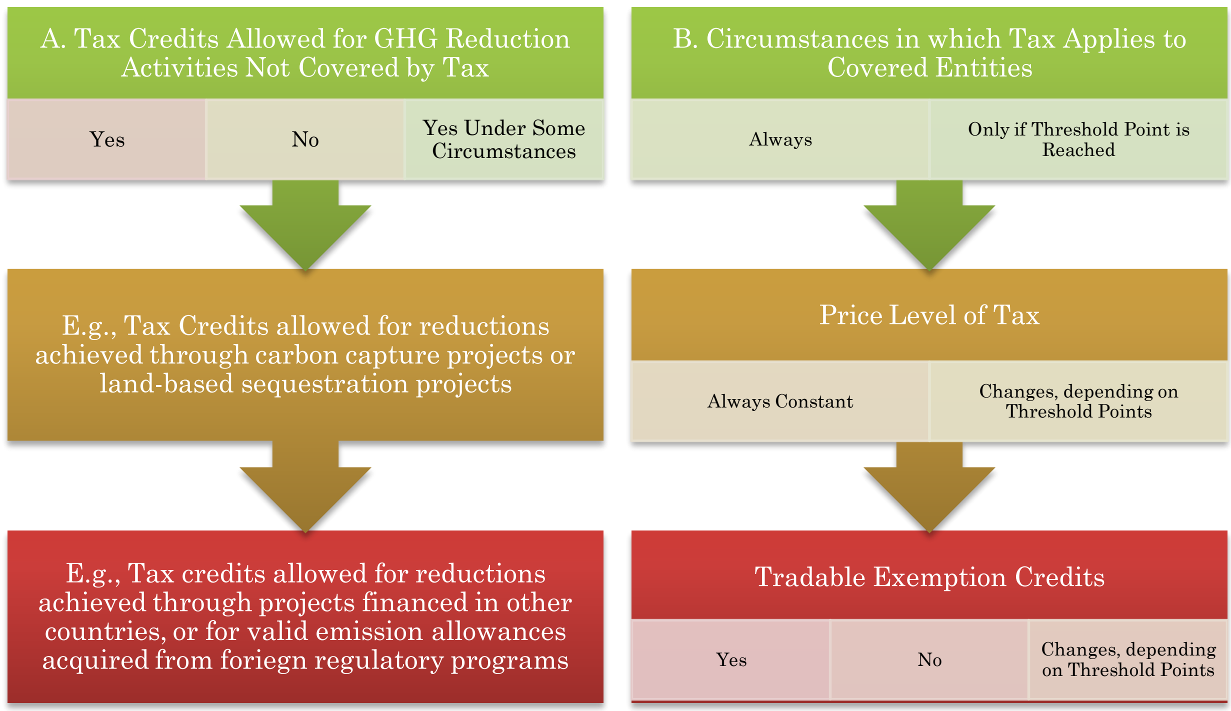
Figure 3. GHG Tax Primary Design Options



Flexibility Options

- In addition to the above primary design options, a GHG tax program could be designed so that covered entities receive a tax credit for CO_2 emissions reduced through land-based sequestration projects, carbon capture projects, or for project-based reductions in GHGs that are not subject to tax (see Figure 4 below).

Figure 4. GHG Tax Flexibility Mechanisms



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1 NYT1 at 3 (citing McKinsey Global Institute Report). Estimates that the yearly growth in worldwide demand could be cut by more than half through 2020 to an annual rate of 0.6% from a forecast 2.2%, using current technology alone. Available steps include compact fluorescent lighting, improved insulating on new buildings, reduced standby power requirements and an accelerated push for appliance-efficiency standards.

2 NYT at 4: "A price on carbon dioxide emissions, most economists agree, would be the most efficient way to combat global warming." Northrop

3 Northrop

4 NYT1

5 *See* Stern Review, Executive Summary (Long) at xvii, *available at* http://www.hm-treasury.gov.uk./media/8AC/F7/Executive_Summary.pdf ("Establishing a carbon price, through tax, trading or regulation, is an essential foundation for climate change policy.")

6 For the mechanism to be negotiated and created and then for it to transform market forces that will reshape our global energy economy will likely take a longer time than scientists believe we have available. Northrop, 2.

7 Northrop

8 Although Repetto argues that an upstream cap and trade program on carbon could have economy-wide scope, he notes that other proposals would be necessary to reach other GHG gases.

9 Northrop. Reference other authors and the manner in which they categorize the package of policies (IPCCC, Stern, etc…) A national climate change policy should include incentives for business as well as increased spending on research on futuristic technologies to curb carbon emissions. NYT1 at 2

10 NYT1 at 3.

11 NYT1; Stern at i; "the greatest and widest-ranging market failure ever seen."

12 NYT1, Northrop.

13 NYT1, quoting Robert N. Stavins, director of the environmental economic program at Harvard University. Northrop.

14 NYT1

15 Repetto at 13-14 describing upstream cap and trade system with cap on carbon. However, rational extends to cap and trades systems for broader a range of gases and the effects of a tax.

16 Stern Report.

17 NYT1, quoting J. Rogers, Duke Energy.

18 Future energy scenarios are the product of developmental assumptions for complex demographic, socioeconomic and technological factors and may thus vary significantly. *See* Martin I. Hoffert et al., *Advanced Technology Paths to Global Climate Change: Energy for a Greenhouse Planet*, 298 SCIENCE 981 (2002); Martin I. Hoffert et al., *Energy Implications of Future Stabilization of Atmospheric* CO_2, 395 NATURE 881, 883 (1998); INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPECIAL REPORT ON EMISSION SCENARIOS, 95–96, 221 (2000). One terawatt (TW) equals one thousand gigawatts or one million megawatts.

19 The U.S. Department of Energy Information Administration's (EIA) "reference case" projects that total world energy consumption will increase from 421 quadrillion British Thermal Units (BTU) in 2003 to 722 quadrillion BTU in 2030—a 71% total increase. EIA, INTERNATIONAL ENERGY OUTLOOK 2006 7 (2006) (hereinafter IEA 2006).

20 Non-OECD countries are projected to have the strongest energy consumption growth rate, accounting for 57% of the entire projected increase in world energy consumption through 2030. *Id.* at 7. For Non-OECD countries, EIA predicts that CO_2 emissions will increase from 11.6 billion metric tons carbon equivalent in 2003 to 26.2 billion metric tons in 2030—a total increase of 125%. *Id.* at 73. During this same period of time, total U.S. CO_2 emissions from energy use are projected to increase from about 5.9 to 8.0 million metric tons carbon equivalent—a total increase of 35%. EIA, ANNUAL ENERGY OUTLOOK 2007, Table 18: Carbon Dioxide Emissions by Sector and Source (2007). These figures and projections should, of course, be viewed in a historical context that takes into account cumulative emissions. For instance, by some estimates the cumulative CO_2 emission from the U.S. accounts for 29% of the world total, while cumulative emissions from China accounts for only 7.6% of the world total. Similarly, cumulative emissions from the EU-25 accounts for about 26.5% of the world total, while cumulative emissions from India accounts for a mere 2.2%. HERZOG ET AL., NAVIGATING THE NUMBERS: GREENHOUSE GAS DATA AND INTERNATIONAL CLIMATE POLICY 31–32 (2005).

21 IEA, World Energy Outlook 2006 5 (2006).

22 *Id.* at 5.

23 While in 2003 developing nations consumed about 50% as much oil as OECD nations, by 2030 they are expected to consume about 77% as much oil as OECD nations. EIA 2006, *supra* note 2, at Figure 27: World Oil Consumption by Region and Country Group, 2003 and 2030.

24 IEA *supra* note 4, at 2.

25 Pascala and Socolow claim that a 500 ppm stabilization pathway can be attained using *existing* technology—via implementation of 15 "technology wedges," each of which could be scaled up by 2055 to reduce GHG emissions by 1GtC/yr. Pascala and Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCIENCE 968–72 (2004). Pascala and Socolow's assessment, however, fails to take into account the stabilization wedges *already* built into their underlying baseline scenario, meaning that to achieve the 500 ppm stabilization pathway anywhere from 21 to 49 wedges capable of being scaled up to 1GtC/yr will be needed by 2055—rather than 15 wedges. *See* Tom Wigley, *Saving the Planet: Emissions Scenarios, Stabilization, and Uncertainties*, NCAR Summer Colloquium, July 2006.

26 For a more thorough comparison of the two mechanisms see, "Limiting Caron Dioxide Emissions: Prices Versus Caps, Congressional Budget Office, Economic and Budget Issue Brief (Mar. 15, 2005); Chapter 12, Climate Change Economics and Policy, William Pizer.

27 For more detailed descriptions of the two types of pricing mechanisms, see NYT1 at 4-5.

28 For the emission tax, only those emitters who can reduce emissions at a cost below the fixed fee or tax will choose to do so, so only the cheapest reductions are undertaken. For a cap and trade mechanism, when individuals observe a market price for permits, those who can reduce emissions more cheaply will do so to sell excess permits or to avoid having to buy additional ones. Similarly, those who face higher reduction costs will avoid reductions by buying permits or by keeping those they already possess. Pizer at 100.

29 Congressional Budget Office Economic and Budget Issue Brief, Limiting Carbon Dioxide Emissions: Prices Versus Caps, at 2-5; Nordhaus, supra. at 6-7.

30 Pizer at 101-3. Summarize economic theory and results of numerical simulations: In his simulations, emissions were below the target level in more than 75% of the outcomes. In other words, on average the carbon tax achieves more reductions than a quantity target. CBO Report at 2-5.

31 Pizer.

32 Pizer.

33 Pizer at 102 (simulations show range in costs consequences of both policies.

34 CRS Report.

35 E.g., Nordhaus at 7.

36 See e.g., Nordhaus at 7-8, tax approaches can promote more efficient collection and recycling or revenues from GHG restraints, although this presumes that some or all of emissions permits will be allocated at zero cost.

37 This author's recommendation of pursuing a tax rather than cap and trade appears to be based on the science results of the IPCC Second Assessment Report. Pizer at 104 and 107. The data from that period (1996) supported that a 450 ppm concentration would not be reached before 2030 even in the absence of emission controls. And the assumption was that it was acceptable to allow the stock of GHGs to grow in the interim.

38 Pizer at 104.

39 NYT1 at 5.

40 NYT1 at 5.

41 See e.g., Nordhaus, expresses concern for corruption in the international regime.

42 NYT1 at 4, citing economists William D.Nordhaus of Yale and R. Cooper of Harvard.

43 Cooper at 1-8.

44 Pizer at 105.

45 Nordhaus at 7-8.

46 NYT1 at 5.

47 CRS, Bills in 110th at summary.

48 Repetto at 8 "most economists who have studied the issue" with no reference.

49 NYT1 at 5.

50 NYT1 at 5.

51 Nordhaus at 4, 8-9.

52 See Repetto supra. at 6-9 (discusses "policy lock-in")

53 See Nordhaus supra. at 4.

54 One of the most noted shortcomings of the Kyoto protocol is the manner in which the goals were set, which have been described as arbitrary in nature. See Nordhaus at 5 describing the Kyoto Protocol: The approach of freezing emissions at a given historical level for a group of countries is not related to any identifiable goal for concentrations, temperature, costs, damages, or "dangerous interferences." It is not inevitable that quantity-type arrangements are inefficient. However, the target should be set to ensure some well-defined and well-designed economic and environmental objectives, such as a maximum increase in temperature.

55 IPCC Fourth , working Group III, Executive Summ at 3-10 (draft)

56 Hansen at 88.

57 Global temperature is a useful metric to assess proximity to dangerous anthropogenic interference, (DAI), the standard used in UNFCC, because with knowledge of the Earth's history, global temperature can be related to two principal dangers that the Earth faces: sea level rises and extinction of species, because of their potential tragic consequences and practical irreversibility on human time scales. Hansen at 92. Warming of 2-3degrees C, predicted under a business as usual scenario, would bathe most of Greenland and West Antarctic in melt-water during lengthened melt seasons, could yield sea level rise of several meters per century with eventual rise of tens of meters, enough to transform global coastlines. Global warming of 3 degrees C over the 21st century, predicted under a business as usual scenario, could eliminate a majority (about 60%) of species on the planet.

58 Source says do not cite or quote: IPCC Fourth Assessment Report, Working Group III, Executive Summary at 3-10.: Defining what is dangerous anthropogenic interference with the climate system, and hence what are limits to be set for policy purposes is a complex task and can only partially be informed by science, s it inherently involves normative judgments. Choosing a stabilization level implies the balancing of the risks of climate change (risks of gradual change and of extreme events, risk of irreversible change of the climate, including risks for food security, ecosystems and sustainable development) against the risk of response measures that may threaten economic sustainability. This judgment is necessarily a social and political one, depending on the level of risk deemed acceptable, deep emission reductions are unavoidable in order to achieve stabilization. The lower the level, the earlier these deep reductions have to be realized.

59 Hansen (PNAS) supra. at 92.

60 IPCC 4th, Group III, not for citation, at 7.

61 IPCC 4th, Group III, not for cite at 7.

62 These are discussed in IPCC 4th, Group III, not for cite at 6.

63 Hansen. 2006

64 But see earlier economic analysis by Nordhaus, 2006

65 Hansen et.al. 2287.

[66] USACP Report, supra. at 7 (USCAP data); NCEP Report (2007) at (NCEP data); Stern Review (Executive Summary) at (Stern data); Doniger at (Doniger data); Hanset et. Al. at (NASA-Columbia data); Nordhaus,supra at (Nordhaus data); EESI Report, supra. at (California and RGGI data); WRI supra. at (data for federal bills)
[67] Doniger.
[68] NYT1, quoting James E Rogers, chief executive of Duke Energy, "…we need to start now because the longer we wait, the more difficult and expensive this is going to be." NYT1 quoting Richard Cooper, Harvard Economist who likens this approach to an insurance policy. You pay now so things are less risky in the future.
[69] Doniger, supra., at 764 (the article includes a graph comparing the two approaches) On the other side some analysts argue that delay is cheaper because we will develop breakthrough technologies in the interim. This same article refutes this argument as implausible. Id. See also Stern , supra. at xi-xii, xvi. (illustrating pathways to stabilization and pointing out the high cost of inaction)
[70] E.g., Northrop, supra.; Stern, supra.
[71] Northrop.
[72] Northrop. Jim Hansen, head of NASA Goddard Institute for Space Studies, speaks of the proximity of "tipping points." Northrop
[73] Podesta at 6; Repetto at 1 (policy tipping points, marked by rather abrupt policy changes or reversals following long periods of inaction);Hansen at ____; Northrop at 2 referring to Hansen. "…when it comes to climate change, we are quickly approaching what is known as "a tipping pint" –where our continued pollution will render catastrophic climate change inevitable and its impact on the poor irreversible.
[74] Leslie McCarthy, NASA Feature article, *Research Finds that Earth's Climate is Approaching 'Dangerous' Point*, May 30, 2007, *available at* http://www.nasa.gov/centers/goddard/news/topstory/2007/danger_point.html
[75] Bill Blakemore, ABC News, *NASA: Danger Point Closer than Thought from Warming*, May 29, 2007, *available at* http://www.abcnews.go.com/print?id=3223473
[76] Doniger.
[77] Lohr, supra.
[78] Repetto at 24.
[79] IPCC 4th, Group 3, not for cite at 9.
[80] Stern, supra. at xvii.
[81] CRS, 110th, at 1.
[82] CRS 110th at 1; see also CRS Federal Laws and Policies…. For a more detailed history of the development of national GHG related policies in the U.S.
[83] CRS 110th, at 1.
[84] Source for Figure 1 derived from EIA, Annual Energy Outlook 2007 (2007).
[85] CRS 110th, at 1.
[86] CRS Report RL32055, "Climate Change Legislation in the 108th Congress" summary (updated January 6, 2005)
[87] *See* Arizona Climate Change Advisory Group (est. Feb. 2005 by Exec. Order No. 2005-02); Illinois Climate Change Advisory Group (est. Oct. 2006 by Exec. Order No. 2006-11); New Mexico Climate Change Advisory Group (est. June 2005 by Exec. Order No. 05-033).
[88] *See* Wisconsin Task Force on Global Warming (est. April 2007 by Exec. Order No. 191).
[89] *See* California Climate Action Team (est. June 2005 pursuant to Exec. Order No. S-3-05).
[90] *See* Utah Governor's Blue Ribbon Advisory Council on Climate Change (est. Aug. 2006).
[91] *See* Alaska Climate Impact Assessment Commission (est. May 2006 by House Concurrent Resolution 30); Arkansas Governor's Commission on Global Warming (est. April 2007 by HB2460); Florida Energy Commission (est. June 2006 by Senate Bill 888; charged, *inter alia*, with developing recommendations vis-à-vis climate change); North Carolina Commission on Global Climate Change (est. Sept. 2005 by Senate Bill 1134); Vermont Commission on Climate Change (est. Dec. 2005 by Exec. Order No. 07-05).
[92] *See* discussion, *infra*, Part III.
[93] *Id.*
[94] For commentary dealing with federal inaction on climate change relative to action by sub-federal entities, see the following: Emma Marris, *Nine States Impose Limits on Greenhouse-Gas Pollution*, 437 NATURE 11 (2005) ("It seems that in the face of federal inaction, individual states have begun making their own climate policy."); *California Bucks Federal Inaction on Climate Change*, BUSINESS AND THE ENVIRONMENT, Nov. 2006, at 13 ("Faced with inaction by the Bush Administration, many U.S. states are taking action to combat climate change."); *Climate Change: Frustrated by Federal Inaction, States Assert Their Right to Combat Greenhouse Gas Emissions*, HOUSTON CHRONICLE, Aug. 31, 2005, at 8 ("With the issue of man-made atmospheric warming buried deep in the Bush administration's policy freezer, a growing number of governors are taking action on their own."); *Doing It Their Way,* THE ECONOMIST, Sept. 9, 2006, at 22 ("The federal government's inaction contrasts with a flurry of activity at lower levels of government."); *United States: Bottom-Up Greenery: Climate Change*, THE ECONOMIST, Mar. 20, 2004, at 51 ("[T]he very obstinacy [of George

Bush on climate change] has fomented a backlash in the states."); Barry G. Rabe, *Statehouse and Greenhouse: The States are Taking the Lead on Climate Change*, THE BROOKINGS REVIEW, Spring 2002, at 11 ("[W]hile Washington has continued to stumble on the global warming issue, a number of states have launched constructive efforts to lower emissions of carbon dioxide . . . ."); Patrick O'Driscoll, *The West Takes Lead on Climate Change*, USA TODAY, Feb. 28, 2006, at A1 ("Half a dozen Western governors impatient for more federal action on global warming are mounting state campaigns to deal with climate change on their own."); David Appell, *Acting Locally*, SCIENTIFIC AMERICAN, June 2003, at 20 ("Frustrated by federal inaction on preventing climate change, states and municipalities have begun reducing greenhouse gas emissions on their own."); Janet Larsen, *Mayors Respond to Washington Leadership Vacuum on Climate Change*, HUMANIST, July/August 2006, at 4 ("Response to the Washington climate action void isn't limited to cities. States and businesses also are taking part."); *U.S. States Go It Alone on Climate Change*, ECOLOGIST, Oct. 2005, at 8 ("Unwilling to wait on the recalcitrant president, nine states . . . are developing a scheme to cap and then reduce the level of greenhouse gas emissions from power plants.").

See also Andrew Revkin and Jennifer Lee, *White House Attacked for Letting States Lead on Climate*, NEW YORK TIMES, Dec. 11, 2003, at A32 (quoting Washington State Governor Gary Locke as saying, "The states are taking action for one simple reason: because the federal government is not"); Andrew Revkin and Jennifer Lee, *Warming Feud: States vs. Bush Team*, INTERNATIONAL HERALD TRIBUNE, Dec. 11, 2003 (reporting that many "Democratic state officials said the administration was using state initiatives as cover for its own inaction."); Jeffrey Ball, *States Feel Heat on Global-Warming Steps: Political, Industry Pressures Undermine Efforts to Trump Washington on Emissions in Absence of Federal Action Curbs*, WALL STREET JOURNAL, Nov. 12, 2003, at A4 (observing that "State officials tout their activism as a rebuke to what they call the Bush administration's failure to address climate change on a national level.").

With respect to legal literature, see: Randall S. Abate, *Kyoto or Not, Here We Come: The Promise and Perils of the Piecemeal Approach to Climate Change Regulation in the United States*, 15 CORNELL J.L. & PUB. POL'Y 369 (2006) ("Effective federal climate change regulation in the United States has been thwarted because the second Bush Administration is reluctant to recognize the problem . . . . This limited federal response . . . has prompted . . . efforts at the state, regional, and local levels . . . ."); Kristen H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 EMORY L.J. 159 (2006) ([I]t is the states and local governments—not the federal government—that are taking the lead in addressing climate change in the United States."); Barry Rabe et al., *State Competition as a Source Driving Climate Change Mitigation*, 14 N.Y.U. ENVT'L. L.J. 1 (2005) ("Various state governments are presently taking significant steps to mitigate climate change. This trend is particularly interesting in its sharp contrast to the federal government's official stance on climate change . . . .").

95 *See* Peterson & Rose, *supra* note 11, at 619–20.

96 The authority to regulate what the federal government does not—as well as to exceed federal standards—is not really a reason as to *why* climate policies should be enacted at the state rather than federal level. Rather, these factors go more to the issue of whether states *can* legitimately regulate in this domain; as opposed to the normative issue of whether they *should* do so.

97 This very drawback to state-level policies can generate pressure to preempt the regulatory patchwork with a uniform national standard. *See* Kirsten H. Engel and Scott R. Saleska, *Sub-Global Regulation of the Global Commons: The Case of Climate Change*, 32 ECOLOGY L.Q. 183, 224 (2005) (noting that industry efforts to include motor vehicle tailpipe emission limitations in the Clean Air Act of 1965 were largely inspired by the unappetizing prospect of having to comply with fifty different state standards for the same product).

98 *See* Peterson & Rose, *supra* note 11, at 620 (discussing the risk of "capital flight" and "carbon leakage").

99 In 2002 total U.S. CO_2 emissions equaled ~5,897 $MtCO_2$. This amount was 55% higher than China, the number two emitter in 2002, which had CO_2 emissions of ~3,798 $MtCO_2$. World Resource Institute, Climate Analysis Indicators Tool (CAIT), Version 3.0 (2006) (*available at* http://cait.wri.org).

100 Data for chart derived from WORLD RESOURCES INSTITUTE, CLIMATE ANALYSIS INDICATORS TOOL (CAIT US), VERSION 1.0 (2007), *available at* http://cait.wri.org. Percentile figures represent 2001 data.

101 *See* PEW CENTER ON GLOBAL CLIMATE CHANGE, LEARNING FROM STATE ACTION ON CLIMATE CHANGE: MARCH 2006 UPDATE 9 (2006). The following are among the GHG reduction policies recommended in state climate action plans: energy efficiency audits; model energy codes; tax incentives for fuel switching and cogeneration; renewable portfolio standards, emissions trading regimes; recycling programs; afforestation programs; and methane reclamation programs. *See* U.S. EPA, State Action Plans (2004), *available at* http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsStateActionPlans.html (last visited March 29, 2006).

102 In 2001 GHG emissions from these states equaled ~3348.8 $MtCO_2E$ relative to total U.S. GHG emissions of ~6712.5$MtCO_2E$ (49.88% of the total). CAIT, *supra* note 16. If we were to include Texas, which has not adopted a climate action plan and is the largest state GHG emitter by far, this percentage would rise to 61.2%.

103 The following seven states have not adopted a climate action plan and are also among the top 17 U.S. state GHG emitters: Florida, Georgia, Indiana, Louisiana, Michigan, Ohio, and Texas. See Table 1.

[104] U.S. EPA, STATE AND LOCAL CLIMATE CHANGE PROGRAM, PARTNERSHIPS AND PROGRESS: 2001 PROGRESS REPORT 15 (2001).
[105] U.S. ENERGY INFORMATION AGENCY, ANNUAL ENERGY OUTLOOK 2006, Reference Case Table 18: Carbon Dioxide Emissions by Sector and Source (2006).
[106] Richard Rosenzweig et al., *The Emerging International Greenhouse Gas Market*, Pew Center on Global Climate Change, March 2002, at iii.
[107] *Id.*
[108] *Id.*
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[112] *Id.*
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[124] *Id.*
[125] *Id.*
[126] *Id.*
[127] *See generally*, Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme of greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (Oct. 25, 2003) [hereinafter "EU Emissions Trading Directive"].
[128] OECD/IEA*, supra* note 16, Chapter 2, at 69.
[129] *Id.*
[130] *Emission Trading Scheme (EU ETS)*, http://ec.europa.eu/environment/climat/emission.htm
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[133] UNITED KINGDOM DEPARTMENT FOR ENVIRONMENT FOOD AND RURAL AFFAIR, AN OPERATOR'S GUIDE TO THE EU EMISSIONS TRADING SCHEME: THE STEPS TO COMPLIANCE 4 (2005) (hereinafter referred to as OPERATOR'S GUIDE").
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[137] *Id.*
[138] *See* Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms (Oct. 27, 2004) [hereinafter "Linking Directive"].
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[141] *Id.*
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[143] *Id.*
[144] OPERATOR'S GUIDE, *supra* note 69, at 20.

[145] OECD/IEA, *supra* note 16, at 76.
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[147] *Id.* at 77.
[148] *Id.* at 79.
[149] *Id.* at 78.
[150] *Id.* at 77.
[151] *Id.* at 78-79.
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[156] *Id.*
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[163] OECD/IEA, *supra* note 16, at 89.
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[167] *Id.*
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[169] *Id.*
[170] *Id.*
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[172] *Id.* at 2, 11.
[173] *Id.* at 17.
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[178] Honor Mahony, *EU May Toughen Emissions Trading Scheme*, BUS.WK., Nov 14, 2006.
[179] For a listing of all federal bills related to climate action introduced in the 110th Congress and received by the Government Printing Office prior to March 3, 2007, see The Climate Action Database, *available at* http://lawweb.colorado.edu/eesi/dms/.
[180] CRS Report RL33846, supra. at 1-2.
[181] See CRS RL33846, supra. at 2 ; H.R. 2069, 110th Cong. (2007) (seeks to amend the Internal Revenue Code of 1986 to reduce emissions of CO2 by imposing a tax on primary fossil fuels based on their carbon content; would impose a $10 per ton (of carbon) charge on coal, pertroleum and natural gas when the fuel is either extracted or imported; the charge would increase by $10 every year until U.S. carbon dioxide emissions have dropped 80% from 1990).
[182] CRS Report RL33846, supra. at 4.
[183] NCEP Report 2007, supra. at 12.
[184] Repetto at 33
[185] Northrop, supra. at 2.
[186] For access to over 300 proposals from a variety of sources, including,but not limited to, NGO's, academic groups, business organization and scientists, see Climate Action Database, supra.
[187] Northrop, supra. at 3.
[188] Northrop, supra. at 3; NCEP supra at ; USCAP, supra at
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[190] Cooper, supra. at 3.