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Subject: Draft #2



Please find attached the latest draft of this memo. Comments welcome. The sulfur dioxide section, I must stress, is likely to become more balanced once EPA weighs in (e.g., on the fact that emissions are below the required level, which would put upward pressure on the permit price, etc.)

DRAFT #2: CLOSE HOLD
September 26, 1997

MEMORANDUM FOR THE PRESIDENT

FROM:

SUBJECT: Climate change

This memorandum provides more detail on some of the issues raised during our climate change meeting with you on September 18. We will be holding a principals meeting today, and another one early next week, to pin down specific recommendations from the NEC/CEQ principals on targets and timetables, policy options to achieve those targets and timetables, and other issues of importance to them. We will then put together an NEC/CEQ recommendations memorandum and a briefing book that contains the underlying memoranda from the principals and other background materials. The recommendations memo and briefing book will be submitted to you by the end of next week, so that it can inform your thinking before the October 6 White House conference.

This memo:

- Outlines the sources of current emissions in the United States;
- Discusses the potential for technology to reduce the costs of emissions reductions, and highlights a possible technology program to address climate change; and
- Discusses several aspects of a tradeable permits system, including:
 - The benefits of a permits system relative to mandated standards;
 - The lessons offered by the SO₂ trading program;
 - Grandfathering versus auctioning with revenue recycling; and
 - Where in the production stream the permit requirements would best be imposed.

I. Sources of emissions in the United States

Greenhouse gases of policy significance include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and a variety of engineered chemicals, including chlorofluorocarbons (CFCs), and hydrochlorofluorocarbons (HCFCs). In 1995, gross U.S. emissions of these greenhouse gases amounted to 1.7 billion metric tons of carbon equivalent. Although measurement errors are large, the increase in forest cover and other natural "sinks" that absorb carbon reduced U.S. emissions by an estimated 117 million tons in 1995. Net emissions were therefore 1.6 billion tons.

Of the 1.7 billion tons in gross emissions, 1.4 billion tons (85 percent of the total) are due to carbon dioxide emissions. As the table below shows, roughly one-third of the CO₂ emissions come from transportation activities, one-third from buildings, and one-third from industry. (In this accounting, the CO₂ produced to generate electricity is charged to the sector using the electricity. Taken together, emissions from all electricity production amount to 36 percent of CO₂ emissions.)

U.S. CO₂ emissions are now more than 10 percent above 1990 levels, and are projected to be 28 percent over 1990 levels by 2010.

U.S.: Sources of CO₂ Emissions in 1995

Source	Current CO ₂ emissions (millions of metric tons, carbon-equivalent)
Transportation	436.6
Buildings	489.9
Industry	466.0
GROSS EMISSIONS	1,422.2**

*Source: *Climate Action Report 1997*, Table 3-2, page 60.

** Detail does not sum to total because of other small sources of emissions. Sinks reduce carbon-equivalent emissions by 117.0 million metric tons, implying net emissions of 1,305.2 million tons.

TRANSPORTATION

Transportation contributes 31 percent of U.S. CO₂ emissions. Its emissions are growing by about 2 percent (10 million tons) per year -- roughly twice as fast as industry and buildings -- because of increases in vehicle miles traveled and the increasing popularity of fuel-inefficient sport utility vehicles (which now account for almost half of all new passenger vehicle sales).

Transportation: Sources of CO₂ emissions

Source	Emissions in billions of tons (% of transportation emissions)	Notes
Automobiles	152 (34.9%)	PNGV initiative aims to raise fuel efficiency by factor of 3
Light trucks	101 (23.2%)	PNGV could be expanded to light trucks -- and could potentially double the efficiency of these vehicles
Heavy trucks	67 (15.4%)	PNGV could be expanded to heavy trucks -- and could potentially increase efficiency by 50 percent
Aircraft	57 (13.1%)	Goal of new NASA/FAA/DOD program is to cut fuel usage per passenger mile by 35 percent within 10 years
Other	59 (13.4%)	Largely oil and gas pipelines
TOTAL	436.6 (100.0%)	

BUILDINGS

Residential buildings produce 19 percent of U.S. CO₂ emissions, and commercial buildings account for another 15 percent -- implying that buildings account for over a third of total emissions. Emissions from both residential and commercial buildings are growing by 1 percent annually (2.6 and 2.1 million tons respectively). Energy demand in residential buildings is greatest for heating, electrical appliances, and air conditioning. In commercial buildings, demand is greatest for lighting, electric equipment, and air conditioning.

Buildings: Sources of CO₂ emissions

Source	Emissions in billions of tons (% of building emissions)	Notes
Space heat	211 (43.0%)	With improved building designs, new buildings can be much more efficient. Residential heating units can be made 10 to 25 percent more efficient. The "energy star" program aims to encourage energy-efficient buildings.
Appliances	98 (20.0%)	Refrigerator and freezer efficiency can be increased 25 to 30 percent using available technology.
Cooling	69 (14.0%)	Existing technology can reduce commercial air conditioning and ventilation by almost 50 percent.
Lights	69 (14.0%)	Energy for residential lighting can be cut by 50 percent and commercial lighting by 25 percent with existing technology.
Water heat	44 (9.0%)	Best available appliance technology can increase efficiency 25 to 30 percent.
TOTAL	489.9 (100.0%)	

INDUSTRY

Industries produce about a third of all CO₂ emissions. Emissions from this source are expected to increase at 0.8 percent per year (4 million tons). About 80 percent of all industrial CO₂ emissions come from petroleum refining, chemicals, paper, lumber and other forest products, and metals.

Industry: Sources of CO₂ emissions

Source	Emissions in billions of tons (% of industry emissions)	Notes
Machine drive/electrolytic	149 (32.0%)	Major potential for efficiency improvements through better control strategies, designs, and components
Steam	126 (27.0%)	Regulatory changes are needed to encourage high-efficiency, new units. Use of biomass instead of fossil fuel can lead to further gains.
Process heat	89 (19.0%)	
Off-road equipment	33 (7.0%)	New diesel technology can be applied to many of these uses.
Heat/air conditioning/light	28 (6.0%)	
Feedstocks/other	42 (9.0%)	
TOTAL	466 (100.0%)	

ELECTRICITY GENERATION

As noted, the CO2 produced to generate electricity is charged to the sector using the electricity in the accounting above. Emissions from all electricity production amount to 36 percent of CO2 emissions.

The table below shows that coal accounts for 50 percent of electricity generated in the U.S., but 77 percent of CO2 emissions from electricity generation. Coal produces 72 percent more greenhouse gases than natural gas per unit of energy delivered -- which is why a carbon emissions reduction program would have a much larger impact on coal prices than on natural gas or other energy prices.

On average, the electric energy produced by an electric generator is only about a third of the energy input -- the other two-thirds is released as waste into the air or nearby waters. As more generation occurs closer to industrial and commercial sites, it should be easier to capture more of the heat from electric generation that would otherwise be wasted.

Electricity

Source	Share of electricity CO2 emissions	Share of electricity generation
Oil	1.9%	1.5%
Natural gas	20.7%	23.0%
Coal	77.4%	50.1%
Nuclear	--	15.8%
Hydro & renewables	--	9.6%
TOTAL	100.0%	100.0%

II. The Role of Technology

Over the long-run, all your advisers concur that advances in technology are crucial to reducing greenhouse gas emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. According to your science advisers, three kinds of technologies seem promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep aquifers or in other ways.

There is agreement that a package of technology options should be a component of any U.S. climate strategy. Options could include direct government expenditures, tax breaks for R&D, or regulatory standards. *But your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.*

- Some of your advisers believe that the cost estimates presented above are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also stress the importance of market incentives for technological advances, and the substantial body of evidence that markets respond to such incentives. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, therefore, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora.* In other words, it is impossible to achieve 1990 emissions

levels by 2010 without a substantial increase in carbon prices.

III. Tradeable Permits

During our meeting with you, we discussed a tradeable permits system for reducing carbon emissions. This section examines several questions related to tradeable permits. The first is why a tradeable permits system facilitates less costly reductions than mandated standards (e.g., that every car must have a fuel efficiency higher than some level).

Tradeable Permits Versus Mandated Standards

A natural question about tradeable permits is why they reduce the costs associated with meeting a given emissions reduction objective. Wouldn't it be easier and more straightforward to mandate standards on items such as automobile fuel efficiency?

Mandated standards are generally a more costly approach than market-based systems to reducing pollution. The reason is that standards often require *all* purchasers of new capital to improve the efficiency with which they use energy, regardless of the cost, and then offer no incentive to improve environmental efficiency beyond the given standard. A tradeable permits system, on the other hand, focuses directly on GHG emissions, allows reductions to take place wherever they are cheapest, and imposes no arbitrary constraint on incentives for further improvement. And in most cases, a tradeable permits system is less administratively costly.

An illustrative example

An example may be helpful. Assume that there are two types of coal-fired plants, both of which emit 100,000 tons of carbon per year. The first type can easily switch to less carbon-intensive fuels (such as natural gas), and thereby reduce carbon emissions even for a given level of energy output (since natural gas has less carbon per BTU than coal). To be more specific, this first type of power plant can achieve carbon emissions reductions at a cost of \$25 for every carbon ton reduction. The second type, however, was designed in a manner that makes it extremely difficult to switch fuel to reduce emissions: it can achieve emissions reductions only at a cost of \$150 per ton.

The average cost of mandating that carbon emissions at all plants fall by 30 percent is therefore \$2.6 million per plant (\$0.75 million at the first type, and \$4.5 million at the second). Under a permit system, however, the total cost would be dramatically reduced by allowing the second type of plant to buy permits from the first type. This way, a 30 percent reduction in total emissions would cost only \$1.5 million per plant (all of the 60,000 ton reduction would occur at the first type of plant, at a cost of \$25 per ton). In this example, the permit system produces a cost saving of over 70 percent *to achieve the same environmental goal*. This level of cost saving is not unrealistic: studies by environmental economists often find that market-based systems reduce the cost of environmental regulations by as much as 90 percent.

CAFE standards

It may also be worthwhile examining the specific case of fuel efficiency standards. Federal regulation began in 1976 through Corporate Average Fuel Efficiency (CAFE) standards. When the CAFE standards first went into effect, new vehicle average fuel efficiency was 17.2 miles per gallon (mpg). That figure rose 10 mpg over the next ten years. Fuel efficiency levels have since stabilized at around 28 mpg. Proponents of fuel efficiency standards argue that currently available technologies could markedly improve motor vehicle efficiency. Indeed, the Congressional OTA has reported that regulatory pressure could raise average new car fuel efficiency by about 13 percent in 2000 and 22 percent by 2005.

A debate is ongoing over the effectiveness of the CAFE standards. While the improvement in new car fuel efficiency between 1975 and 1986 is not disputed, some analysts have noted that real gasoline prices increased by 70 percent between 1973 and 1981. Thus, they argue that the increase in fuel efficiency resulted from consumer demand for high-mileage vehicles in the face of rising fuel prices -- not from the CAFE standards. Opponents of standards also note that simply increasing fuel efficiency, without changing the price of gasoline, reduces the cost of driving additional miles and thus induces people to drive more miles -- so that the positive effects of increased fuel *efficiency* will be at least partially offset by an increase in *miles driven*.

Tighter CAFE standards should not be viewed as a costless approach to reducing carbon emissions in the United States. For example, standards would have to be substantially tightened on sport utility vehicles and other light trucks as well as passenger cars to ensure effectiveness. Such vehicles now comprise almost half of new vehicle sales in the U.S., arguably as a way to sidestep the current standards, and tighter standards would therefore force consumers to forgo their obvious attraction to these (relatively) fuel-inefficient vehicles. Also, since the standards only apply to *new* cars and the median expected life of a passenger car is now 14 years (16 years for trucks), the full impact of any change in CAFE standards would not be felt by 2010.

Several studies have estimated the cost of reducing carbon emissions with CAFE standards. Krupnick *et al.* (1992) estimated the implied cost of carbon reductions from increasing the CAFE standard to 37.5 miles per gallon at \$106 per ton of carbon reduced. Charles River Associates estimated a carbon price of \$104 per ton in raising CAFE standards to 40 miles per gallon.

The SO2 Example: How Much Can We Learn From It?

Another natural question regarding a carbon emissions permit trading system is what we can learn from the sulfur dioxide (SO₂) allowance trading program. The SO₂ permit program evolved out of the Clean Air Act Amendments of 1990, which required a 50 percent reduction in SO₂ emissions from electric-utility boilers. To accomplish this goal, a fixed number of emission allowances were allocated to electric utilities based on historical fuel use. (In addition, a small number of allowances are now auctioned every year.) Allowances may be traded to any party anywhere, and may be "banked" for use in future years. Regulated entities must monitor their emissions continuously, and report on them annually. Penalties are imposed if an entity does not hold sufficient allowances to cover its emissions.

Around the time that the 1990 Amendments were enacted, a commonly held view was that achieving the targeted reduction in SO₂ would require the price of emissions to rise above \$400 per ton, and possibly as high as \$1,000 per ton. Today, the price of SO₂ allowances ranges between \$90 and \$120 per ton. Many observers have interpreted the discrepancy between predicted and actual prices as indicating that significant reductions in carbon emissions could likewise be attained at surprisingly low cost.

The Treasury Department, ^{4 (E.A)} however, argues that the comparison is not a valid interpretation of the historical record.

- First, Treasury argues, most of the price estimates failed to distinguish between Phase I of the SO₂ program (1995-99, when only electric utilities are required to participate) and Phase II (2000 and after, when large industrial emitters will be brought into the program). Analysts who did recognize this distinction issued much lower predictions for the price of permits during Phase I, ranging from about \$250 per ton to about \$400 per ton -- roughly half the more commonly quoted range.
- Second, Treasury argues, early estimates of permit prices were based on inaccurate guesses as to the provisions of the final bill. For example, the EPA ended up distributing an extra 3.5 million bonus allowances (allocated to plants installing scrubbers) beyond the level that had been anticipated earlier. The last pre-enactment estimate (from an EPA/ICF study) -- the one with the best information about the legislation that would actually be passed -- projected that the Phase I permit price would be between \$170 and \$200 per ton.
- Third, the remaining discrepancy between predicted and actual permit prices partially reflects the deregulation of the freight-carrying railroads and the consequent reduction in rates -- a development that had nothing to do with the SO₂ program. It would be imprudent to assume that any similarly favorable factors will emerge with respect to a carbon trading program. Certainly, there is no deregulatory action on the horizon that could bring the price of a carbon program down by a comparable amount.
- Finally, Treasury notes, careful analysis has shown that actual abatement costs to date have averaged about \$200 per ton, and thus have substantially exceeded the currently

prevailing permit price. The discrepancy between abatement costs and the permit price could result from implicit (from general public opinion) and explicit (from Public Utility Commissions) restrictions on the ability of utilities to purchase permits, or from overinvestments in long-term contracts for low-sulfur coal and in SO₂ scrubbers. Utilities have continued to operate their installed scrubbers notwithstanding the unexpectedly low price of permits because the *variable* cost of operating a scrubber is only about \$75 per ton.

Two other distinctions between the SO₂ program and any prospective carbon program are worth noting:

- A greenhouse program would dwarf the SO₂ program: Whereas the annual stock of permits under the SO₂ program is worth less than \$1 billion, the annual stock of permits under a carbon trading program might be worth between \$30 billion and \$150 billion. The difference in aggregate permit values reflects the fact that achieving a significant reduction in carbon emissions will require *fundamental changes* in the structure of the American economy. For example, a long-term solution to the carbon problem will require moving away from combustion of petroleum-based fuels in the transportation, utility, and manufacturing sectors. By contrast, in the case of SO₂, there were proven technologies on the shelf, waiting to be called forth when the necessary price signals were given.
- A meaningful greenhouse gas control program will be more complicated to administer than the current SO₂ program. The SO₂ trading program will cover approximately 2,000 utility sources when fully in operation (Phase II); a greenhouse gas trading program will have to cover substantially more sources. Even if the number of sources were minimized by placing the permit requirement as far upstream as possible -- that is, at the primary fossil fuel processor level -- the number of sources could range from 3,000 to nearly 1 million.

Grandfathering Versus Auctioning-With-Revenue Recycling

Another issue related to a permit system, and one we touched upon in our meeting, is whether the permits should be auctioned or grandfathered. To summarize the cases for and against grandfathering:

- Auctioning would raise revenue -- potentially more than \$100 billion a year -- that could be used to reduce other taxes, fund the adjustment programs favored by the labor unions, offset the regressivity of the emissions reduction scheme, or raise national saving. As some rough examples of what could be done under a revenue-neutral auction approach, \$100 billion raised from auctioning permits could be used for one of the following:
 - Exclude over \$6,000 of payroll from both the employer and employee part of the OASDI tax;
 - Cut the employees' OASDI payroll tax (currently 6.2 percent) in half;

→ Reduce the 15 percent income tax rate in the lowest bracket to 10.2 percent; or

→ More than double the standard deduction (currently \$6,700 for married couple)

- By contrast, grandfathering in effect confers an enormous amount of wealth on corporations -- possibly upwards of \$100 billion per year, or about 20 percent of total after-tax corporate profits. By giving away this wealth to corporations, grandfathering precludes a "tax waste, not work" strategy.

→ One way to think about the difference between grandfathering and auctioning is to recognize that grandfathering is functionally equivalent to auctioning the permits, and then giving the proceeds of the auctions back to existing emitters.

- Although firms are likely to pass most of the cost through to consumers, auctions ostensibly force them to pay large costs simply for the right to maintain their business-as-usual operations. *Regardless of whether the permits are auctioned or grandfathered, though, consumers are likely to bear most of the costs involved in reducing emissions (through higher energy prices).* Ironically, grandfathering thus protects corporations even though they do not need protection -- since they will pass on most of the cost increase -- and gives away the funds that could protect consumers, who will bear most of the costs from adjusting to the emissions reduction scheme.
- The prospects for support from key businesses -- such as those you met with last month -- are much higher with grandfathering than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.
- Grandfathering is much less likely to be characterized as a tax than an auctioned permit system.
- While grandfathering may reduce corporate opposition, it would also attract many claimants. Deciding which claimants deserve the permits could prove very difficult, and the lobbying behavior inherent in attempts to capture the permit wealth could make the entire system inefficient. Furthermore, pressure for grandfathered permits is likely to be strongest among mid-stream firms -- such as electric utilities and perhaps large energy-intensive manufacturers. As discussed below, however, this may not be the optimal point in the production cycle to impose the permit requirement.

Where To Impose the Permit Requirement

A key policy decision in a tradeable permits system is where in the production process to impose the permit requirement. This question is related to the grandfathering question discussed

above: for example, if we grandfather permits by giving them to manufacturers, it would seem incongruous to impose the permit requirement further upstream (e.g., at the well-head).

The two principal possibilities for imposing the requirement include the primary fuel and the sectoral level:

- ***Imposing the Requirement on Primary Fuel Producers***. Under a program in which primary fuel producers are required to hold allowances, permits would be required for the carbon dioxide (CO₂) emission potential contained in fuel. Primary fuel and refined product imports and exports would also need to be accounted for in such a system. A primary fuel permit program could be imposed at the level of:
 - Extraction: the total number of companies involved would be 2,000 oil and natural gas producers and 3,600 coal companies;
 - Distribution: e.g., natural gas distributors, and gasoline and other petroleum product distributors. The number of such sources is extremely large; or
 - Processing: e.g., natural gas processors, coal blending/cleaning facilities, and petroleum refiners. There are approximately 200 oil refineries, 3,600 coal blending/cleaning facilities and 623 natural gas processing facilities. (Coal processors are typically affiliated with mines, so there is little practical difference between requiring permits at the point of extraction or processing for coal.)
- ***Imposing Permit-Holding Requirements by Sector***. An alternative approach, which is consistent with permits being grandfathered by sector, would be to require participants in each sector to hold and use permits. Although this system would be most comparable to the current SO₂ emissions allowance trading system, it would be fundamentally more difficult to implement because of the number of emitters.

A sectoral emission allocation approach could be applied only to large emitters, but at the cost of a substantial loss in coverage. Including the six largest *industrial* CO₂ emitting sectors (including electric utilities, but excluding the transportation sector) in a sectoral trading program would encompass about 20,000 market participants -- but only 51 percent of total U.S. CO₂ emissions. In order to cover the literally millions of small emitters, permit requirements would probably have to be shifted upstream in a manner that would mimic the permit requirements for primary fuel processors discussed in the previous section. Requiring the permits at an earlier stage of this chain offers administrative advantages and the ability to comprehensively cover all emissions. Appendix B provides additional background on sectoral issues.

Appendix A

U.S. Experience with Emissions Trading

The United States has had experience with a number of emissions trading schemes other than the SO₂ trading.

Water Effluent Trading: The US generally has regulated surface water quality through a system of discharge limits for large sources of water pollution. In addition, states have standards for ambient water quality that are often not attained even after large dischargers apply "best technology" because small sources (such as runoff from farms) contribute significantly to water pollution. A number of state and local governments are employing trading systems for watersheds that either allow trading among large dischargers, or allow large dischargers to fulfill their requirements by controlling small sources. Examples include the Fox River in Wisconsin, the Dillon Reservoir in Colorado, and the Tar-Pamlico River in North Carolina. The latter two programs are designed to reflect expected economic growth in the future, so the quantity of effluent allowances allocated exceeds current discharge levels. Once growth consumes this excess, trading is expected to reduce compliance costs.

Inter-refinery Lead Trading: EPA operated a lead trading program from 1983 to 1987 as it phased out lead from gasoline. Lead trading allowed refiners and importers to trade lead reduction credits to meet limits for the lead content of gasoline. The quantity of allowances to which a firm was entitled was determined by the amount of leaded fuel produced by the firm and the contemporaneous EPA standard. Those who bettered the standard could sell their credits to others. Some 10 billion grams of lead were traded during the course of the program, at prices ranging from 0.75 to 5 cents per gram. Allowing the trading of lead credits reduced the costs of the program by approximately 20 percent.

Criteria Air Pollutant Trading: EPA first began incorporating aspects of emissions trading in its air program in 1974, when it allowed a modified source to use "credits" earned by another source within the same plant to avoid additional regulatory requirements. Since then, emission trading has substantially expanded. Trades have numbered in the thousands and have been estimated by Hahn and Hester (1986) to have saved between \$525 million and \$12 billion.

Market Mechanisms for Chlorofluorocarbon (CFC) Phaseout: Under the 1987 Montreal Protocol to limit stratospheric ozone depletion, the U.S. required the phase out of the production of CFCs by 1996. As part of its program, the U.S. adopted a tradable permit regime covering CFC manufacturers and importers. These allowances were allocated based on each firm's 1986 market share. As the market for CFCs declined, the system allowed firms to allocate production among different facilities according to the least-cost pattern of supply. It also gave CFC users the flexibility to switch between different CFC compounds, within the overall limit on allowances. This program helped reduce the costs of the phaseout. In 1988, EPA estimated that the cost to halve CFC use would be \$3.55 per kilogram. By 1993, it became clear that all uses could be eliminated by 1996 at a cost of \$2.45 per kilogram.

Appendix B

Sectoral Emissions Trading Issues

Requiring manufacturers to hold permits to emit would greatly increase the complexity of a trading system, compared with the system of requiring primary fuel producers to hold permits.

1. Electric Utilities

The electric utility sector emits about one-third of the CO₂ in the United States, with emissions of 495 MMTC in 1994. The number of utility point sources is limited and well defined, totaling about 2,115 generating units in 1995. As a result of the SO₂ program, the electric utility sector is one of the few in the U.S. that is familiar with permit trading programs.

The definition of what constitutes a "source" under an electric utility program has an influence on coverage, the degree of leakage, and the administrative and monitoring costs. A source could be defined as a combustion unit, a plant, or a corporate entity (which may own multiple units and plants). Units covered by the acid rain program are already required to report carbon emissions data to the EPA. It is also possible to target a trading program at the company level based on total fuel inputs. This type of company level allocation could also be applied to independent power producers (IPPs), many of whom own several facilities. Smaller entities (e.g., municipals, IPPs owning one or a few small generators) could be excluded based on annual emissions levels.

Covered sources could be limited to those fired by coal, natural gas, and fuel oil. Alternative-fuel fired units, such as those burning municipal solid waste, refuse derived fuels, or waste fuels (such as wood chips) may or may not be included as well.

2. Heavy Manufacturing Industries

The industrial sector emitted approximately 293 million metric tons of carbon in 1994 from the combustion of fossil fuels and industrial processes. There is no single industry sector (excluding the electric utility sector) that generates the majority of CO₂ emissions. Paper and allied products is the largest sector (including direct emissions from by-products), followed by chemical and allied products, primary metals, and petroleum refining. [[Cement manufacturers are the fourth largest source category among the manufacturing sector. In 1994, calcining cement manufacture (a non-combustion process by which limestone materials are converted to lime) accounted for 9.5 million metric tons of carbon emissions, while fuel combustion accounted for another 6 million MMTC.]]]

The industry sectors listed above represent about 58 percent of industrial emissions, and about 12 percent of total U.S. CO₂ emissions. Individually, each represents less than five percent of total US emissions. A CO₂ regulatory program including electric utilities and the 17,000 industrial sources in the sectors listed above would thus capture about 90 percent of total industrial emissions (including utilities) and about 51 percent of total US CO₂ emissions.

The scope and effectiveness of a manufacturing sector program would depend on what level emission caps were placed, and the types of sources and fuels included. These issues parallel

those in the utility sector and are discussed below.

Allocation Basis. An emissions trading program could be implemented at the corporate or facility level, or for specific sources (e.g., boilers). Corporate level fuel consumption data may be more comprehensive than industrial source data, which may not currently be tracked.

Coverage. A manufacturing trading program could be limited to specific sources, including industrial boilers, on-site electricity generation and cogeneration, and carbon (or other greenhouse gas emissions) from industrial processes (such as cement manufacture).

Source Size. Within a source category (e.g., boilers), exemptions may be granted based on size (e.g., industrial boilers smaller than 25 MMBtu/hour). Exempting small units may involve a certain amount of leakage, as utilization may be shifted from affected boilers to unaffected ones. Regulations could be designed to address this issue.

Data quality could determine the scope of a manufacturing program. Most large industrial companies probably maintain data on purchases of natural gas, coal and fuel oil at the facility or corporate level. It would be difficult to verify the accuracy of these reports and emissions monitoring may be impractical for all but the largest sources. Boiler level data would be easier to verify. However, boiler-level fuel input data is typically currently maintained by only the largest industrial sources.

3. Transportation

Motor vehicle manufacturers consumed only 0.5 percent of US manufacturing energy consumption (netting-out emissions associated with the sector's electricity use). This sector's direct combustion may be captured in a trading regime, depending on the program's scope. Much more important are the carbon emissions associated with the fleet of private, commercial, and other transportation sector equipment (such as off-road vehicles, buses, trains and planes) manufactured. The transportation sector is responsible for approximately 32 percent of US CO₂ emissions.

Unlike utility or heavy industrial sources however, the transportation sector is comprised of millions of individual sources. Effective control of transportation emissions could involve alternative approaches directed at the equipment manufacturers, fuel producers or end-user. Manufacturers could be required to hold permits covering the CO₂ emissions associated with the automobile fleet (and other equipment). The level of allowances required could be determined based on several factors, including:

Average fuel consumption (miles per gallon) for the vehicle fleet, weighted by sales of each vehicle or equipment type

Estimated annual average vehicle miles traveled (VMT) per car in the fleet, for each fuel type

Estimated average lifetime of a car in the fleet

CO2 emission rates for gasoline, diesel, and other fuels.

The problem with this approach is that it does not focus on emissions, but rather fuel efficiency. An automobile that gets 10 miles to the gallon but is driven only 1,000 miles a year would bear greater cost than a 40 mile per gallon automobile that is driven 40,000 miles, despite the fact that the latter emits 10 times as much CO2.

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SCENARIO 1

ADOPT POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE

Overall strategy

- Reach internationally feasible full agreement in Kyoto.
- Fight to sell and ratify agreement domestically over the next few years.

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits. R&D and Federal energy efficiency programs.
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Energy price effects

We present two alternative sets of estimates. The first assumes that international trading among the developed countries (Annex I) becomes operational. The second set of estimates assumes no international trading. Your economic advisers note that the first set of estimates involves more arbitrary assumptions than the second.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.
- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1 and \$2 per million BTUs in 2010. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$500 to \$1,000 more in 2010. Effects would be regressive in the first instance, although this could be offset by using revenue to reduce other regressive taxes.

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1.80 and \$3.15 per million BTUs in 2010.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$900 to \$1,500 more in 2010.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.
- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.
- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2. They will compare the reductions necessary to achieve 1990 levels by 2010 to the oil shocks of the 1970's, regardless of whether those comparisons are warranted.

SCENARIO 2
**DEVISE CHEAPEST DOMESTIC POLICY WITH POSSIBILITY OF
KEEPING CARBON CONCENTRATIONS AT TWICE PRE-INDUSTRIAL
LEVELS**

Overall strategy

- Devise cheapest domestic policy with possibility of keeping carbon concentrations at twice pre-industrial levels.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero in 2010. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

Energy price effects (The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1.)

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of about \$0.10 to \$0.25 per million BTUs.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$10 to \$100 more in 2010.

International reaction

- Kyoto agreement impossible. The U.S. will be blamed for undermining the current round of international negotiations (Rio II). Given this international reaction, agreement on international trading system unlikely.
- Developing country component of this approach is unrealistic, because developing countries will not agree.

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object.
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The central question is whether a strategy can be found for bridging the gap between Scenarios 1 and 2, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three approaches that, to differing degrees, bridge the gap.

Components

Target and timetable: three alternatives	A) 1990 by 2010-2020 B) 1990 plus 15 percent by 2010, 1990 plus 7.5 percent by 2020, 1990 plus 5 percent by 2030, and 1990 by 2040 C) 2000 by 2010, 1995 by 2020, 1990 by 2040
Domestic implementation	Tradeable permits, with an "escape clause" on the permit price, or equivalent measures. R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

As indicated in the table above, all the alternatives below would be predicated on *binding commitments from key developing countries*. Also, under any of these approaches, we could build in an "escape clause" to limit the economic costs.

Approach A: 1990 by 2010-2020

This approach would attempt to soften the criticism of Scenario 1 by stretching out the 2010 deadline to lower the economic costs. Instead, the U.S. commitment would be that average emissions between 2010 and 2020 would be equal to the 1990 emission level.

Economic Effects

- The economic effects of this approach are very similar to those of Scenario 1. In particular, models suggest that the economic costs of the emissions reductions required under this approach are about 90 percent of the costs from Scenario 1.
- Depending on the international trade regime, the permit price in 2010 under this approach would be somewhere between \$30 and \$100. Gas prices in 2010 would rise between 10 cents and 25 cents per gallon.

Environmental and International Ramifications

- This approach would probably satisfy the concerns of environmental constituencies, but would still subject the United States to criticism for being "too weak."

Approach B: Phasing in 1990 targets

This approach delays the year at which emissions are reduced to 1990 levels, but also builds in intermediate targets that provide a glidepath to that goal. Relative to Scenario 2, this approach allows us to maintain credibility by committing to some target by 2010 -- by at dramatically lower cost than under Scenario 1.

Economic Effects

- Relative to Scenario 1, this approach would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without lengthening the timetable to 2040 or later.

- The intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- This approach would be met by some dissatisfaction from the environmental community, since we would be seen as pushing our 1990 commitment off into the distant future. It is unclear how successful the interim commitments would be in mollifying these concerns.
- The international community would similarly be worried about our long-run commitment, and it is once again unclear whether these concerns could be reduced by the intermediate commitments. Many of your advisers worry that the delays in reaching 1990 levels embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Shifting base year in intermediate commitments

This approach would shift the intermediate commitments in Approach B to a new basis: for example, we would commit to reaching 2000 levels by 2010, 1995 levels by 2020, and 1990 levels by 2040.

- In one sense, the target year 1990 is disadvantageous for the United States. Between 1990 and 1995, our emissions grew 6.5 percent, while those in Western Europe *fell* by 0.2 percent. Thus, the choice of 1990 instead of a later year can be seen as a transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading.
- However, viewed from a broader perspective, the 1990 baseline is highly advantageous for the United States. Since the United States is the world's largest emitter of greenhouse gases, *any* baseline based on total historical emissions offers us significant advantages relative to other countries. (Compare, for example, a baseline based on per capita shares of global greenhouse gas concentrations). The 1990 baseline has generated momentum within the international negotiations; trying to shift the base year could re-open the question of whether historical emissions are the

appropriate metric, and thus risks long-term damage to U.S. interests.

Economic Effects

- The economic effects of this approach are very similar to those of the previous approach: the intermediate target of reaching 2000 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be sharply criticized internationally, since there would be relatively little gain for almost any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.
- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

Final
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THE WHITE HOUSE
WASHINGTON

September 15, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
KATHLEEN McGINTY
DANIEL TARULLO

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of several we will be submitting over the next month on climate change policy. As you know, many consider this issue to be the premier environmental challenge of the next century. As the world's largest emitter of greenhouse gases, our country's actions will be watched closely: If we act prudently, we can take steps to reduce emissions over the long term without undue adverse effects on economic growth. But the issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain.

The complexity of the issue is reflected in four different constraints:

- Environmental. Reflecting the seriousness of the issue, the environmental community is pushing for a highly aggressive stance on reducing greenhouse gas emissions -- one that involves an early and steep reduction in emissions. They will be sharply critical of policies that seem less aggressive.
- International and diplomatic. The international negotiations have focused on relatively aggressive approaches. Adopting a less aggressive approach would therefore also have adverse diplomatic implications. We would be severely criticized in international circles for putting forward proposals that do not meet international expectations.
- Economic. Economists recognize the severity of the problem, but argue that a more gradual approach can achieve similar environmental objectives at substantially lower economic cost. Critics would charge that a strict target and timetable would slow growth and cost jobs.

- Domestic. Aggressive approaches would expose us to well-financed campaigns -- by major corporations and labor unions -- that demagogue our policies as excessively costly and as a large energy tax increase. These groups will also strongly insist on strong developing country participation in any worldwide emissions reduction system. Reflecting these corporate and union pressures, the Hill is extremely opposed to an aggressive approach -- especially one that does not involve the developing countries -- and is extremely unlikely to ratify any such approach.

The first two of these constraints are roughly consistent, as are the second two. *Our basic dilemma, however, is that the first two constraints are incongruous with the third and fourth.* An aggressive approach would play well internationally and with environmental groups, but would be sharply criticized by corporations, labor unions, and the Hill. A more gradual approach, however, would garner some support from domestic interests but would be met with derision abroad and by environmental constituents.

In this context, it is worth noting that on substance grounds, your advisers strongly object to the proposals that have been floated by the European Union. In other words, not all international pressures are necessarily consistent with "good policy." In particular, your advisers believe that the EU approach is problematic in three ways:

- Its approach to developing countries, in which developing countries do not have to bear any of the burden of emissions reductions, will undermine the environmental benefits of efforts in this area;
- Its approach to reducing emissions -- cutting emissions 15 percent *below* 1990 levels by 2010 -- is dangerously front-loaded, and predicated on naive and misleading assumptions.
- The combination of these two factors leads to a credibility problem, that may actually reduce the chances of getting a solid international agreement over the medium-term.

The developing country issue highlights the vast gulf between the dialogue abroad (where previous U.S. proposals on developing country participation are almost uniformly considered too aggressive) and at home (where Senator Byrd's resolution, calling for even tougher demands on developing countries than previous U.S. proposals, passed the Senate 95-0). Your advisers favor a tougher line on developing countries than we have taken to date. This could involve a two-step approach to the international negotiations: reach agreement among the developed countries, but do not submit the agreement for domestic ratification until key (such as the biggest and richest) developing countries commit to binding targets. Developing countries are extremely unlikely to agree to binding targets in the foreseeable future, so this approach would imply that we will not be ratifying any international climate agreement for at least several years. *The danger is that even floating this approach could produce such negative reactions as to preclude agreement in Kyoto.* On the other hand, this approach may boost the domestic viability of any international agreement once it is reached. We will discuss this issue with you in more detail in the near

future.

The three illustrative scenarios presented in this memorandum are intended to frame our own decision-making process in the run-up to the Kyoto negotiations in December and beyond. One thought to keep in mind in evaluating these scenarios is how to avoid proposals that would be subject to demagoguery on taxes or on shifting jobs abroad. Other key issues that pervade these scenarios include:

- How to implement a carbon emissions reduction scheme at home;
- How much we can reasonably expect from technological advances without a significant price signal; and
- The role of developing economies in reducing global emissions.

These four issues are discussed in more detail in Section III of the memorandum.

II. THREE SCENARIOS

The climate change issue involves so many different parts (the target and timetable for our emissions, whether to use a tradeable permits system to reach that target, whether to auction the permits, etc.) that it is easy to become enmeshed in the details while losing sight of larger strategic considerations. The purpose of this section is to present scenarios that try to present some of the trade-offs on that higher strategic plane; subsequent memoranda and meetings will allow us to examine many of the component pieces in more detail.

The three scenarios we consider are:

- Scenario 1: Adopt most attractive policies currently acceptable in international sphere, fight for domestic ratification;
- Scenario 2: Devise more economically efficient domestic policy, even if not internationally acceptable; and
- Scenario 3: Try to bridge the gap

It is crucial to emphasize that the scenarios are meant to be illustrative, to provide a way of thinking about our policy proposals. Similarly, the economic figures presented along with each scenario are highly uncertain and require further vetting by some interested agencies. They reflect educated guesses based on economic models. But the issues of disagreement discussed above, along with many others, could have a substantial effect on the precise outcomes. In particular, the estimates of the effects from international trading are especially uncertain.

SCENARIO 1

ADOPT POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE

Overall strategy

- Reach internationally feasible full agreement in Kyoto.
- Fight to sell and ratify agreement domestically over the next few years.

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits. R&D and Federal energy efficiency programs.
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Energy price effects

We present two alternative sets of estimates. The first assumes that international trading among the developed countries (Annex I) becomes operational. Under such a system of international trading, there is substantial uncertainty over the size of net international transfers of the permits. But under some scenarios, purchases of permits from other countries in 2010 could amount to \$5 to \$10 billion -- implying that international purchases of permits account for up to half our total reductions toward the 1990 goal. Some of your advisers believe that this deficit could prove to be a large political liability.

The second set of estimates assumes no international trading. Your economic advisers note that the first set of estimates involves more arbitrary assumptions than the second.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.

- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1 and \$2 per million BTUs in 2010. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$500 to \$1,000 more in 2010. Effects would be regressive in the first instance, although this could be offset by using revenue to reduce other regressive taxes.

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1.80 and \$3.15 per million BTUs in 2010.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$900 to \$1,500 more in 2010.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing

country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.

- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.
- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2. They will compare the reductions necessary to achieve 1990 levels by 2010 to the oil shocks of the 1970's, regardless of whether those comparisons are warranted.

SCENARIO 2
DEVISE CHEAPEST DOMESTIC POLICY WITH POSSIBILITY OF KEEPING
CARBON CONCENTRATIONS AT TWICE PRE-INDUSTRIAL LEVELS

Overall strategy

- Devise cheapest domestic policy with possibility of keeping carbon concentrations at twice pre-industrial levels.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero in 2010. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

Energy price effects

The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1.

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton, relative to the

current price of about \$20 per ton.

- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of about \$0.10 to \$0.25 per million BTUs.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$10 to \$100 more in 2010.

International reaction

- Kyoto agreement impossible. The U.S. will be blamed for undermining the current round of international negotiations (Rio II). Given this international reaction, agreement on international trading system unlikely.
- Developing country component of this approach is unrealistic, because developing countries will not agree.

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object.
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The difficulties with Scenarios 1 and 2 are clear: Scenario 1 represents a strong and credible commitment to address the climate change problem, but only at a potentially significant cost to the U.S. economy. Scenario 2 substantially mitigates the economic costs, but would do would be met by immense criticism abroad and among environmental groups at home as insufficiently responsive to the scale of the climate change challenge.

The central question is whether a strategy can be found for bridging the gap between these approaches, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three approaches that, to differing degrees, bridge the gap.

Components

Target and timetable: three alternatives	A) 1990 by 2010-2020 B) 1990 plus 15 percent by 2010, 1990 plus 7.5 percent by 2020, 1990 plus 5 percent by 2030, and 1990 by 2040 C) 2000 by 2010, 1995 by 2020, 1990 by 2040
Domestic implementation	Tradeable permits, with an "escape clause" on the permit price, or equivalent measures. R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

As indicated in the table above, all the alternatives below would be predicated on binding commitments from key developing countries. One possible way to address the developing country issue is a two-step approach: we could try to reach an agreement among the developed economies, but no such international agreement would be submitted for ratification before the key developing economies agreed to their commitments.

Also, under any of these approaches, we could build in an "escape clause" to limit the economic costs. The escape clause would involve government sales of permits at a fixed price -- that fixed price would then define the maximum price for the permits, thus limiting the potential economic costs. For example, if the government were willing to sell unlimited permits at a fixed

price of \$50 per ton, it would guarantee that gas prices did not rise by more than 15 cents per gallon in 2010. However, if the "escape clause" were triggered, the U.S. would not meet its ostensible target and timetable.

Approach A: 1990 by 2010-2020

This approach would attempt to soften the criticism of Scenario 1 by stretching out the 2010 deadline to lower the economic costs. Instead, the U.S. commitment would be that average emissions between 2010 and 2020 would be equal to the 1990 emission level.

Economic Effects

- The economic effects of this approach are very similar to those of Scenario 1. In particular, models suggest that the economic costs of the emissions reductions required under this approach are about 90 percent of the costs from Scenario 1.
- Depending on the international trade regime, the permit price in 2010 under this approach would be somewhere between \$30 and \$100. Gas prices in 2010 would rise between 10 cents and 25 cents per gallon.

Environmental and International Ramifications

- This approach would probably satisfy the concerns of environmental constituencies, but would still subject the United States to criticism for being "too weak."

Approach B: Phasing in 1990 targets

This approach delays the year at which emissions are reduced to 1990 levels, but also builds in intermediate targets that provide a glidepath to that goal. Relative to Scenario 2, this approach allows us to maintain credibility by committing to some target by 2010 -- by at dramatically lower cost than under Scenario 1.

Economic Effects

- Relative to Scenario 1, this approach would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without lengthening the timetable to 2040 or later.
- The intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- This approach would be met by some dissatisfaction from the environmental community, since we would be seen as pushing our 1990 commitment off into the distant future. It is unclear how successful the interim commitments would be in mollifying these concerns.
- The international community would similarly be worried about our long-run commitment, and it is once again unclear whether these concerns could be reduced by the intermediate commitments. Many of your advisers worry that the delays in reaching 1990 levels embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Shifting base year in intermediate commitments

This approach would shift the intermediate commitments in Approach B to a new basis: for example, we would commit to reaching 2000 levels by 2010, 1995 levels by 2020, and 1990 levels by 2040.

- In one sense, the target year 1990 is disadvantageous for the United States. Between 1990 and 1995, our emissions grew 6.5 percent, while those in Western Europe *fell* by 0.2 percent. Thus, the choice of 1990 instead of a later year can be seen as a transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading.
- However, viewed from a broader perspective, the 1990 baseline is highly advantageous for the United States. Since the United States is the world's largest emitter of greenhouse gases, *any* baseline based on total historical emissions offers us significant advantages relative to other countries. (Compare, for example, a baseline based on per capita shares of global greenhouse gas concentrations). The 1990 baseline has generated momentum within the international negotiations; trying to shift the base year could re-open the question of whether historical emissions are the appropriate metric, and thus risks long-term damage to U.S. interests.

Economic Effects

- The economic effects of this approach are very similar to those of the previous approach: the intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be sharply criticized

internationally, since there would be relatively little gain for almost any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.

- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

III. KEY ISSUES

As discussed above, there are three key issues that pervade these scenarios: domestic implementation, technology, and joint implementation. We will undoubtedly discuss these issues with you in more detail over the coming weeks, but wanted to flag them for you now.

A. Domestic implementation

Under the system to be negotiated in Kyoto, each participating country would be able to choose its own method for ensuring emissions reductions. The potential "domestic implementation" methods differ markedly in terms of their economic efficiency and political feasibility. We are committed to a market-based approach to reducing emissions, rather than a command-and-control regulatory approach.

The primary non-tax market-based structure for domestic enforcement is a system of tradeable permits. Under this approach, the Federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. *One key issue with permits is the allocation mechanism.* There are two approaches to allocation: auctioning, or grandfathering. Your economic advisers have grave concerns about the cost -- and even the feasibility -- of a grandfathering system. Others dispute this claim, arguing that such mechanisms are both feasible and crucial for garnering corporate support.

1. An auction-based approach

The United States and many other countries have long used auctions to sell government securities, and governments have also used auctions to allocate other resources -- such as oil leases, timber, and portions of the spectrum. The auction mechanism for distributing carbon permits has two main advantages:

- First, it would raise revenue that could be used to reduce other taxes, offset the regressivity of the emissions reduction scheme, raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction could generate relatively small amounts of money or as much as \$150 billion per year. If those funds were used to reduce distortionary taxes, the so-called double

dividend may result: improved environmental protection *and* less distortionary overall taxation.

- Second, it would ensure that permits are placed directly into the hands of those who value them most highly.

The main disadvantages to an auction approach are that it would be characterized as a tax much more easily than an approach based on grandfathering, and that it would make it much more difficult to garner corporate support.

- Auctions would force most businesses to pay large costs simply for the right to maintain their business-as-usual operations. Despite the fact that many these firms would likely pass most of the cost through to consumers, a firestorm of opposition will arise from these businesses.
- Corporate opponents would undoubtedly attack the auctions as a tax, even if the revenues were recycled to reduce other taxes. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

2. Grandfathering

Instead of forcing emitters to pay for permits at an auction, the government could grandfather them administratively, based on a pre-determined formula. The most likely system would involve granting permits to existing emitters based on historical fuel use or emissions; permits are allocated in this manner in the SO₂ trading program.

This approach has significant political advantages over an auction:

- The prospects for support from key businesses -- such as those you met with last month -- are much higher with an allocation scheme than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.

This approach brings with it several disadvantages, however.

- An administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. Such an approach would reward those who were biggest polluters in the past.
- The value of the permits would attract many claimants. Deciding which claimants deserve the permits could prove very difficult. Treasury and CEA have grave concerns that the lobbying behavior inherent in attempts to capture the permit wealth will make the

entire system grossly inefficient and perhaps unworkable.

- Administrative allocation schemes forgo the opportunity to raise revenues -- and thus to use the revenues to cut other taxes.

Significantly, it may be possible to combine an auction and an administrative allocation approach -- for example, by auctioning some percentage of the permits, and administratively allocating the rest.

B. The role of technology

Over the long-run, all your advisers concur that advances in technology are crucial to reducing greenhouse gas emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. According to your science advisers, three kinds of technologies seem promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep aquifers or in other ways.

There is agreement that a package of technology options should be a component of any U.S. climate strategy. Options could include direct government expenditures, tax breaks for R&D, or regulatory standards. *But your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.*

- Some of your advisers believe that the cost estimates presented above are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also stress the importance of market incentives for technological advances, and the substantial body of evidence that markets respond to such incentives. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the

relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, therefore, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora.* In other words, it is impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

C. Joint implementation

Another source of disagreement among your advisers is the role of joint implementation (JI). JI is a mechanism by which a private entity in the United States could invest in greenhouse gas mitigation projects in developing countries without emissions budgets. In exchange, the investor (and the U.S.) would receive credit towards its emission budget. Your administration has consistently supported joint implementation, from early in your first term. The Vice President has signed framework agreements on this subject with several Latin American countries. In addition, the business community strongly supports joint implementation and some companies -- especially in the utility sector -- have been making joint implementation a reality over the past few years. But some of your advisers are concerned that it will be difficult to change the program from its current pilot scale to a full-blown international system.

In principle, JI provides a very low cost mechanism for reducing emissions, by "trading" emissions here for emissions abroad, where the cost of reduction is much lower. In practice, however, JI requires a mechanism for guaranteeing that emission reductions that qualify for credits are "additional" to -- above and beyond -- reductions that would have happened anyway in the baseline case. How can we tell whether the low emissions power generation plant built in a developing country would have been built in the absence of JI incentives? If credit is given for investments that would have happened anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. On the other hand, if the standard of "additionality" is set too high, or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

September 15, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
KATIE McGINTY
DANIEL TARULLO

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of several we will be submitting over the next month on climate change policy. As you know, many consider this issue to be the premier environmental challenge of the next century. As the world's largest emitter of greenhouse gasses, our country's actions will be watched closely: If we act prudently, we can take steps to reduce emissions over the long term without undue adverse effects on economic growth. But the issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain.

The complexity of the issue is reflected in four different sets of constituent constraints that we face:

- Environmental. The environmental community is pushing for an aggressive stance on reducing greenhouse gas emissions.
- International and diplomatic. The international negotiations have focused on relatively aggressive approaches; adopting a less aggressive approach would therefore have adverse diplomatic implications.
- Economic. Economists recognize the severity of the problem, but argue that a more gradual approach can achieve similar environmental objectives at substantially lower economic cost.
- Domestic. Major corporations and labor unions will criticize aggressive approaches as excessively costly and as a large energy tax increase; they will also insist on strong developing country participation in a worldwide emissions reduction system.

The first two of these constraints are roughly consistent, as are the second two. *Our basic dilemma, however, is that the first set of constraints is incongruous with the second set.* An aggressive approach would play well internationally and with environmental groups, but would be sharply criticized by corporations, labor unions, and the Hill. A more gradual approach, however, would garner some support from domestic interests but would be met with derision abroad and by environmental constituents.

In this context, it is worth noting that on substance grounds, your advisers strongly object to the proposals that have been floated by the European Union. In other words, not all international pressures are necessarily consistent with "good policy." In particular, your advisers believe that the EU approach is problematic in three ways:

- Its approach to developing countries, in which developing countries do not have to bear any of the burden of emissions reductions, will undermine the environmental benefits of any efforts in this area;
- Its approach to reducing emissions -- cutting emissions 15 percent *below* 1990 levels by 2010 -- is dangerously front-loaded, and predicated on naive and misleading assumptions.
- The combination of these two factors leads to a credibility problem, that may actually reduce the chances of getting a solid international agreement over the medium-term.

The developing country issue highlights the vast gulf between the dialogue abroad (where previous U.S. proposals on developing country participation are almost uniformly considered too aggressive) and at home (where Senator Byrd's resolution, calling for even tougher demands on developing countries than previous U.S. proposals, passed the Senate 95-0). Your advisers favor a much tougher line on developing countries, even if that necessitates a two-step approach to the international negotiations: reach agreement among the developed countries, but do not submit the agreement for domestic ratification until key developing countries commit to binding targets.

The three illustrative scenarios presented in this memorandum are intended to frame our own decision-making process in the run-up to the Kyoto negotiations in December and beyond. Several key issues pervade these scenarios:

- How to implement a carbon emissions reduction scheme at home;
 - How much we can reasonably expect from technological advances without a significant price signal;
 - The role of developing economies in reducing global emissions; and
 - How the environmental effects *differ from* policy actions, within the range being considered.
- UCWSS VANDY*

These four issues are discussed in more detail in Section III of the memorandum.

II. THREE SCENARIOS

The climate change issue involves so many different parts (the target and timetable for our emissions, whether to use a tradeable permits system to reach that target, whether to auction the permits, etc.) that it is easy to become enmeshed in the details while losing sight of larger strategic considerations. The purpose of this section is to present scenarios that try to present some of the trade-offs on that higher strategic plane; subsequent memoranda and meetings will allow us to examine many of the component pieces in more detail.

The three scenarios we consider are:

- Scenario 1: Adopt most attractive policies currently acceptable in international sphere, fight for domestic ratification;
- Scenario 2: Devise more economically efficient domestic policy, even if not internationally acceptable; and
- Scenario 3: Try to bridge the gap

It is crucial to emphasize that the scenarios are meant to be illustrative, to provide a way of thinking about our policy proposals. Similarly, the economic figures presented along with each scenario are highly uncertain. They reflect educated guesses based on economic models. But the issues of disagreement discussed above, along with many others, could have a substantial effect on the precise outcomes. In particular, the estimates of the effects from international trading are especially uncertain.

SCENARIO 1 **ADOPT POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE**

Overall strategy

- Reach internationally feasible full agreement in Kyoto.
- Fight to sell and ratify agreement domestically over the next few years.

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits. R&D and Federal energy efficiency programs.
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Energy price effects

U.S. carbon dioxide emissions are projected to grow by almost 30 percent between 1990 and 2010. Thus, reaching 1990 levels in 2010 would require significant reductions in energy use. Some have noted that the cutbacks would be of the same magnitude, or greater, than the reductions in energy use during the two oil shocks of the 1970s. During this period, aggregate energy prices roughly doubled. Similarly, the implied increase in energy prices needed to reach 1990 emissions levels by 2010 could entail a significant inflationary shock, with an associated rise in the CPI and decline in real wages.

However, others note that the analogy with the oil shocks of the 1970s could be misleading. The oil shocks came suddenly and unexpectedly -- in contrast, the economy would have time to prepare for emissions limitations under a climate change regime. Also, a significant share of the increased cost of energy was captured by OPEC countries -- in contrast, only a small fraction of increased energy costs would ~~leave~~ the U.S. under a climate change regime.

represent ~~to~~ transfers from to other countries

We present two alternative sets of estimates. The first assumes that international trading among the developed countries (Annex I) becomes operational. The second assumes that it does not. Your economic advisers note that the first set of estimates involves more arbitrary assumptions than the second.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.
- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1 and \$2 per million BTUs in 2010. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$500 to \$1,000 more in 2010. Effects would be regressive in the first instance, although this could be offset by using revenue to reduce other regressive taxes.
- International transfers. There is substantial uncertainty over the size of net international transfers of the permits. However, under some scenarios, purchases of permits from other countries in 2010 could amount to \$5 to ~~\$10~~ billion. Some of your advisers believe that this deficit could prove to be a large political liability. — 9

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1.80 and \$3.15 per million BTUs in 2010.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$900 to \$1,500 more in 2010.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.
- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.
- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2.

SCENARIO 2

DEVISE CHEAPEST DOMESTIC POLICY WITH POSSIBILITY OF KEEPING CARBON CONCENTRATIONS AT TWICE PRE-INDUSTRIAL LEVELS

Overall strategy

- Devise cheapest domestic policy with possibility of keeping carbon concentrations at twice pre-industrial levels.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero ~~ten years~~ after ratification. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

700d: → 2010

Energy price effects

The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1.

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton, relative to the

current price of about \$20 per ton.

- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of about \$0.10 to \$0.25 per million BTUs.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$10 to \$100 more in 2010.

International reaction

- Kyoto agreement impossible. The U.S. will be blamed for undermining the current round of international negotiations (Rio II). Given this international reaction, agreement on international trading system unlikely.
- Developing country component of this approach is unrealistic, because developing countries will not agree.

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object.
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The difficulties with Scenarios 1 and 2 are clear: Scenario 1 represents a strong and credible commitment to address the climate change problem, but only at a potentially significant cost to the U.S. economy. Scenario 2 substantially mitigates the economic costs, but would do would be met by immense criticism abroad and among environmental groups at home as insufficiently responsive to the scale of the climate change challenge.

The central question is whether a strategy can be found for bridging the gap between these approaches, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three approaches that, to differing degrees, bridge the gap.

Components

Target and timetable	A) 1990 by 2010-2020 B) 1990 plus 15 percent by 2010, 1990 plus 7.5 percent by 2020, 1990 plus 5 percent by 2030, and 1990 by 2040 C) 2000 by 2010, 1995 by 2020, 1990 by 2040
Domestic implementation	Tradeable permits, with an "escape clause" on the permit price, or equivalent measures. R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

As indicated in the table above, all the alternatives below would be predicated on binding commitments from key developing countries. One possible way to address the developing country issue is a two-step approach: we could try to reach an agreement among the developed economies, but no such international agreement would be submitted for ratification before the key developing economies agreed to their commitments.

Also, under any of these approaches, we could build in an "escape clause" to limit the economic costs. The escape clause would involve government sales of permits at a fixed price -- that fixed price would then define the maximum price for the permits, thus limiting the potential economic costs. For example, if the government were willing to sell unlimited permits at a fixed

price of \$50 per ton, it would guarantee that gas prices did not rise by more than 15 cents per gallon in 2010. However, if the “escape clause” were triggered, the U.S. would not meet its ostensible target and timetable.

Approach A: 1990 by 2010-2020

This approach would attempt to soften the criticism of Scenario 1 by stretching out the 2010 deadline to lower the economic costs. Instead, the U.S. commitment would be that average emissions between 2010 and 2020 would be equal to the 1990 emission level.

Economic Effects

- The economic effects of this approach are very similar to those of Scenario 1. In particular, models suggest that the economic costs of the emissions reductions required under this approach are about 90 percent of the costs from Scenario 1.
- Depending on the international trade regime, the permit price in 2010 under this approach would be somewhere between \$30 and \$100. Gas prices in 2010 would rise between 10 cents and 25 cents per gallon.

Environmental and International Ramifications

- This approach would probably satisfy the concerns of environmental constituencies, but would still subject the United States to criticism for being “too weak.”

Approach B: Phasing in 1990 targets

This approach delays the year at which emissions are reduced to 1990 levels, but also builds in intermediate targets that provide a glidepath to that goal. Relative to Scenario 2, this approach allows us to maintain credibility by committing to some target by 2010 -- by at dramatically lower cost than under Scenario 1.

Economic Effects

- Relative to Scenario 1, this approach would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without lengthening the timetable to 2040 or later.
- The intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

internationally, since there would be relatively little gain for ^{almost} any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.

- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

III. KEY ISSUES

As discussed above, there are four key issues that pervade these scenarios: domestic implementation, technology, developing countries, and environmental effects. We will undoubtedly discuss these issues with you in more detail over the coming weeks, but wanted to flag them for you now.

A. Domestic implementation

Under the system to be negotiated in Kyoto, each participating country would be able to choose its own method for ensuring emissions reductions. The potential "domestic implementation" methods differ markedly in terms of their economic efficiency and political feasibility. We are committed to a market-based approach to reducing emissions, rather than a command-and-control regulatory approach.

The primary non-tax market-based structure for domestic enforcement is a system of tradeable permits. Under this approach, the Federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. *One key issue with permits is the allocation mechanism.* There are two approaches to allocation: auctioning, or ~~grandfathering~~ *allocation*. Your economic advisers have grave concerns about the cost -- and even the feasibility -- of a grandfathering system. Others dispute this claim, arguing that such mechanisms are both feasible and crucial for garnering corporate support.

1. An auction-based approach

The United States and ^{many} ~~most~~ other countries have long used auctions to sell government securities, and governments have also used auctions to allocate other resources -- such as oil leases, timber, and portions of the spectrum. The auction mechanism for distributing carbon permits has two main advantages:

- First, it would raise revenue that could be used to reduce other taxes, offset the regressivity of the emissions reduction scheme, raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction could generate relatively small amounts of money or as much as \$150 billion per

Environmental and International Ramifications

- This approach would be met by some dissatisfaction from the environmental community, since we would be seen as pushing our 1990 commitment off into the distant future. It is unclear how successful the interim commitments would be in mollifying these concerns.
- The international community would similarly be worried about our long-run commitment, and it is once again unclear whether these concerns could be reduced by the intermediate commitments. Many of your advisers worry that the delays in reaching 1990 levels embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Shifting base year in intermediate commitments

This approach would shift the intermediate commitments in Approach B to a new basis: for example, we would commit to reaching 2000 levels by 2010, 1995 levels by 2020, and 1990 levels by 2040.

- In one sense, the target year 1990 is disadvantageous for the United States. Between 1990 and 1995, our emissions grew 6.5 percent, while those in Western Europe fell by 0.2 percent. Thus, the choice of 1990 instead of a later year can be seen as a transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading.
- However, viewed from a broader perspective, the 1990 baseline is highly advantageous for the United States. Since the United States is the world's largest emitter of greenhouse gases, *any* baseline based on total historical emissions offers us significant advantages relative to other countries. (Compare, for example, a baseline based on per capita shares of global greenhouse gas concentrations). The 1990 baseline has generated momentum within the international negotiations; trying to shift the base year could re-open the question of whether historical emissions are the appropriate metric, and thus risks long-term damage to U.S. interests.

Economic Effects

	with trade	No trade
Sam	\$11	+25% in 2010 \$12
	\$17	+10% \$60

- The economic effects of this approach are very similar to those of the previous approach: the intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be sharply criticized

1/18/14
275
not 250

internationally, since there would be relatively little gain for any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.

- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

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- First, it would raise revenue that could be used to reduce other taxes, offset the regressivity of the emissions reduction scheme, raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction could generate relatively small amounts of money or as much as \$150 billion per

year. If those funds were used to reduce distortionary taxes, the so-called double dividend may result: improved environmental protection *and* less distortionary overall taxation.

- Second, it would ensure that permits are placed directly into the hands of those who value them most highly.

The main disadvantages to an auction approach are that it would be characterized as a tax much more easily than an approach based on grandfathering, and that it would make it much more difficult to garner corporate support.

- Auctions would force most businesses to pay large costs simply for the right to maintain their business-as-usual operations. Despite the fact that many these firms would likely pass most of the cost through to consumers, a firestorm of opposition will arise from these businesses.
- Corporate opponents would undoubtedly attack the auctions as a tax, even if the revenues were recycled to reduce other taxes. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

2. Grandfathering

Instead of forcing emitters to pay for permits at an auction, the government could grandfather them administratively, based on a pre-determined formula. The most likely system would involve granting permits to existing emitters based on historical fuel use or emissions; permits are allocated in this manner in the SO₂ trading program.

This approach has significant political advantages over an auction:

- The prospects for support from key businesses -- such as those you met with last month -- are much higher with an allocation scheme than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.

This approach brings with it several disadvantages, however.

- An administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. Such an approach would reward those who were biggest polluters in the past.
- The value of the permits would attract many claimants. Deciding which claimants deserve the permits could prove very difficult. Treasury and CEA have grave concerns

that the lobbying behavior inherent in attempts to capture the permit wealth will make the entire system grossly inefficient.

- Administrative allocation schemes forgo the opportunity to raise revenues -- and thus to use the revenues to cut other taxes.

Significantly, it may be possible to combine an auction and an administrative allocation approach -- for example, by auctioning some percentage of the permits, and administratively allocating the rest.

B. The role of technology

Over the long-run, all your advisers concur that advances in technology are crucial to reducing greenhouse gas emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. According to your science advisers, three kinds of technologies seem promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep aquifers or in other ways.

There is agreement that a package of technology options should be a component of any U.S. climate strategy. *But your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.*

- Some of your advisers believe that the cost estimates presented above are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also stress the importance of market incentives for technological advances, and the substantial body of evidence that markets respond to such incentives. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the

relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, therefore, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora.* In other words, it is impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

C. Joint implementation

Another source of disagreement among your advisers is the role of joint implementation (JI). JI is a mechanism by which a private entity in the United States could invest in greenhouse gas mitigation projects in developing countries without emissions budgets. In exchange, the investor (and the U.S.) would receive credit towards its emission budget. The Vice President has signed framework agreements on this subject with several Latin American countries. In addition, the business community strongly supports joint implementation and some companies -- especially in the utility sector -- have been making joint implementation a reality over the past few years. But some of your advisers are concerned that the program will either prove ineffective in lowering costs to mitigate climate change, or will undermine efforts to reduce *global* emissions.

In principle, JI provides a very low cost mechanism for reducing emissions, by “trading” emissions here for emissions abroad, where the cost of reduction is much lower. In practice, however, JI requires a mechanism for guaranteeing that emission reductions that qualify for credits are “additional” to -- above and beyond -- reductions that would have happened anyway in the baseline case. How can we tell whether the low emissions power generation plant built in a developing country would have been built in the absence of JI incentives? If credit is given for investments that would have happened anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. On the other hand, if the standard of “additionality” is set too high, or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

D. Environmental effects

A final source of uncertainty and disagreement is over the size of the environmental effects from different government policies. Our best models suggest that under business-as-usual

(BAU), concentration levels of carbon are expected to rise from approximately 360 parts per million by volume (ppmv) today to over 500 ppmv in 2050 and over 700 ppmv by 2100 -- the highest in more than 50 million years. Pre-industrial concentrations were approximately 250 ppmv, and concentrations are expected to reach twice these pre-industrial levels in about 2060. The increase in carbon concentrations is expected to produce an increase in mean global temperature of between 2 and 6.5 degrees Fahrenheit.

Associated with this increase in temperatures will be a rise in sea levels that will inundate more than 9000 square miles in the United States (with Florida and Louisiana most vulnerable). According to a NOAA study, average July temperatures in Washington, D.C. will be 5 to 15 degrees Fahrenheit higher by the end of the next century.

The relevant question in evaluating our policy choices, however, is not this environmental baseline. Rather, we must compare the likely environmental costs averted under one set of our actions to the likely costs averted under some other set of actions.

- One set of your advisers recognizes the potentially substantial costs inherent in the baseline. But they argue that the best models available suggest that *differences* in the targets and timetables of the type discussed in this memo have little effect on the ultimate global concentration of carbon, and therefore on climate change. For example, one controversial conclusion is that the differences in possible developed country paths -- assuming that such differences have no impact on developing country emissions -- between the most aggressive and least cost paths discussed above produce only 0.1 degrees Fahrenheit difference in the temperature increases by 2100. In other words, these advisers argue that by changing the shape of the emissions path to a given ultimate concentration, it is possible to achieve the same environmental benefit at a much lower economic cost.
- Other advisers believe that such comparisons are fundamentally misleading, because delayed action by the U.S. will further delay action by the developing countries. Delayed U.S. emissions reductions -- even if balanced by steeper reductions in the out-years -- therefore imply that contrary to what is asserted by the first group of advisers, ultimate concentrations will be higher (with the concomitant worsening of climate change).

Furthermore, this argument continues, even if a delayed emissions path to the same ultimate concentration could somehow be achieved, there is an (admittedly very small) probability that the different emissions paths will matter for the climate system. The conclusion is that the environmental differences among the scenarios (particularly Scenario 1 and Scenario 2) are potentially momentous.

September 15, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
KATIE McGINTY
DANIEL TARULLO

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of several we will be submitting over the next month on climate change policy. As you know, many consider this issue to be the premier environmental challenge of the next century. As the world's largest emitter of greenhouse gasses, our country's actions will be watched closely: If we act prudently, we can take steps to reduce emissions over the long term without undue adverse effects on economic growth. But the issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain.

The complexity of the issue is reflected in four different sets of constituent constraints that we face:

- Environmental. The environmental community is pushing for an aggressive stance on reducing greenhouse gas emissions.
- International and diplomatic. The international negotiations have focused on relatively aggressive approaches; adopting a less aggressive approach would therefore have adverse diplomatic implications.
- Economic. Economists recognize the severity of the problem, but argue that a more gradual approach can achieve similar environmental objectives at substantially lower economic cost.
- Domestic. Major corporations and labor unions will criticize aggressive approaches as excessively costly and as a large energy tax increase; they will also insist on strong developing country participation in a worldwide emissions reduction system.

The first two of these constraints are roughly consistent, as are the second two. *Our basic dilemma, however, is that the first set of constraints is incongruous with the second set.* An aggressive approach would play well internationally and with environmental groups, but would be sharply criticized by corporations, labor unions, and the Hill. A more gradual approach, however, would garner some support from domestic interests but would be met with derision abroad and by environmental constituents.

In this context, it is worth noting that on substance grounds, your advisers strongly object to the proposals that have been floated by the European Union. In other words, not all international pressures are necessarily consistent with "good policy." In particular, your advisers believe that the EU approach is problematic in three ways:

- Its approach to developing countries, in which developing countries do not have to bear any of the burden of emissions reductions, will undermine the environmental benefits of any efforts in this area;
- Its approach to reducing emissions -- cutting emissions 15 percent *below* 1990 levels by 2010 -- is dangerously front-loaded, and predicated on naive and misleading assumptions.
- The combination of these two factors leads to a credibility problem, that may actually reduce the chances of getting a solid international agreement over the medium-term.

The developing country issue highlights the vast gulf between the dialogue abroad (where previous U.S. proposals on developing country participation are almost uniformly considered too aggressive) and at home (where Senator Byrd's resolution, calling for even tougher demands on developing countries than previous U.S. proposals, passed the Senate 95-0). Your advisers favor a much tougher line on developing countries, even if that necessitates a two-step approach to the international negotiations: reach agreement among the developed countries, but do not submit the agreement for domestic ratification until key developing countries commit to binding targets.

The three illustrative scenarios presented in this memorandum are intended to frame our own decision-making process in the run-up to the Kyoto negotiations in December and beyond. Several key issues pervade these scenarios:

- How to implement a carbon emissions reduction scheme at home;
- How much we can reasonably expect from technological advances without a significant price signal;
- The role of developing economies in reducing global emissions; and
- How the environmental effects *differ from* policy actions, within the range being considered.

These four issues are discussed in more detail in Section III of the memorandum.

II. THREE SCENARIOS

The climate change issue involves so many different parts (the target and timetable for our emissions, whether to use a tradeable permits system to reach that target, whether to auction the permits, etc.) that it is easy to become enmeshed in the details while losing sight of larger strategic considerations. The purpose of this section is to present scenarios that try to present some of the trade-offs on that higher strategic plane; subsequent memoranda and meetings will allow us to examine many of the component pieces in more detail.

The three scenarios we consider are:

- Scenario 1: Adopt most attractive policies currently acceptable in international sphere, fight for domestic ratification;
- Scenario 2: Devise more economically efficient domestic policy, even if not internationally acceptable; and
- Scenario 3: Try to bridge the gap

It is crucial to emphasize that the scenarios are meant to be illustrative, to provide a way of thinking about our policy proposals. Similarly, the economic figures presented along with each scenario are highly uncertain. They reflect educated guesses based on economic models. But the issues of disagreement discussed above, along with many others, could have a substantial effect on the precise outcomes. In particular, the estimates of the effects from international trading are especially uncertain.

SCENARIO 1

ADOPT POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE

Overall strategy

- Reach internationally feasible full agreement in Kyoto.
- Fight to sell and ratify agreement domestically over the next few years.

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits. R&D and Federal energy efficiency programs.
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Energy price effects

U.S. carbon dioxide emissions are projected to grow by almost 30 percent between 1990 and 2010. Thus, reaching 1990 levels in 2010 would require significant reductions in energy use. Some have noted that the cutbacks would be of the same magnitude, or greater, than the reductions in energy use during the two oil shocks of the 1970s. During this period, aggregate energy prices roughly doubled. Similarly, the implied increase in energy prices needed to reach 1990 emissions levels by 2010 could entail a significant inflationary shock, with an associated rise in the CPI and decline in real wages.

However, others note that the analogy with the oil shocks of the 1970s could be misleading. The oil shocks came suddenly and unexpectedly -- in contrast, the economy would have time to prepare for emissions limitations under a climate change regime. Also, a significant share of the increased cost of energy was captured by OPEC countries -- in contrast, only a small fraction of increased energy costs would ~~leave~~ the U.S. under a climate change regime.

represent ~~to~~ (transfers from) to other countries

We present two alternative sets of estimates. The first assumes that international trading among the developed countries (Annex I) becomes operational. The second assumes that it does not. Your economic advisers note that the first set of estimates involves more arbitrary assumptions than the second.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.
- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1 and \$2 per million BTUs in 2010. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$500 to \$1,000 more in 2010. Effects would be regressive in the first instance, although this could be offset by using revenue to reduce other regressive taxes.
- International transfers. There is substantial uncertainty over the size of net international transfers of the permits. However, under some scenarios, purchases of permits from other countries in 2010 could amount to \$5 to ~~\$10~~ billion. Some of your advisers believe that this deficit could prove to be a large political liability. 9

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1.80 and \$3.15 per million BTUs in 2010.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$900 to \$1,500 more in 2010.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.
- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.
- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2.

SCENARIO 2

DEVISE CHEAPEST DOMESTIC POLICY WITH POSSIBILITY OF KEEPING CARBON CONCENTRATIONS AT TWICE PRE-INDUSTRIAL LEVELS

Overall strategy

- Devise cheapest domestic policy with possibility of keeping carbon concentrations at twice pre-industrial levels.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero ~~ten years~~ after ratification. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

700d: ↗ 2010

Energy price effects

The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1.

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton, relative to the

current price of about \$20 per ton.

- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of about \$0.10 to \$0.25 per million BTUs.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$10 to \$100 more in 2010.

International reaction

- Kyoto agreement impossible. The U.S. will be blamed for undermining the current round of international negotiations (Rio II). Given this international reaction, agreement on international trading system unlikely.
- Developing country component of this approach is unrealistic, because developing countries will not agree.

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object.
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The difficulties with Scenarios 1 and 2 are clear: Scenario 1 represents a strong and credible commitment to address the climate change problem, but only at a potentially significant cost to the U.S. economy. Scenario 2 substantially mitigates the economic costs, but would do would be met by immense criticism abroad and among environmental groups at home as insufficiently responsive to the scale of the climate change challenge.

The central question is whether a strategy can be found for bridging the gap between these approaches, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three approaches that, to differing degrees, bridge the gap.

Components

Target and timetable	A) 1990 by 2010-2020 B) 1990 plus 15 percent by 2010, 1990 plus 7.5 percent by 2020, 1990 plus 5 percent by 2030, and 1990 by 2040 C) 2000 by 2010, 1995 by 2020, 1990 by 2040
Domestic implementation	Tradeable permits, with an "escape clause" on the permit price, or equivalent measures. R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

As indicated in the table above, all the alternatives below would be predicated on binding commitments from key developing countries. One possible way to address the developing country issue is a two-step approach: we could try to reach an agreement among the developed economies, but no such international agreement would be submitted for ratification before the key developing economies agreed to their commitments.

Also, under any of these approaches, we could build in an "escape clause" to limit the economic costs. The escape clause would involve government sales of permits at a fixed price -- that fixed price would then define the maximum price for the permits, thus limiting the potential economic costs. For example, if the government were willing to sell unlimited permits at a fixed

price of \$50 per ton, it would guarantee that gas prices did not rise by more than 15 cents per gallon in 2010. However, if the “escape clause” were triggered, the U.S. would not meet its ostensible target and timetable.

Approach A: 1990 by 2010-2020

This approach would attempt to soften the criticism of Scenario 1 by stretching out the 2010 deadline to lower the economic costs. Instead, the U.S. commitment would be that average emissions between 2010 and 2020 would be equal to the 1990 emission level.

Economic Effects

- The economic effects of this approach are very similar to those of Scenario 1. In particular, models suggest that the economic costs of the emissions reductions required under this approach are about 90 percent of the costs from Scenario 1.
- Depending on the international trade regime, the permit price in 2010 under this approach would be somewhere between \$30 and \$100. Gas prices in 2010 would rise between 10 cents and 25 cents per gallon.

Environmental and International Ramifications

- This approach would probably satisfy the concerns of environmental constituencies, but would still subject the United States to criticism for being “too weak.”

Approach B: Phasing in 1990 targets

This approach delays the year at which emissions are reduced to 1990 levels, but also builds in intermediate targets that provide a glidepath to that goal. Relative to Scenario 2, this approach allows us to maintain credibility by committing to some target by 2010 -- by at dramatically lower cost than under Scenario 1.

Economic Effects

- Relative to Scenario 1, this approach would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without lengthening the timetable to 2040 or later.
- The intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- This approach would be met by some dissatisfaction from the environmental community, since we would be seen as pushing our 1990 commitment off into the distant future. It is unclear how successful the interim commitments would be in mollifying these concerns.
- The international community would similarly be worried about our long-run commitment, and it is once again unclear whether these concerns could be reduced by the intermediate commitments. Many of your advisers worry that the delays in reaching 1990 levels embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Shifting base year in intermediate commitments

This approach would shift the intermediate commitments in Approach B to a new basis: for example, we would commit to reaching 2000 levels by 2010, 1995 levels by 2020, and 1990 levels by 2040.

- In one sense, the target year 1990 is disadvantageous for the United States. Between 1990 and 1995, our emissions grew 6.5 percent, while those in Western Europe *fell* by 0.2 percent. Thus, the choice of 1990 instead of a later year can be seen as a transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading.
- However, viewed from a broader perspective, the 1990 baseline is highly advantageous for the United States. Since the United States is the world's largest emitter of greenhouse gases, *any* baseline based on total historical emissions offers us significant advantages relative to other countries. (Compare, for example, a baseline based on per capita shares of global greenhouse gas concentrations). The 1990 baseline has generated momentum within the international negotiations; trying to shift the base year could re-open the question of whether historical emissions are the appropriate metric, and thus risks long-term damage to U.S. interests.

Economic Effects

- The economic effects of this approach are very similar to those of the previous approach: the intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be sharply criticized

internationally, since there would be relatively little gain for ^{almost} any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.

- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

III. KEY ISSUES

As discussed above, there are four key issues that pervade these scenarios: domestic implementation, technology, developing countries, and environmental effects. We will undoubtedly discuss these issues with you in more detail over the coming weeks, but wanted to flag them for you now.

A. Domestic implementation

Under the system to be negotiated in Kyoto, each participating country would be able to choose its own method for ensuring emissions reductions. The potential "domestic implementation" methods differ markedly in terms of their economic efficiency and political feasibility. We are committed to a market-based approach to reducing emissions, rather than a command-and-control regulatory approach.

The primary non-tax market-based structure for domestic enforcement is a system of tradeable permits. Under this approach, the Federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. *One key issue with permits is the allocation mechanism.* There are two approaches to allocation: auctioning, or grandfathering. *allocation* Your economic advisers have grave concerns about the cost -- and even the feasibility -- of a grandfathering system. Others dispute this claim, arguing that such mechanisms are both feasible and crucial for garnering corporate support.

1. An auction-based approach

The United States and ^{many} most other countries have long used auctions to sell government securities, and governments have also used auctions to allocate other resources -- such as oil leases, timber, and portions of the spectrum. The auction mechanism for distributing carbon permits has two main advantages:

- First, it would raise revenue that could be used to reduce other taxes, offset the regressivity of the emissions reduction scheme, raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction could generate relatively small amounts of money or as much as \$150 billion per

year. If those funds were used to reduce distortionary taxes, the so-called double dividend may result: improved environmental protection *and* less distortionary overall taxation.

- Second, it would ensure that permits are placed directly into the hands of those who value them most highly.

The main disadvantages to an auction approach are that it would be characterized as a tax much more easily than an approach based on grandfathering, and that it would make it much more difficult to garner corporate support.

- Auctions would force most businesses to pay large costs simply for the right to maintain their business-as-usual operations. Despite the fact that many these firms would likely pass most of the cost through to consumers, a firestorm of opposition will arise from these businesses.
- Corporate opponents would undoubtedly attack the auctions as a tax, even if the revenues were recycled to reduce other taxes. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

2. Grandfathering

Instead of forcing emitters to pay for permits at an auction, the government could grandfather them administratively, based on a pre-determined formula. The most likely system would involve granting permits to existing emitters based on historical fuel use or emissions; permits are allocated in this manner in the SO₂ trading program.

This approach has significant political advantages over an auction:

- The prospects for support from key businesses -- such as those you met with last month -- are much higher with an allocation scheme than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.

This approach brings with it several disadvantages, however.

- An administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. Such an approach would reward those who were biggest polluters in the past.
- The value of the permits would attract many claimants. Deciding which claimants deserve the permits could prove very difficult. Treasury and CEA have grave concerns

that the lobbying behavior inherent in attempts to capture the permit wealth will make the entire system grossly inefficient.

- Administrative allocation schemes forgo the opportunity to raise revenues -- and thus to use the revenues to cut other taxes.

Significantly, it may be possible to combine an auction and an administrative allocation approach -- for example, by auctioning some percentage of the permits, and administratively allocating the rest.

B. The role of technology

Over the long-run, all your advisers concur that advances in technology are crucial to reducing greenhouse gas emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. According to your science advisers, three kinds of technologies seem promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep aquifers or in other ways.

There is agreement that a package of technology options should be a component of any U.S. climate strategy. *But your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.*

- Some of your advisers believe that the cost estimates presented above are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also stress the importance of market incentives for technological advances, and the substantial body of evidence that markets respond to such incentives. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the

relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, therefore, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora*. In other words, it is impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

C. Joint implementation

Another source of disagreement among your advisers is the role of joint implementation (JI). JI is a mechanism by which a private entity in the United States could invest in greenhouse gas mitigation projects in developing countries without emissions budgets. In exchange, the investor (and the U.S.) would receive credit towards its emission budget. The Vice President has signed framework agreements on this subject with several Latin American countries. In addition, the business community strongly supports joint implementation and some companies -- especially in the utility sector -- have been making joint implementation a reality over the past few years. But some of your advisers are concerned that the program will either prove ineffective in lowering costs to mitigate climate change, or will undermine efforts to reduce *global* emissions.

In principle, JI provides a very low cost mechanism for reducing emissions, by “trading” emissions here for emissions abroad, where the cost of reduction is much lower. In practice, however, JI requires a mechanism for guaranteeing that emission reductions that qualify for credits are “additional” to -- above and beyond -- reductions that would have happened anyway in the baseline case. How can we tell whether the low emissions power generation plant built in a developing country would have been built in the absence of JI incentives? If credit is given for investments that would have happened anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. On the other hand, if the standard of “additionality” is set too high, or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

D. Environmental effects

A final source of uncertainty and disagreement is over the size of the environmental effects from different government policies. Our best models suggest that under business-as-usual

(BAU), concentration levels of carbon are expected to rise from approximately 360 parts per million by volume (ppmv) today to over 500 ppmv in 2050 and over 700 ppmv by 2100 -- the highest in more than 50 million years. Pre-industrial concentrations were approximately 250 ppmv, and concentrations are expected to reach twice these pre-industrial levels in about 2060. The increase in carbon concentrations is expected to produce an increase in mean global temperature of between 2 and 6.5 degrees Fahrenheit.

Associated with this increase in temperatures will be a rise in sea levels that will inundate more than 9000 square miles in the United States (with Florida and Louisiana most vulnerable). According to a NOAA study, average July temperatures in Washington, D.C. will be 5 to 15 degrees Fahrenheit higher by the end of the next century.

The relevant question in evaluating our policy choices, however, is not this environmental baseline. Rather, we must compare the likely environmental costs averted under one set of our actions to the likely costs averted under some other set of actions.

- One set of your advisers recognizes the potentially substantial costs inherent in the baseline. But they argue that the best models available suggest that *differences* in the targets and timetables of the type discussed in this memo have little effect on the ultimate global concentration of carbon, and therefore on climate change. For example, one controversial conclusion is that the differences in possible developed country paths -- assuming that such differences have no impact on developing country emissions -- between the most aggressive and least cost paths discussed above produce only 0.1 degrees Fahrenheit difference in the temperature increases by 2100. In other words, these advisers argue that by changing the shape of the emissions path to a given ultimate concentration, it is possible to achieve the same environmental benefit at a much lower economic cost.
- Other advisers believe that such comparisons are fundamentally misleading, because delayed action by the U.S. will further delay action by the developing countries. Delayed U.S. emissions reductions -- even if balanced by steeper reductions in the out-years -- therefore imply that contrary to what is asserted by the first group of advisers, ultimate concentrations will be higher (with the concomitant worsening of climate change).

Furthermore, this argument continues, even if a delayed emissions path to the same ultimate concentration could somehow be achieved, there is an (admittedly very small) probability that the different emissions paths will matter for the climate system. The conclusion is that the environmental differences among the scenarios (particularly Scenario 1 and Scenario 2) are potentially momentous.

This is not quite the final version. 

September 15, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
KATIE MCGINTY
DANIEL TARULLO

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of several we will be submitting over the next month on climate change policy. As you know, many consider this issue to be the premier environmental challenge of the next century. As the world's largest emitter of greenhouse gasses, our country's actions will be watched closely: If we act prudently, we can take steps to reduce emissions over the long term without undue adverse effects on economic growth. But the issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain.

The complexity of the issue is reflected in four different sets of constituent constraints that we face:

- Environmental. The environmental community is pushing for an aggressive stance on reducing greenhouse gas emissions.
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In this context, it is worth noting that on substance grounds, your advisers strongly object to the proposals that have been floated by the European Union. In other words, not all international pressures are necessarily consistent with "good policy." In particular, your advisers believe that the EU approach is problematic in three ways:

- Its approach to developing countries, in which developing countries do not have to bear any of the burden of emissions reductions, will undermine the environmental benefits of any efforts in this area;
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The three illustrative scenarios presented in this memorandum are intended to frame our own decision-making process in the run-up to the Kyoto negotiations in December and beyond. Several key issues pervade these scenarios:

- How to implement a carbon emissions reduction scheme at home;
- How much we can reasonably expect from technological advances without a significant price signal;
- The role of developing economies in reducing global emissions; and
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It is crucial to emphasize that the scenarios are meant to be illustrative, to provide a way of thinking about our policy proposals. Similarly, the economic figures presented along with each scenario are highly uncertain. They reflect educated guesses based on economic models. But the issues of disagreement discussed above, along with many others, could have a substantial effect on the precise outcomes. In particular, the estimates of the effects from international trading are especially uncertain.

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However, others note that the analogy with the oil shocks of the 1970s could be misleading. The oil shocks came suddenly and unexpectedly -- in contrast, the economy would have time to prepare for emissions limitations under a climate change regime. Also, a significant share of the increased cost of energy was captured by OPEC countries -- in contrast, only a small fraction of increased energy costs would leave the U.S. under a climate change regime.

represent ~~to~~ transfers from to other countries

We present two alternative sets of estimates. The first assumes that international trading among the developed countries (Annex I) becomes operational. The second assumes that it does not. Your economic advisers note that the first set of estimates involves more arbitrary assumptions than the second.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.
- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1 and \$2 per million BTUs in 2010. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$500 to \$1,000 more in 2010. Effects would be regressive in the first instance, although this could be offset by using revenue to reduce other regressive taxes.
- International transfers. There is substantial uncertainty over the size of net international transfers of the permits. However, under some scenarios, purchases of permits from other countries in 2010 could amount to \$5 to ~~\$10~~ billion. Some of your advisers believe that this deficit could prove to be a large political liability. 9

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of between \$1.80 and \$3.15 per million BTUs in 2010.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$900 to \$1,500 more in 2010.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.
- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.
- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2.

SCENARIO 2

DEVISE CHEAPEST DOMESTIC POLICY WITH POSSIBILITY OF KEEPING CARBON CONCENTRATIONS AT TWICE PRE-INDUSTRIAL LEVELS

Overall strategy

- Devise cheapest domestic policy with possibility of keeping carbon concentrations at twice pre-industrial levels.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero ten ~~years~~ after ratification. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

Todd: 2010

Energy price effects

The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1.

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton, relative to the

current price of about \$20 per ton.

- BTU-equivalent. In terms of oil prices, the energy price increase is equivalent to a tax of about \$0.10 to \$0.25 per million BTUs.
- Effects on families. These price increases imply that the average family would either have to reduce consumption or pay \$10 to \$100 more in 2010.

International reaction

- Kyoto agreement impossible. The U.S. will be blamed for undermining the current round of international negotiations (Rio II). Given this international reaction, agreement on international trading system unlikely.
- Developing country component of this approach is unrealistic, because developing countries will not agree.

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object.
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The difficulties with Scenarios 1 and 2 are clear: Scenario 1 represents a strong and credible commitment to address the climate change problem, but only at a potentially significant cost to the U.S. economy. Scenario 2 substantially mitigates the economic costs, but would do would be met by immense criticism abroad and among environmental groups at home as insufficiently responsive to the scale of the climate change challenge.

The central question is whether a strategy can be found for bridging the gap between these approaches, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three approaches that, to differing degrees, bridge the gap.

Components

Target and timetable	A) 1990 by 2010-2020 B) 1990 plus 15 percent by 2010, 1990 plus 7.5 percent by 2020, 1990 plus 5 percent by 2030, and 1990 by 2040 C) 2000 by 2010, 1995 by 2020, 1990 by 2040
Domestic implementation	Tradeable permits, with an "escape clause" on the permit price, or equivalent measures. R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes.
International trading	U.S. would seek international trading system among all participating countries.

As indicated in the table above, all the alternatives below would be predicated on binding commitments from key developing countries. One possible way to address the developing country issue is a two-step approach: we could try to reach an agreement among the developed economies, but no such international agreement would be submitted for ratification before the key developing economies agreed to their commitments.

Also, under any of these approaches, we could build in an "escape clause" to limit the economic costs. The escape clause would involve government sales of permits at a fixed price -- that fixed price would then define the maximum price for the permits, thus limiting the potential economic costs. For example, if the government were willing to sell unlimited permits at a fixed

price of \$50 per ton, it would guarantee that gas prices did not rise by more than 15 cents per gallon in 2010. However, if the "escape clause" were triggered, the U.S. would not meet its ostensible target and timetable.

Approach A: 1990 by 2010-2020

This approach would attempt to soften the criticism of Scenario 1 by stretching out the 2010 deadline to lower the economic costs. Instead, the U.S. commitment would be that average emissions between 2010 and 2020 would be equal to the 1990 emission level.

Economic Effects

- The economic effects of this approach are very similar to those of Scenario 1. In particular, models suggest that the economic costs of the emissions reductions required under this approach are about 90 percent of the costs from Scenario 1.
- Depending on the international trade regime, the permit price in 2010 under this approach would be somewhere between \$30 and \$100. Gas prices in 2010 would rise between 10 cents and 25 cents per gallon.

Environmental and International Ramifications

- This approach would probably satisfy the concerns of environmental constituencies, but would still subject the United States to criticism for being "too weak."

Approach B: Phasing in 1990 targets

This approach delays the year at which emissions are reduced to 1990 levels, but also builds in intermediate targets that provide a glidepath to that goal. Relative to Scenario 2, this approach allows us to maintain credibility by committing to some target by 2010 -- by at dramatically lower cost than under Scenario 1.

Economic Effects

- Relative to Scenario 1, this approach would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without lengthening the timetable to 2040 or later.
- The intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- This approach would be met by some dissatisfaction from the environmental community, since we would be seen as pushing our 1990 commitment off into the distant future. It is unclear how successful the interim commitments would be in mollifying these concerns.
- The international community would similarly be worried about our long-run commitment, and it is once again unclear whether these concerns could be reduced by the intermediate commitments. Many of your advisers worry that the delays in reaching 1990 levels embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Shifting base year in intermediate commitments

This approach would shift the intermediate commitments in Approach B to a new basis: for example, we would commit to reaching 2000 levels by 2010, 1995 levels by 2020, and 1990 levels by 2040.

- In one sense, the target year 1990 is disadvantageous for the United States. Between 1990 and 1995, our emissions grew 6.5 percent, while those in Western Europe *fell* by 0.2 percent. Thus, the choice of 1990 instead of a later year can be seen as a transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading.
- However, viewed from a broader perspective, the 1990 baseline is highly advantageous for the United States. Since the United States is the world's largest emitter of greenhouse gases, *any* baseline based on total historical emissions offers us significant advantages relative to other countries. (Compare, for example, a baseline based on per capita shares of global greenhouse gas concentrations). The 1990 baseline has generated momentum within the international negotiations; trying to shift the base year could re-open the question of whether historical emissions are the appropriate metric, and thus risks long-term damage to U.S. interests.

Economic Effects

- The economic effects of this approach are very similar to those of the previous approach: the intermediate target of reaching 15 percent above 1990 levels by 2010 implies a permit price of about \$15 to \$30 in 2010.

Environmental and International Ramifications

- The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be sharply criticized

internationally, since there would be relatively little gain for any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.

- This approach would also be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

III. KEY ISSUES

As discussed above, there are four key issues that pervade these scenarios: domestic implementation, technology, developing countries, and environmental effects. We will undoubtedly discuss these issues with you in more detail over the coming weeks, but wanted to flag them for you now.

A. Domestic implementation

Under the system to be negotiated in Kyoto, each participating country would be able to choose its own method for ensuring emissions reductions. The potential "domestic implementation" methods differ markedly in terms of their economic efficiency and political feasibility. We are committed to a market-based approach to reducing emissions, rather than a command-and-control regulatory approach.

The primary non-tax market-based structure for domestic enforcement is a system of tradeable permits. Under this approach, the Federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. *One key issue with permits is the allocation mechanism.* There are two approaches to allocation: auctioning, or grandfathering. Your economic advisers have grave concerns about the cost -- and even the feasibility -- of a grandfathering system. Others dispute this claim, arguing that such mechanisms are both feasible and crucial for garnering corporate support.

1. An auction-based approach

The United States and ^{many} most other countries have long used auctions to sell government securities, and governments have also used auctions to allocate other resources -- such as oil leases, timber, and portions of the spectrum. The auction mechanism for distributing carbon permits has two main advantages:

- First, it would raise revenue that could be used to reduce other taxes, offset the regressivity of the emissions reduction scheme, raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction could generate relatively small amounts of money or as much as \$150 billion per

year. If those funds were used to reduce distortionary taxes, the so-called double dividend may result: improved environmental protection *and* less distortionary overall taxation.

- Second, it would ensure that permits are placed directly into the hands of those who value them most highly.

The main disadvantages to an auction approach are that it would be characterized as a tax much more easily than an approach based on grandfathering, and that it would make it much more difficult to garner corporate support.

- Auctions would force most businesses to pay large costs simply for the right to maintain their business-as-usual operations. Despite the fact that many these firms would likely pass most of the cost through to consumers, a firestorm of opposition will arise from these businesses.
- Corporate opponents would undoubtedly attack the auctions as a tax, even if the revenues were recycled to reduce other taxes. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

2. Grandfathering

Instead of forcing emitters to pay for permits at an auction, the government could grandfather them administratively, based on a pre-determined formula. The most likely system would involve granting permits to existing emitters based on historical fuel use or emissions; permits are allocated in this manner in the SO₂ trading program.

This approach has significant political advantages over an auction:

- The prospects for support from key businesses -- such as those you met with last month -- are much higher with an allocation scheme than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.

This approach brings with it several disadvantages, however.

- An administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. Such an approach would reward those who were biggest polluters in the past.
- The value of the permits would attract many claimants. Deciding which claimants deserve the permits could prove very difficult. Treasury and CEA have grave concerns

that the lobbying behavior inherent in attempts to capture the permit wealth will make the entire system grossly inefficient.

- Administrative allocation schemes forgo the opportunity to raise revenues -- and thus to use the revenues to cut other taxes.

Significantly, it may be possible to combine an auction and an administrative allocation approach -- for example, by auctioning some percentage of the permits, and administratively allocating the rest.

B. The role of technology

Over the long-run, all your advisers concur that advances in technology are crucial to reducing greenhouse gas emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. According to your science advisers, three kinds of technologies seem promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep aquifers or in other ways.

There is agreement that a package of technology options should be a component of any U.S. climate strategy. *But your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.*

- Some of your advisers believe that the cost estimates presented above are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also stress the importance of market incentives for technological advances, and the substantial body of evidence that markets respond to such incentives. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the

relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora.* In other words, it is impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

C. Joint implementation

Another source of disagreement among your advisers is the role of joint implementation (JI). JI is a mechanism by which a private entity in the United States could invest in greenhouse gas mitigation projects in developing countries without emissions budgets. In exchange, the investor (and the U.S.) would receive credit towards its emission budget. The Vice President has signed framework agreements on this subject with several Latin American countries. In addition, the business community strongly supports joint implementation and some companies -- especially in the utility sector -- have been making joint implementation a reality over the past few years. But some of your advisers are concerned that the program will either prove ineffective in lowering costs to mitigate climate change, or will undermine efforts to reduce *global* emissions.

In principle, JI provides a very low cost mechanism for reducing emissions, by "trading" emissions here for emissions abroad, where the cost of reduction is much lower. In practice, however, JI requires a mechanism for guaranteeing that emission reductions that qualify for credits are "additional" to -- above and beyond -- reductions that would have happened anyway in the baseline case. How can we tell whether the low emissions power generation plant built in a developing country would have been built in the absence of JI incentives? If credit is given for investments that would have happened anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. On the other hand, if the standard of "additionality" is set too high, or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

D. Environmental effects

A final source of uncertainty and disagreement is over the size of the environmental effects from different government policies. Our best models suggest that under business-as-usual

(BAU), concentration levels of carbon are expected to rise from approximately 360 parts per million by volume (ppmv) today to over 500 ppmv in 2050 and over 700 ppmv by 2100 -- the highest in more than 50 million years. Pre-industrial concentrations were approximately 250 ppmv, and concentrations are expected to reach twice these pre-industrial levels in about 2060. The increase in carbon concentrations is expected to produce an increase in mean global temperature of between 2 and 6.5 degrees Fahrenheit.

Associated with this increase in temperatures will be a rise in sea levels that will inundate more than 9000 square miles in the United States (with Florida and Louisiana most vulnerable). According to a NOAA study, average July temperatures in Washington, D.C. will be 5 to 15 degrees Fahrenheit higher by the end of the next century.

The relevant question in evaluating our policy choices, however, is not this environmental baseline. Rather, we must compare the likely environmental costs averted under one set of our actions to the likely costs averted under some other set of actions.

- One set of your advisers recognizes the potentially substantial costs inherent in the baseline. But they argue that the best models available suggest that *differences* in the targets and timetables of the type discussed in this memo have little effect on the ultimate global concentration of carbon, and therefore on climate change. For example, one controversial conclusion is that the differences in possible developed country paths -- assuming that such differences have no impact on developing country emissions -- between the most aggressive and least cost paths discussed above produce only 0.1 degrees Fahrenheit difference in the temperature increases by 2100. In other words, these advisers argue that by changing the shape of the emissions path to a given ultimate concentration, it is possible to achieve the same environmental benefit at a much lower economic cost.
- Other advisers believe that such comparisons are fundamentally misleading, because delayed action by the U.S. will further delay action by the developing countries. Delayed U.S. emissions reductions -- even if balanced by steeper reductions in the out-years -- therefore imply that contrary to what is asserted by the first group of advisers, ultimate concentrations will be higher (with the concomitant worsening of climate change).

Furthermore, this argument continues, even if a delayed emissions path to the same ultimate concentration could somehow be achieved, there is an (admittedly very small) probability that the different emissions paths will matter for the climate system. The conclusion is that the environmental differences among the scenarios (particularly Scenario 1 and Scenario 2) are potentially momentous.

**DRAFT #2**

September 14, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
KATIE McGINTY
DANIEL TARULLO

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of several that we will be submitting to you over the next several weeks on the substance of climate change issues. As you know, this issue provides an opportunity for you to address what many consider to be the premier environmental challenge of the next century. As the world's largest emitter of greenhouse gasses, our country's actions will send a key signal to the rest of the world that steps can be taken to reduce emissions over the long term without undue adverse effects on economic growth. But the issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain.

The purpose of this memorandum is to frame the decision-making process by presenting three scenarios illustrating possible strategies for the Kyoto negotiations in December and beyond. Subsequent decision memoranda will discuss various aspects of our negotiating position in more detail.

II. AREAS OF DISAGREEMENT

Before considering the three scenarios, however, we want to highlight several key issues upon which there is significant disagreement among your advisers:

- How to implement a carbon emissions reduction scheme;
- How much we can reasonably expect from technological advances without a significant price signal;
- How effective joint implementation will prove; and

- How the environmental effects *differ* from policy actions within the range being considered.

We will undoubtedly discuss these critical issues in more detail over the coming weeks; our purpose here is merely to summarize some of the different views to inform your evaluation of the scenarios examined below.

A. Domestic implementation

Under the system to be negotiated in Kyoto, each participating country would be able to choose its own method for ensuring emissions reductions. The potential “domestic implementation” methods differ markedly in terms of their economic efficiency and political feasibility. Market-based structures for domestic enforcement fall into two categories: (1) tradeable permits and (2) a carbon emissions tax. Our focus here is on the first approach.

Tradeable Permits

Under this approach, the Federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. *One key issue with permits is the allocation mechanism.* There are two approaches to allocation: auctioning, or an administrative allocation of permits. Your economic advisers have grave concerns about the cost -- and even the feasibility -- of an administrative allocation system. Others dispute this claim, arguing that administrative allocations mechanisms are both feasible and crucial for garnering corporate support.

1. An auction-based approach

The United States and most other countries have long used auctions to sell government securities, and governments have also used auctions to allocate other resources -- such as oil leases, timber, and portions of the spectrum. The auction mechanism for distributing carbon permits has two main advantages:

- First, it would ensure that permits are placed directly into the hands of those who value them most highly.
- Second, it would raise revenue that could be used to reduce other taxes (e.g., to offset the regressivity of the emissions reduction scheme), raise national saving, or fund adjustment programs. Depending on the stringency of the control regime and other factors, the auction revenue could amount to relatively small amounts of money or as much as \$150 billion per year. If those funds were used to reduce extant distortionary taxes, the so-called double dividend may result: improved environmental protection *and* less distortionary overall taxation.

The main disadvantage to an auction approach is the effect it would have on corporate support and on the likelihood that the program is characterized as a “tax”:

- Auctions would force most businesses to pay large costs simply for the right to maintain their business-as-usual operations. Despite the fact that these firms would likely pass most of the cost through to consumers, a firestorm of opposition will arise from these businesses.
- Corporate opponents would undoubtedly attack the auctions as a tax, even if the revenues were recycled to reduce other taxes. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

2. An administrative allocation approach

Instead of forcing emitters to pay for permits at an auction, the government could allocate them administratively, based on a pre-determined formula. The most likely system would involve granting permits to existing emitters based on historical fuel use or emissions; permits are allocated in this manner in the SO₂ trading program.

This approach has significant political advantages over an auction:

- The prospects for support from key businesses -- such as those you met with last month -- are much higher with an allocation scheme than an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations.

This significant advantage brings with it several disadvantages, however.

- An administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. Such an approach would reward those who were biggest polluters in the past.
- The value of the permits would attract many claimants. Deciding which claimants deserve the permits and avoiding double-counting at different levels of the energy system (miners, refiners, utilities, end-users, etc.) could prove very difficult. Treasury and CEA have grave concerns that the rent-seeking behavior inherent in attempts to capture the permit wealth will make the entire system grossly inefficient. For example, there may be pressure to issue the permits downstream (e.g., to auto manufacturers, washing-machine manufacturers, and air-conditioner manufacturers) even though it would be significantly more efficient to issue them further upstream (e.g., to oil refiners and coal processors).
- Administrative allocation schemes forgo the opportunity to raise revenues -- and thus to use the revenues to cut other taxes.

It may be possible to combine an auction and an administrative allocation approach -- for example, by auctioning some percentage of the permits, and administratively allocating the rest.

B. The role of technology

Your advisers also have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase.

- Some of your advisers believe that the cost estimates presented below are too high because even without an increase in the price of energy, there are numerous opportunities for energy-saving technologies to be developed and applied. For example, one controversial study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010.
- Your economic advisers raise a series of significant methodological objections to the study mentioned above. They also tend to stress the importance of market incentives for technological advances. They argue that technology will clearly be one of the conduits for meeting an emissions reduction target, but that both theoretically and historically, the most rapid technological advances come in response to significant increases in the relative price of energy.

For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Despite ongoing debates over the precise role of technology, therefore, there is broad technical agreement that *a significant price signal is crucial to achieving emissions reductions* of the sort being considered in international fora. In other words, it is impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

C. Joint implementation

Another source of disagreement among your advisers is the role of joint implementation (JI). JI is a mechanism by which a private entity in the United States could invest in greenhouse gas mitigation projects in developing countries without emissions budgets. In exchange, the investor (and the U.S.) would receive credit towards its emission budget. Some of your advisers believe that JI is crucial to reducing the cost of reaching a given target and timetable, and for building corporate support. Others are concerned that the program has been oversold -- and in particular, that it does not guarantee that our overall efforts will succeed in reducing global emissions.

In principle, JI provides a very low cost mechanism for reducing emissions,

by “trading” emissions here for emissions abroad, where the cost of reduction is much lower. In practice, however, JI requires a mechanism for guaranteeing that emission reductions that qualify for credits are “additional” to -- above and beyond -- reductions that would have happened anyway in the baseline case. How can we tell whether the low emissions power generation plant built in a developing country would have been built in the absence of JI incentives? If credit is given for investments that would have happened anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. On the other hand, if the standard of “additionality” is set too high, or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

The JI issue is just one aspect of the role of developing countries in worldwide efforts to reduce greenhouse gas emissions. There is a vast gulf between the dialogue abroad (where previous U.S. proposals on developing country participation are almost uniformly considered too aggressive) and at home (where Senator Byrd’s resolution, calling for even tougher demands on developing countries than previous U.S. proposals, passed the Senate 95-0). *[[Your advisers have decided to adopt a much tougher line on developing countries, even if that necessitates a two-step approach to the international negotiations: reach agreement among the developed countries, but do not submit the agreement for domestic ratification until key developing countries commit to binding targets.]]*

D. Environmental effects

A final source of uncertainty and disagreement is over the size of the environmental effects from different government policies. Our best models suggest that under business-as-usual (BAU), concentration levels of carbon are expected to rise from approximately 360 parts per million by volume (ppmv) today to over 500 ppmv in 2050 and over 700 ppmv by 2100 -- the highest in more than 50 million years. Pre-industrial concentrations were approximately 250 ppmv, and concentrations are expected to reach twice these pre-industrial levels in about 2060. The increase in carbon concentrations is expected to produce an increase in mean global temperature of between 2 and 6.5 degrees Fahrenheit.

The relevant question in evaluating our policy choices, however, is not the baseline. Rather, we must compare the likely environmental costs averted under one set of our actions to the likely costs averted under some other set of actions.

- Some of your advisers believe that although there is substantial uncertainty involved, the best models available suggest that differences in the targets and timetables of the type discussed in this memo have relatively little effect on the ultimate concentration of carbon and therefore on climate change. For example, models predict that the difference between the most aggressive and least aggressive paths discussed below produce differences in temperature increases by 2100 of less than 0.1 degrees Fahrenheit. In other words, they

argue that by changing the shape of the emissions path to a given ultimate concentration, it is possible to achieve the same environmental benefit at a much lower economic cost.

- Others believe that such comparisons are fundamentally misleading because they assume that our actions have little influence on developing country behavior, and do not account for the (admittedly small) probability that the different emissions paths will interact with potential non-linearities in the climate system. They thus argue that the environmental differences among the scenarios (particularly Scenario 1 and Scenario 2) are potentially momentous.

III. THREE SCENARIOS

The climate change issue involves so many different parts (the target and timetable for our emissions, whether to use a tradeable permits system to reach that target, whether to auction the permits, etc.) that it is easy to become enmeshed in the details while losing sight of larger strategic considerations. The purpose of this section is to present scenarios that try to present some of the trade-offs on that higher strategic plane; subsequent memoranda and meetings will allow us to examine many of the component pieces in more detail.

The three scenarios we consider are:

- Scenario 1: Adopt most attractive policies currently acceptable in international sphere, fight for domestic ratification;
- Scenario 2: Devise more economically efficient domestic policy, even if not internationally acceptable; and
- Scenario 3: Trying to bridge the gap

It is crucial to emphasize that the scenarios are meant to be illustrative, to provide a way of thinking about our policy proposals. Similarly, the economic figures presented along with each scenario are highly uncertain. They reflect educated guesses based on economic models. The issues of disagreement discussed above, along with many others, could have a substantial effect on the precise outcomes.

SCENARIO 1

ADOPT POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE

Overall strategy

- Reach the most advantageous but internationally feasible full agreement in Kyoto
- Fight to sell and ratify agreement domestically over the next few years

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits. R&D and Federal energy efficiency programs.
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Energy price effects

The cutbacks in energy use (relative to GDP) required to meet this target are at least comparable to -- and arguably greater -- than those achieved in the decade of the two oil shocks, a period in which aggregate energy prices roughly doubled. Not surprisingly, therefore, the implied increase in energy prices needed to reach 1990 emissions levels by 2010 would entail a significant inflationary shock, with an associated rise in the CPI and decline in real wages.

With Annex I (developed economy) trading

- Permit price. Carbon prices in 2010 up between \$50 and \$90 per ton.
- Gas prices. Gas prices in 2010 would rise by between 10 and 25 cents.
- Coal prices. Coal prices in 2010 would rise by between \$30 and \$70 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax of between \$1.50 and \$3 per million BTUs in 2010. (In 1993, the Administration proposed a

tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)

- Effects on families. Some critics might charge that the average family would either have to reduce consumption or pay as much as \$500 to \$1,000 more in 2010 from the increase in energy prices. The increase in expenditures as a percentage of income for the lowest decile is approximately six times the percentage increase for the highest decile.
- International transfers. There is substantial uncertainty over the size and even the direction of net international transfers. However, under some scenarios, purchases of permits from other countries in 2010 could amount to \$5-\$10 billion.

No Annex I trading

- Permit price. A carbon price increase of between \$80 and \$140 per ton in 2010.
- Gas prices. Prices in 2010 would rise by between 20 and 30 cents per gallon.
- Coal prices. Coal prices in 2010 would rise by between \$50 and \$100 per ton, relative to a current price of \$20 per ton.
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax of between \$2 and \$4 per million BTUs in 2010.
- Effects on families. Some critics might charge that higher expenditures of as much as \$900 to \$1,500 more in 2010 from the increase in energy prices.

International reaction

- Kyoto agreement feasible, albeit not guaranteed.
- Some criticism from Europeans and other countries.

Domestic reaction

- Hill. Kyoto agreement *extremely* unlikely to be ratified (Byrd resolution); attacked as massive energy tax hike. Even without ratification vote, Congressional anger could manifest itself in many ways.
- Corporations. Major concerns over costs imposed on the economy, as well as developing country stance. Firms in energy-intensive industries will argue (regardless of the evidence) that their operations will flee the United States for other countries. Strong support from renewable energy and energy-efficiency firms.
- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path.

- Labor. Strong opposition, driven particularly by coal workers
- Elite media. Likely to support Administration for tackling critical issue
- Outside critics. Many economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target, as will be discussed under Scenario 2.

SCENARIO 2

DEVISE MORE ECONOMICALLY EFFICIENT DOMESTIC POLICY

Overall strategy

- Devise more economically efficient domestic policy with same ultimate carbon concentration as Scenario 1.
- Allow more time for capital stock to turn over naturally, while providing signal for technological development and dissemination.
- Since this scenario will not be remotely acceptable in the international sphere, it is provided more as a benchmark than a true scenario.

Components

Target and timetable	Reduce emissions <i>growth</i> to zero ten years after ratification. Then, determine when emissions would return to 1990 or other base year level.
Domestic implementation	Tradeable permits (auctioned), or equivalent measures (e.g., \$5 per ton initially, rising over time). R&D and Federal energy efficiency programs.
Developing country participation	U.S. would insist on mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes. Extremely difficult to get developing countries to agree on such targets.
International trading	U.S. would seek international trading system among all participating countries. Little prospect for success in near term.

Energy price effects

The overall cost of this approach is approximately 1/10 to 1/3 as expensive as under Scenario 1, even for a given ultimate concentration of carbon.

- Permit price. A carbon price increase of between \$5 and \$10 per ton by 2010, scheduled to increase further over time.
- Gas prices. Gas prices in 2010 would rise by an estimated 2 to 3 cents.
- Coal prices. Coal prices in 2010 would rise by between \$5 and \$7 per ton, relative to the current price of about \$20 per ton.
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax of

about \$0.05 to \$0.30 per million BTUs.

- Effects on families. Some critics might charge that the average family would either have to reduce consumption or pay as much as \$10 to \$100 more in 2010 from the increase in energy prices.

International reaction

- Kyoto agreement impossible.
- The U.S. will be blamed for undermining the current round of international negotiations (Rio II).

Domestic reaction

- Hill. Less chance of intense attack.
- Corporations. Many firms could decide that the gradual approach to emissions reductions is the best they will be able to achieve.
- Environmental groups. Environmental groups sharply criticize.
- Labor. The AFL-CIO does not object
- Elite media. Criticism from many editorial boards. More criticism likely if severe weather events raise prominence of issue.

SCENARIO 3: TRYING TO BRIDGE THE GAP

Overall strategy

The difficulties with Scenarios 1 and 2 are clear: Scenario 1 represents a strong and credible commitment to address the climate change problem, but only at a significant -- and politically infeasible -- cost to the U.S. economy. Scenario 2 substantially mitigates the economic costs, but will be met by immense criticism abroad and among environmental groups at home as insufficiently responsive to the scale of the climate change challenge.

The central question is whether a strategy can be found for bridging the gap between these approaches, providing a credible commitment to taking the environmental problem seriously without imposing untenable costs on the U.S. economy. We suggest three directions for bridging the gap between these two extremes:

- Delaying the 1990 base year;
- Delaying the 2010 year; and
- Softening the 1990 by 2010 commitment by building in an escape clause likely to be triggered

These directions should not be taken as mutually exclusive; they may be used separately or in combination in finding the common ground between the first two scenarios. In each case, we take as our reference point Scenario 1, with a target and timetable of 1990 emissions levels by 2010.

All the alternatives below could be predicated on binding commitments from key developing countries. One possible way to address the developing country issue is a two-step approach: we could try to reach an agreement among the developed economies, but no such international agreement would be submitted for ratification before the key developing economies agreed to their commitments.

Approach A: Moving the Target Base Year (1990)

- The first approach to bridging the gap would maintain the 2010 deadline, but change the base year from 1990 to some later year. Possibilities include the year of ratification or 2000.
- The target year 1990 is a particularly disadvantageous one from the perspective of the United States. Between 1990 and 1995, our emissions grew xxx% while those in ... grew by only yyy%. projections of 2000.... Thus, the choice of 1990 instead of a later year essentially amounts to a large transfer from the U.S. to the rest of the world, a transfer made explicit in the case of Annex I trading. As a result, we could greatly mitigate the costs to the U.S. economy by moving the target from 1990 to a later year.

- Alternatively, the 1990 base year could be maintained, but the target could be set above 1990 levels -- for example, we could commit to reaching 1990 emissions levels plus 15 or 20 percent by 2010. This commitment would be roughly equivalent, in terms of domestic emissions, to a 2000 by 2010 commitment.

Economic Effects

- The advantage of this approach is that it would greatly mitigate the economic effects. With developed country trading, reaching 1990 levels plus 15 to 20 percent by 2010 implies a permit price in 2010 of about \$10, rather than the \$50 price implied by trying to reach 1990 levels by 2010. Without developed country trading, the permit price would be between \$15 and \$25 -- relative to \$80 to \$140 under the 1990 by 2010 commitment.

Environmental and International Political Ramifications

- The disadvantage of this approach is that there is much negotiating history invested in the 1990 target. A move off of that target by the U.S. would be criticized internationally, since there would be relatively little gain for any country other than the U.S., and even some loss in countries such as Germany and Russia. There would probably be less international censure for an increase in the 1990 target, even at the same economic cost to the U.S.
- Either approach would be met with some disappointment from the environmental community -- but we would receive some credit for taking a concrete step over a relatively short horizon.

Approach B: Moving the Timetable (1990 by some year later than 2010)

- Alternatively, 1990 could be maintained as a base year, and the timetable could be lengthened from 2010. Under Scenario 2, it was lengthened indefinitely to approximately 2040. Alternatives could be to lengthen it more modestly, say to 2025.
- Concerns about appearing insufficiently attentive to the problem could be addressed by taking action immediately upon ratification: for example, raising the price on carbon by \$10 or \$15 per ton, either through a tax or a tradeable permit scheme.
- Another twist on this scheme would be that it could combined with the approach above: for example, we could commit to 1990 levels by 2025, and 2000 levels by 2010. Such an approach would also help to address the charge that our proposal was too backloaded.

Economic Effects

- This would once again mitigate the economic costs of the program. But it requires a substantial lengthening of the timetable to induce substantial reductions in costs. For

example, a target and timetable of 1990 by 2020 still forces us to bear 90 percent of the economic costs of a 1990 by 2010 commitment. Because of the slow turnover of the capital stock, economic costs are not dramatically reduced without an even longer lengthening of the timetable.

Environmental and International Political Ramifications

- This approach would also be met by increased dissatisfaction from the environmental community, since we would be seen as pushing our commitment off sufficiently far that we have no intention of meeting it. It is unclear how successful any initial carbon price increase would be in mollifying these concerns.
- The international community would similarly be worried about our long run commitment, and it is once again unclear whether these concerns could be reduced by an initial carbon price in this range. In particular, many of your advisers worry that the delays embodied in this approach would undermine U.S. leadership on a critical issue, and make it even more difficult for us to convince developing countries to participate.

Approach C: Adopt 1990 by 2010, with "escape clause" to minimize domestic costs

- This approach bridges the gap by adopting a 1990 by 2010 target and timetable, but insisting on an "escape clause": the U.S. government would stand ready to sell unlimited permits at \$10 to \$20 per ton.
- The approach allows technology optimists to believe that we will meet the 1990 by 2010 target and timetable, but provides an upper bound on the economic costs imposed (even if that means the target and timetable is not met).
- The economic cost is capped -- if the cap binds, it's functionally equivalent to a tax of that amount per ton. Revenue neutral, but still "tax cut" if funds from selling permits are used to reduce other taxes.

Economic effects

- Some environmentalists and technology optimists believe that it is possible to reduce emissions to 1990 levels by 2010 with a relatively low permit price -- low enough so that the escape clause is irrelevant. But the economic models generally suggest that the escape clause will be triggered -- so that the permit price would be as set in the escape clause (\$10 to \$20), not the higher amount that would be necessary to succeed in fully reducing emissions to their 1990 levels by 2010.
- In essence, this provides a guarantee. If our projections are too pessimistic, and we can achieve the target and timetable with a permit price in the \$10 to \$20 range, then there will be no need to invoke the escape clause. But if the costs turn out to be much higher, they will be capped and the economic exposure of the nation limited.

Environmental and International Political Ramifications

- The escape clause is likely to be criticized by other countries, who may argue that it makes it extremely unlikely that we will meet our ostensible target and timetable. Such criticism could damage our credibility worse than either of the other two approaches, since we will not be viewed as taking the process sufficiently seriously. Nonetheless, even if the escape clause is triggered and we fail to meet the target and timetable, we will still have made an important first step: a \$10 to \$20 charge per ton of carbon.
- Domestic environmental constituencies may exert pressure to retain the target and timetable, but remove the escape clause. If the escape clause is stripped away during the debate, the economic costs skyrocket.
- The approach does, however, have the important advantage of taking seriously the claims of the technology “optimists”: if the promised benefits of technology do emerge, then this may be a credible plan for meeting our goal.

M

DRAFT: CLOSE HOLD/PRELIMINARY AND INCOMPLETE

September 9, 1997

MEMORANDUM FOR:

FROM:

SUBJECT: Climate change scenarios

I. INTRODUCTION

This memorandum is the first of many that we will be submitting to you over the next several weeks on the substance of climate change issues. As you know, the climate change issue is particularly difficult -- both analytically and politically -- because the environmental and economic consequences are potentially momentous and yet highly uncertain. The purpose of this memorandum is to frame the decision-making process by presenting three illustrative scenarios for our strategy at the Kyoto negotiations in December and beyond. Subsequent decision memoranda will discuss various aspects of our negotiating position in more detail.

II. TWO AREAS OF DISAGREEMENT

Before considering the three scenarios, however, we want to highlight two key issues upon which there is significant disagreement among your advisers: how to implement a carbon emissions reduction scheme (for example, whether permits should be auctioned or granted to firms), and how much we can reasonably expect from technological advances without a significant price signal. We will undoubtedly discuss these critical issues in more detail over the coming weeks; our purpose here is merely to summarize some of the different views to inform your evaluation of the scenarios examined below.

Domestic implementation

The immediate focus of the international negotiations to be held in Kyoto is to provide greenhouse gas "emissions budgets" for the U.S. and other developed ("Annex I") countries. Each participating country would be able to choose its own method for ensuring domestic compliance with this emissions budget. The potential "domestic implementation" methods differ markedly in terms of their economic efficiency and political feasibility. Two broad types of structures for domestic enforcement include (1) tradeable permits and (2) a carbon emissions tax.

Tradeable Permits

Under this approach, the federal government would issue a limited supply of permits for emissions, and these permits would be tradeable. The U.S. has substantial experience with tradeable permit schemes, most notably under the SO₂ trading program associated with the Clean Air Act. (While the SO₂ trading program has been extremely successful, its success has been at least partly the result of unrelated policy decisions and good luck -- such as the deregulation of the nation's freight railways, which dramatically reduced the cost of shipping low-sulphur Western coal to Eastern markets. A carbon trading program would also be an order of magnitude larger than the SO₂ trading program. So we should be at least somewhat careful about applying lessons from the SO₂ example to a carbon trading program.)

The key issue with permits is the allocation mechanism. There are two approaches to allocation: auctioning, or an administrative approach. Your economic advisers are strongly in favor of auctioning the permits, while some of your other advisers believe the administrative approach is crucial to ensuring support for the overall effort.

1. An auction-based approach

The United States and most other countries have long used auctions to sell government securities, and governments have recently begun to use auctions to allocate other resources (such as portions of the spectrum in the U.S. and New Zealand). The auction mechanism for distributing carbon permits has two main advantages. First, it would ensure that permits would be placed directly into the hands of those that valued them most highly. Second, an auction would raise a substantial amount of revenue that could be used to reduce other taxes, raise national saving, or fund adjustment programs. The auction revenue could amount to between \$50 billion and \$150 billion per year, depending in part on the stringency of the overall program. The available economic research suggests that the overall economic cost of reducing carbon emissions will be much lower (though still significant) if permits are auctioned and the proceeds are recycled by reducing other distortionary taxes. It is rare that revenue can be raised in a way that improves rather than distorts incentives; it would be unfortunate to miss such an opportunity.

The main disadvantages to an auction approach are political. Auctions would force some businesses to pay significant sums of money to the government for the right to emit carbon -- a marked change from the past, when they had been able to emit free of charge. Despite the fact that these firms would pass the cost through to consumers, a firestorm of opposition and pleas of poverty will arise from these businesses. Corporate opponents would likely start calling the auctions a tax. The success of the auction approach would depend critically on building constituencies for the tax reductions made possible by the auction revenues.

*Some may mention
that follows*

2. An administrative approach

Instead of forcing emitters to pay for permits at an auction, the government could allocate them administratively, based on a pre-determined formula. Annual emission allowances would be distributed at no cost to the recipient firms. There are many possible allocation criteria. One would involve allocating permits to existing emitters based on historical fuel use or emissions. Permits are allocated in this manner in the SO₂ trading program; facilities covered under the program receive permits based on fuel use in the baseline period (1985-87). Other possible methods of allocation would rely not only on past levels of emissions, but also past and projected levels of efficiency.

The advantage of the administrative approach is simply the disadvantage of auctions: it would not force companies to pay explicitly for the right to emit carbon, and so would provide a means of mollifying opposition. But this significant advantage brings with it several disadvantages. First, an administrative system would confer a substantial amount of wealth on those to whom the permits are awarded. This could result in an unappealing distribution of "permit wealth" because it would confer the most wealth on those that had emitted the most carbon during the baseline period. Second, allocation schemes also forgo the opportunity to raise revenues and use the revenues to cut other taxes. Finally, allocative schemes could result in significant inefficiencies. For example, political pressure may dictate that permits be issued downstream (e.g., to auto manufacturers, washing-machine manufacturers, and air-conditioner manufacturers) even though it would be significantly more efficient approach to issue them upstream (e.g., to oil refiners and coal processors).

The role of technology

In addition to different views about whether permits should be auctioned or granted to firms, your advisers also hold different views about the potential for more rapid development and adoption of technological innovations to offset the costs of reducing our reliance on fossil fuels. Indeed, your advisers have sharp disagreements about how much we can reasonably expect of technological advances without the spur of a price increase. Your economic advisers tend to stress the importance of market incentives for technological advances. They argue that (1) energy efficiency has grown rapidly in the past, and our baseline projections should reflect this; (2) consequently, technology will clearly be one of the conduits for meeting an emissions reduction target; but (3) historically, the most rapid technological advances have come in response to significant increases in the relative price of energy. For instance, over the entire postwar period, the fossil-fuel efficiency (BTUs from fossil fuels per dollar of GDP) of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen.

Others believe that even without an increase in the price of energy, there are numerous

opportunities for energy-saving technologies to be developed and applied. For example, a study conducted by five of the Department of Energy's national laboratories concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010. The report, however, simply assumes the existence of government programs that would develop and disseminate pollution-reducing technologies -- without specifying these programs or examining the costs of implementing them. It is thus a concise summary of the potential for increased efficiency without any increase in price, but provides little insight into how costly it would be to actually achieve (e.g., through government programs to spur development and adoption of technological advances) those potential reductions.

The degree of disagreement on this crucial topic, however, can easily be exaggerated. Even the study mentioned above -- which is seen as being extremely optimistic about the role of technology -- concludes that it is not possible to reach a target of 1990 emissions levels by 2010 without a \$50 per ton increase in the price of carbon. Despite ongoing debates over the precise role of technology, therefore, there is broad technical agreement that *a significant price signal is crucial to achieving emissions reductions* of the sort being considered in international fora. In other words, it is impossible to achieve 1990 emissions levels by 2010 without an increase in carbon prices substantial enough for people to notice.

III. THREE SCENARIOS

Keeping these ~~three~~ ^{two} sources of disagreement in mind, we can now examine three scenarios for Kyoto and beyond. The climate change issue involves so many different parts (the target and timetable for our emissions, whether to use a tradeable permits system to reach that target, whether to auction the permits, etc.) that it is easy to become enmeshed in the details while losing sight of larger strategic considerations. The purpose of this section is to present scenarios that try to present some of the trade-offs on that higher strategic plane; subsequent memoranda and meetings will allow us to examine many of the component pieces in more detail.

The three scenarios we consider are:

- Scenario 1: Adopt best policies currently acceptable in international sphere, fight for domestic ratification
- Scenario 2: Devise "ideal" domestic policy, fight for international acceptance
- Scenario 3: Adopt agreement in Kyoto but do not submit immediately for ratification, continue international negotiating process over developing economies

Within each of these scenarios, we specify a target and timetable for emissions reductions, a domestic implementation package, and a position on the degree of developing country participation. (Some of the specific choices for these parameters could be matched with any of the scenarios: we have made specific assignments in an initial attempt to add realism to the scenarios.) We then examine the economic effects, as well as the international and domestic

reaction.

The business-as-usual (BAU) baseline

In order to evaluate the impact of these different scenarios, we need some baseline. Our best models suggest that under business-as-usual (BAU), concentration levels of carbon are expected to rise from approximately 360 parts per million by volume (ppmv) today to over 500 ppmv in 2050 and over 700 ppmv by 2100 -- the highest in more than 50 million years. Pre-industrial concentrations were approximately 250 ppmv, and concentrations are expected to reach twice these pre-industrial levels in about 2060. The increase in carbon concentrations is expected to produce an increase in mean global temperature of between 1 and 3.5 degrees Celsius, with a central estimate of about ~~2.4~~ ^{3.5} degrees.

Uncertainty and environmental effects of carbon emissions reductions

It is essential to recognize that there is substantial uncertainty surrounding estimates of the environmental effects under the business-as-usual baseline, as well as under alternative government policies. For that reason, we focus in this memo on the economic costs -- which are somewhat more precisely measured, although still highly uncertain.

Models of the carbon cycle, however, do permit some analysis of the environmental benefits under alternative scenarios. For example, reaching 1990 emissions levels by 2010 (Scenario 1) would imply a concentration level in 2100 of about 650 ppmv, relative to the approximately 710 ppmv estimated under the business-as-usual baseline. The *central* estimate for the temperature increase would be reduced by about 0.2 degrees by the year 2100 -- for an increase of about 2.2 degrees versus an estimated 2.4 degrees under the BAU.

The environmental effects are similar under the "least cost" path of stabilizing carbon concentrations (Scenario 2). The central estimate of the temperature increases in 2100 under the two scenarios differs by less than 0.05 degrees; in either case, the reduction in temperature from the BAU is about 0.2 degrees. As discussed below, however, the economic costs of these different paths differ substantially.

Once again, the estimate of the environmental effects involve significant uncertainty. But the best models available do suggest that differences in the targets and timetables of the type discussed in this memo have relatively little effect on the ultimate concentration of carbon -- which is the primary determinant of climate change effects -- in the atmosphere.

SCENARIO 1: ADOPT-BEST POLICIES CURRENTLY ACCEPTABLE IN INTERNATIONAL SPHERE, FIGHT FOR DOMESTIC RATIFICATION

Overall strategy: Reach the most advantageous but internationally feasible full agreement in Kyoto, then fight to sell and ratify it domestically over the next few years. To obtain an agreement in December, it is likely that we will need to agree to a relatively soft developing economy stance (given the Berlin mandate) and a relatively aggressive target and timetable (e.g., 1990 by 2010). This approach will demonstrate strong Presidential leadership, but is likely to encounter severe domestic opposition (e.g., as already manifest in Byrd resolution). If the agreement is not ratified by the Senate, efforts to combat climate change may be seriously undermined for an extended period of time.

Components

Target and timetable	1990 emissions levels by 2010
Domestic implementation	Tradeable permits, either auctioned or granted to firms (based on historical or projected emissions) <i>Research & Devt.</i>
Developing country participation	Agreement in principle on joint implementation. Unlikely to get international agreement -- even in principle -- on Annex B (voluntary limits for developing economies) or evolution (a mandatory graduation system for adopting quantified targets).
International trading	Agreement in principle on a trading regime within Annex I (developed economies).

Economic effects

No Annex I trading

macro consequences
The economic effects of reaching 1990 levels by 2010 depend critically on the trading regime. A formal agreement on a trading system among even the developed economies is extremely unlikely in Kyoto; an agreement in principle may be feasible. Since the agreement in principle may not become reality -- and since there are a number of difficult issues to resolve in setting up an international trading regime -- it is important to consider the effects with and without trading. The first set of estimates assumes no international trading:

- Permit price. A carbon price increase of between \$70 and \$200 per ton. *16/50 x 546 546%*
- Gas prices. Gas prices would rise by between 18 and 50 cents per gallon. *Increase in coal price*
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax *is more than triple.*

of between \$2 and \$6 per million BTUs. (In 1993, the Administration proposed a tax of \$0.26 per million BTUs plus a \$0.34 per million BTUs tax on oil.)

- *electricity*
Effects on families.

With Annex I (developed economy) trading

- Permit price. Carbon prices are expected to increase between \$40 and \$100 per ton.
- Gas prices. Gas prices would rise by between 10 and 25 cents.
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax of between \$1.50 and \$3 per million BTUs.
- Effects on families. ~~Annex I trading~~ ① magnitude of international transfers.

Reactions

Carbon leakage problem. International reaction

- Kyoto agreement is feasible, albeit not guaranteed. The U.S. position on developing economies is already seen as beyond the acceptable range by other countries. Any strengthening of the U.S. position -- such as a firm evolution system for developing economies -- would significantly reduce the chances of obtaining an agreement, and some weakening may be necessary to achieve international consensus. In any case, timing constraints make it extremely likely that we will only obtain agreements in principle on the developing economy issue.
- Some criticism from Europeans and other countries may occur, for failing to propose a more aggressive target than 1990 levels by 2010.

Domestic reaction

- Hill. Ratification process not likely until 1998 or 1999. But Kyoto agreement *extremely* unlikely to be ratified. Given the clear instructions in the Byrd mandate, Congress is likely to be particularly irritated by the agreement reached. Even without ratification vote, funding for U.S. negotiators could be curtailed or Congressional anger could manifest itself in other ways. Some on the Hill will undoubtedly charge that the agreement represents the largest energy tax increase in history -- about 10 times the BTU tax proposed in 1993.
- Corporations. Major concerns over costs imposed on the economy, as well as developing economy stance. Firms in the aluminum, steel, chemicals, petroleum refining, paper and

allied products, and cement industries will be particularly opposed, and argue that their operations will flee the United States for other countries. Allocation mechanism (granting permits based on emissions) may attenuate opposition to some degree. Strong support is likely from renewable energy and energy-efficiency firms.

- Environmental groups. Many environmental groups will support a 1990 by 2010 target, but would prefer a more aggressive path (the environmental community has explicitly asked for 1990 by 2005). The environmental community is split on the issues of emissions trading and joint implementation: some (e.g., Environmental Defense Fund) are supportive, others (e.g., Sierra Club) oppose.
- Labor. Significant concerns over costs imposed on relatively unionized industries such as steel and cement. Also, strong opposition from union workers in the coal industry and perhaps in the oil industry. Rich Trumka, Secretary-Treasurer of the AFL-CIO, has written to Dan Tarullo that to have the support of the AFL-CIO, "every nation has to be in the regime, abiding by mutually agreed upon reduction regimes," and that transition assistance must be provided.
- Elite media. Likely to support Administration for tackling critical issue.
- Think tanks and specialists. Economists who have studied climate change are likely to be extremely critical of the 1990 by 2010 target. Given a goal of stabilizing carbon concentrations at a given level (e.g., twice pre-industrial levels, or approximately 550 ppmv), the economically least-cost path to that ultimate concentration level is to allow emissions to grow until about 2015 or so, and then not reducing to 1990 levels until approximately 2040. Prominent economists will likely point out that relative to this least-cost path, a 1990 by 2010 path is about three times as costly -- even for the same ultimate carbon concentration level. Environmental think tanks are likely to be supportive of the relatively aggressive target.

SCENARIO 2: DEVISE "IDEAL" DOMESTIC POLICY, FIGHT FOR INTERNATIONAL ACCEPTANCE

Goal: Devise the ideal domestic policy, and then fight for international agreement. This strategy is virtually certain to preclude an agreement in December -- since our developing economy stance would be significantly tougher than others currently find acceptable, and our target and timetable could be significantly less aggressive than other international proposals. The U.S. is likely to be blamed for the failure. But these proposals would focus on *concentrations* -- which are what matters for environmental purposes -- rather than emissions. They may therefore generate support from some in the technical and environmental communities, and eventually from the international community. In the meanwhile, we would try to build strong domestic support for the most "sensible" approach -- which would reduce economic costs by allowing more natural turnover of the capital stock and including binding targets on developing countries, which would also boost the environmental benefits.

There are two senses in which the domestic policy could be "optimal":

- The one that maximizes domestic political support for acting.
- The one that minimizes the costs of achieving a given environmental target.

Along some dimensions -- such as the importance of developing economy participation -- these two definitions are likely to coincide. But along others -- such as whether permits are auctioned or not -- the definitions may not be precisely the same. This scenario therefore considers both. The first perspective (maximizing domestic support) is labelled Scenario 2(A) and the second (minimizing costs) Scenario 2(B).

Components

Target and timetable	~~2(A)~~ : 2(A) and 2(B) ~~2(B)~~ : Stabilize concentrations at twice pre-industrial levels (550 ppmv). U.S. emissions peak sometime between 2010 and 2020, and do not return to 1990 levels until about 2040. <i>Research & development,</i>
Domestic implementation	2(A): Tradeable permits, granted to firms , 2(B): Tradeable permits (auctioned), or small tax (e.g., \$5 per ton initially, rising over time)
Developing country participation	2(A) and 2(B): Mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes

International trading	2(A) and 2(B): International trading system among all participating countries
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Economic effects

- Permit price. A carbon price increase of between \$2 and \$12 per ton. *and to rise quickly*
- Gas prices. Gas prices would rise by an estimated 1 to 3 cents.
- BTU-equivalent. In terms of coal prices, the energy price increase is equivalent to a tax of about \$0.05 to \$0.30 per million BTUs.
- Effects on families. The average family would spend [about \$50] more per year from increased energy costs.

Reactions

International reaction

- Kyoto agreement is impossible, given that U.S. developing country stance would be tightened substantially (and our current stance is already unacceptable internationally), and our target and timetable would be significantly less aggressive than European proposals.
- The U.S. is very likely to be blamed for undermining the current round of international negotiations (Rio II). But over time, we could try to build international support for our approach. Then any agreement that is ultimately reached internationally would have a decent shot at being ratified domestically.

Domestic reaction

- Hill. Failure of immediate agreement may make domestic implementation package less of a political issue. Potentially some criticism for undermining current round of negotiations. The mandatory inclusion of China and a few other developing economies may split the Byrd bloc into those who are truly opposed to acting, and those who are truly concerned about the important developing economies.
- Corporations. Corporations may oppose Scenario 2(A) less than any of the other options, since it grants permits rather than auctions them and it involves a tough developing economy stance. They will also generally favor the target and timetable in this scenario. Indeed, many firms could decide that the focus on concentrations and the gradual approach to emissions reductions is the best they will be able to achieve. But some may

*When all the permits
But firms line up
There must be enough permits,*

still oppose the overall effort (i.e., they may argue that the target and timetable here is worse than no restrictions). Most corporations -- particularly in industries with large current emissions -- are likely to oppose strongly the auctioning or tax provisions included in 2(B).

- Environmental groups.

[OPTION 1: Environmental groups are likely to blame the President and Vice President for failing to get an agreement in December, and for failing to take an aggressive stance on stemming climate change.]

[OPTION 2: Environmental groups support the focus on stabilizing concentrations, rather than emissions. They criticize the Administration for not adopting a more aggressive path toward that stabilized concentration level, but are generally supportive of the effort.]

- Labor. Labor unions are likely to support Scenario 2(B) if the revenues are recycled to reduce regressive taxes. They are likely to attack the "give-away" to firms in Scenario 2(A). Rich Trumka, Secretary-Treasurer of the AFL-CIO, has written to Dan Tarullo that, "If it takes another round of conversation and negotiations to find the right solution mix with our global partners -- the right balance, the right equitable mix -- then take the time to find the best solution."
- Elite media. Likely to criticize Administration for failing to tackle critical policy challenge -- especially if severe weather events raise prominence of issue.
- Think tanks and specialists. Economists likely to be supportive of Scenario 2(B), although some dissidents will remain. They will remain fairly critical of 2(A).

SCENARIO 3: Adopt agreement in Kyoto but do not submit immediately for ratification, continue international negotiating process over developing economies

Goal: This approach recognizes the magnitude of the decisions involved in climate change policies, and that a problem as complicated and critical as this one requires a series of steps over an extended period. This scenario therefore tries to maintain a balance between maintaining momentum in the international negotiations and ensuring that crucial concerns over the participation of developing economies are addressed. It would aim to achieve in Kyoto an interim agreement covering the developed economies, and an agreement on the next stage of negotiations -- which would involve mandatory, binding commitments for some developing economies. Ratification of the Kyoto agreement could be delayed until the developing economy negotiations are completed. One danger with this approach is that the partial Kyoto agreement may be severely attacked before the second stage is completed, thereby undermining our chances for obtaining a good agreement over the long run.

The principal difference between this scenario and Scenario 1 is that here we do not submit the agreement for ratification until we achieve a more substantial commitment from key developing economies. On the other hand, the target and timetable is virtually the same. The principal difference relative to Scenario 2 is that the time horizon for achieving an international agreement here is the next few years, whereas under Scenario 2 it may have to be longer to sway international opinion sufficiently. Another critical difference is that the economic costs are essentially the same as under Scenario 1: the target and timetable is substantially more costly than the least-cost path of achieving emissions reductions.

Components

Target and timetable	1990 levels by 2010 to 2020
Domestic implementation	Tradeable permits, either auctioned or granted to firms
Developing country participation	Do not submit for ratification until mandatory, binding targets for developing economies with relatively large total emissions or relatively high per capita incomes
International trading	International trading system among all participating countries

Economic effects

- Permit price.
- Gas prices.
- BTU-equivalent.

- Effects on families.

Reactions

– *International reaction*

- The U.S. is likely to be criticized by other countries for insisting on a stronger developing economy package before ratifying the putative Kyoto agreement (this conditional agreement at Kyoto could be seen as incongruous with the Berlin mandate, which precludes an expansion of existing developing economy commitments). The U.S. target and timetable is also likely to be criticized.
- It is likely to prove quite difficult to get the crucial developing economies -- China, India, Mexico, Korea, etc. -- to agree to binding quantified targets. Concessions in other areas of our relationships with the developing economies may be necessary.

Domestic reaction

- Hill. The Hill may attack the Administration's acceptance of a binding target before locking in commitments from the developing economies. The period in between Kyoto and the second round of negotiations -- when developing economy commitments would be clarified -- may be particularly difficult, with accusations that the Administration agreed to impose substantial costs on the economy (as under Scenario 1) without securing the developing economy participation so crucial to the global environmental benefits. Even without a vote on ratification, the Hill's frustrations may manifest themselves in other ways -- such as in appropriations bills or in confirmation hearings. And some Senators and Representatives may feel obliged to lock into "no" votes during the 1998 or 2000 elections, thus undermining future opportunities for ratification.
- Corporations. Most corporations are likely to support the insistence on developing economy participation, but will nonetheless strongly attack the target and timetable as being overly aggressive. Indeed, the attack is likely to be nearly as strong as under Scenario. And we may be most vulnerable in between the stages of this strategy.
- Environmental groups. Environmental groups are likely to blame the President and Vice President for failing to submit a full agreement for ratification. It may falsely appear that we are playing games with the process.
- Labor. Labor is unlikely to oppose taking more time to reach an agreement. As noted above, Rich Trumka has indicated that it's worth waiting if necessary. But labor may still oppose the ultimate agreement, even if it includes a set of credible developing economy commitments, because of concerns over employment in specific heavily-affected industries (coal, steel, aluminum, etc.).

- Elite media. The elite media reaction is likely to be mixed. There may be some support for insisting on developing economy participation, but the potentially long delay in submitting the agreement for ratification may be criticized as reflecting a lack of political courage.
- Think tanks and specialists. Economists are likely to sharply critical of the 1990 by 2020 target. **[FILL IN COSTS RELATIVE TO OPTIMAL]**