National Climate Policy: Choosing the Right Architecture

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A. The Approaching Tipping Point in National Climate Policy

The United States is approaching a tipping point in climate policy. After decades of relative inaction, the federal government is very likely to adopt a national policy within the next few years requiring reductions in greenhouse gas emissions. This presents enormous opportunities and risks.

Policy tipping points, marked by rather abrupt policy changes or reversals following long periods of inaction, are actually quite common in many areas of government action, not just in environmental regulation. Policy rarely changes steadily and incrementally; it proceeds by fits and starts. Dramatic change occurs when an issue can find space on the political agenda, gathering wide enough public support, media attention and political entrepreneurs to cast the issue in a new light and overcome opposing interest groups.

All the indicators suggest that such a process is well underway on the climate issue. Some of the more important signs are that

- The climate issue is rising on the scale of public concerns and a large and growing majority of voters believe that government action is required now.

- Many more people now perceive actual evidence of climate change happening now, in such phenomena as Hurricane Katrina, widespread melting in Alaska, and more intense tornados, storms, flooding and wildfires.
- The number of media reports on the climate issue is growing at an increasing rate, and now these reports rarely question whether man-made climate change is occurring. Rather, they focus on the impacts of climate change and how it can be controlled.
- Influential religious communities are now framing climate stabilization as a sacred obligation of stewardship.
- State governments, notably California and the Western states that have aligned themselves with it, as well as the Northeast coalition of state governments, are adopting ambitious climate control policies. This has raised concerns among large corporations about a patchwork of state regulations.
- City governments across the country are adopting climate policies of their own.
- The courts have rejected the Administration's argument that they lack legislative authority or obligation to regulate carbon dioxide emissions.

- More and more large corporations are publicly stating not only their internal actions to reduce greenhouse gas emissions but also their support for mandatory federal limits on emissions.
- The federal government is under increasing pressure to take action from allied countries that have adopted such mandatory limits.

When policy tipping points are reached, even after long periods of stalemate, dramatic changes can occur in a surprisingly short time. Expectations are important in producing rapid change. When players on the policy stage perceive that change is likely, a bandwagon effect often occurs and players fall in line, according to the saying, "When the train is leaving the station, it's time to get on board."

Many large companies and industry associations with significant interests in climate policy are now obviously pursuing this strategy, declaring support for federal emission limits in hopes of winning a role in shaping the details of policy[1]. Some of these companies and industry associations in the electric power, energy, and transportation sectors have recently reversed long-standing and vigorous opposition to just such policies. Similarly, when politicians come to believe that policy change is

[1] Another relevant saying goes "If you're not at the table, you're on the menu."

inevitable, they often drop their opposition in favor of negotiations to craft the best policy they can for the interests they represent. This process is now well underway in Washington, DC.

B. The Costs of Choosing an Inferior Policy Approach

For those of us who believe that national policies to reduce greenhouse gas emissions are long overdue, this is cause for celebration. However, it is also cause for concern. There is a significant danger that policies adopted precipitously or through political negotiations without sufficient analysis and reflection will be inferior. They may lead to unintended consequences, undermining the policy objectives. They may give rise to substantial costs in excess of those required by a more cost-effective approach. They may do both.

The policy regime adopted by the European Union illustrates the point. The limited coverage of the European Emissions Trading System left out many emissions sources that might be controlled at relatively low cost. The absence of provisions to allow banking of permits created price volatility in the carbon market. The over-allocation of permits in Phase I undermined incentives for firms under the carbon cap to reduce emissions. The grandfathering of permits to such firms provided a windfall on their

balance sheets while doing nothing to offset or cushion price increases to consumers.

It is extremely important that federal policies adopted in the United States be both effective in reducing emissions and cost-effective in keeping the resulting economic impacts to a minimum. Not all the proposals currently advanced on Capital Hill meet those criteria, by any means.

Policies to control emissions will require significant adjustments over time in our energy systems, with economic impacts on all households, industries, and regions to greater or lesser degree. Virtually all macroeconomic models that have been used to study the issue find that such impacts need not be large, if a cost-effective policy approach is adopted. Under such an approach, economic analyses find that the impact would represent a slight reduction in the rate of economic growth, which could be more than offset by the reduction in environmental damages. Detailed "bottom-up" studies of key sectors are even more optimistic, finding significant opportunities to reduce emissions while actually saving money.

However, these models also find that the difference in economic costs between a cost-effective policy and an inferior approach could be large, easily one percent of gross domestic product per year. One percent of GDP is about $150 billion, a high price to pay for misguided policy choices.

What is more worrisome is that policies to control greenhouse gas emissions must be kept in place at least for decades and perhaps for a century. Over a decade, the excess cost of an inferior policy choice could be $1.75 trillion or more, given the annual growth in the economy. This would be enough to resolve the social security shortfall, fund expanded health care coverage, eliminate the budget deficit, or fulfill many other worthy public goals.

It is inconceivable that a spending or tax proposal implying costs of $1.75 trillion over a decade could pass the Congress and be signed into law without extensive scrutiny, analysis and debate. However, it is quite conceivable that political horse-trading in some Congressional committee room by legislators or even by their staff could result in decisions based largely on political expediency that could entail excess costs of that magnitude.

C. The Risks of Policy Lock-In

It is crucial that such mistakes be avoided. If mistakes are made, it is highly unlikely that they will be corrected by switching later on to a better policy architecture. The excess costs, then, will go on indefinitely, piling up

huge economic bills decade after decade. Policies tended to get “locked-in”, as leading political scientists have noted. Policy choices are path-dependent: choices made at the outset constrain the options available later on and raise the costs of switching to a different policy regime.

Policy lock-in occurs for several reasons.

- When a policy is adopted, specific institutional and administrative investments are made to support it, both in government and the private sector. Such investments and start-up costs are written off very reluctantly.
- When a new policy is adopted, considerable policy learning takes place, as those involved learn to operate within that framework. That learning gives a familiar regime both cost and psychological advantages over a new and unfamiliar approach.
- Most importantly, policies engender interests that benefit from the specific rules adopted. These may include government bureaucracies, politicians able to allocate benefits and costs, firms that have made investment commitments with profits contingent on the policy continuing, as well as community and other interest advocacy groups that benefit from the policy. All these interests can be expected to lobby against policy change.

It is not difficult to find evidence of policy lock-in at work even within the nascent area of climate policy. For example, there is a strong tendency to look to the cap-and-trade regimes adopted under the Clean Air Act for sulfur and nitrogen oxide control for a policy model to adopt for carbon dioxide control, even though the carbon dioxide problem differs in several important respects and most economists who have studied the issue have concluded that a different approach would be better.

An even stronger illustration is emerging around the Clean Development Mechanism, which was instituted in the Kyoto Protocol as an interim measure to involve the developing countries in carbon abatement activities before they agreed to adopt national mitigation obligations. To deal with its institutional complexities, bureaucracies have developed in the United Nations Secretariat and in the national governments of non-Annex I countries. Procedures and methodologies have been painstakingly devised and promulgated by a growing body of consultants and trainers. New firms have emerged to make profitable investments generating emission reduction credits. Eleven billion dollars have already been committed and private equity funds and others have raised billions more to devote to this market. CDM transactions have provided a new source of tax revenue for some developing country governments. All these responses to the Clean

Development Mechanism tend to entrench it as a policy approach, even though there is general recognition that it is not sufficiently scalable to deal with the emissions abatement that must eventually take place in the developing world.

Because the excess costs of inferior policy choices are so high, because those costs will continue and grow over such a long period of time, and because it will be so difficult to change to a superior approach if an inferior policy is first adopted, it is of critical importance to get it right the first time – to adopt a policy architecture that is both effective and cost-effective, even if political expediency leads in another direction.

D. A Superior Architecture for National Climate Policy

Nation-wide mandatory reductions in greenhouse gas emissions should be brought about through an "upstream" cap-and-trade system that limits sales of fossil fuels in the United States, whether from domestic production or imports. Permits would be required of first sellers of such fuels and would be enforced at the refinery gate in the case of petroleum, the first distribution point in the case of natural gas, at the mine shipping terminus in the case of coal and at the port in the case of imports. Permits would be calibrated to the carbon content of each fossil fuel type and

tradable among first sellers. Reductions would be imposed through gradual reductions in the permits available.

1. An upstream cap-and-trade system is more effective

Such a system will be effective in limiting carbon dioxide emissions, since virtually all such emissions arise from the combustion of carbon fuels. By limiting the availability of fossil fuels at their source, all fuel uses will be covered, whether for electric power generation, industry, transportation, household or commercial energy. Because coverage of carbon fuels will be comprehensive and imposed at source, limitations will be more effective and assured than under alternative approaches.[2]

Unlike a cap-and-trade system imposed "midstream" on large power stations and industrial establishments, which would cover less than half of all carbon dioxide emissions and thus provide less assurance that an overall mitigation target could be achieved, a more comprehensive upstream system will produce a high degree of certainty. For example, the possibility of leakage from emissions sources that are limited to those that are unlimited (for example, from electricity generated by central power station to electricity self-generated by industry or commercial establishments) is eliminated.

[2] Inclusion of other greenhouse gases and carbon emissions from vegetative changes is discussed below.

It is true that petroleum that is diverted from the U. S. market will be sold in other countries. This is less so for coal and natural gas, since transportation costs or constraints limits international trade in those fuels. Nonetheless, to be effective internationally, an upstream cap-and-trade system in this country would have to be accompanied by carbon constraints in other countries. For other Annex I countries, which comprise the majority of world emissions and a large majority of our counter-parties in international trade and investment, those constraints are already in place. They are very likely to be intensified after 2012 if the United States adopts national constraints as well. So, the effectiveness of this, or any other, U.S. policy will depend on the success of negotiations with India, China, and other large developing country emitters to adopt effective national policies as well. Those negotiations are far more likely to succeed if the United States is seen to be ready to adopt effective measures domestically.

2. An upstream system is more cost-effective

The comprehensive coverage of an upstream cap-and-trade regime imposed on first sellers of fossil fuels ensures that it will not only be effective but also cost-effective. To maximize the value of their permits, first sellers will give priority to lower cost sources of the fossil fuels they are permitted to sell and trading will equalize the carbon price across all fossil

fuels. More importantly, the limitation of supply will drive up fossil fuel prices, providing incentives to all users to reduce fossil fuel usage through greater efficiency or reduction in low-priority uses. Users who can do so at relatively low cost will reduce purchases more; those who cannot will reduce purchases less, so the more essential uses will be preserved and the less essential will be eliminated. This process of "economizing" on fuel use will take place throughout the economy, ensuring that all "low-hanging fruit" will be harvested. By contrast, a cap-and-trade system imposed midstream enforces substantial cuts on covered sources but provides no such incentives to the majority of fuel uses and users, ensuring a pattern of abatement that is much less cost-effective.

For any overall mitigation target, an upstream system that induces some reduction in carbon fuel use broadly throughout all sectors of the economy will impose less economic impact than one that concentrates reductions on only some sectors, leaving others relatively unaffected. With a broader base of coverage, the resulting energy price increases needed to achieve the overall reduction will be lower, and the lower price increases will mean less disruption and economic burden.

Because the upstream system is rooted in mandatory limitations on the first sales of fossil fuels, concerns about the responsiveness of consumers

and other energy users to price signals are irrelevant. Though the cuts will drive up energy prices and the prices of energy-intensive goods and services, the price responsiveness or “elasticity” of purchasers will determine only how far prices will rise, not how extensive the reductions will be. Reductions will be pre-determined by the availability of permits. The differential responsiveness of various energy users will only help in discriminating between more and less essential uses.

3. The upstream system encourages continual innovation

Higher prices for fossil fuels will provide a clear economic incentive for development and deployment of alternative energy technologies. Moreover, continuing reductions in the availability of fossil fuels as permit levels are reduced ensures a growing market space for renewables and a robust expectation that that market will expand. Investment will flow into alternative energy and costs will decline with increasing scale, research and development, and learning-by-doing.

Similarly, rising energy prices will stimulate energy efficiency technologies and investments throughout the economy, especially in such key sectors as transportation and buildings. In contrast to a tightening of CAFE standards, which perversely encourages car owners to drive their inefficient old cars longer to avoid the higher price of a more efficient new

car, an upstream cap-and-trade system that raises fuel prices will encourage car owners to scrap their inefficient old cars sooner and buy new ones. This approach will be much better for hard-pressed auto makers in Detroit.

Similarly, energy efficiency innovations will be encouraged in industrial process equipment, motors, industrial controls, heating and cooling equipment, building envelopes, lighting, and a host of other energy-using technologies. Investments in “cleantech”, which is already a booming segment of the venture capital market, will attract even more attention as fears of a cleantech “bubble” are replaced by expectations of long-lasting improvements in investment returns.

4. An upstream system is easy to monitor and enforce.

Even though an upstream system will be comprehensive in covering all energy uses in the world’s largest economy, it is comparatively simple to monitor and enforce. According to a study by Resources for the Future, there will be only about 2000 permit holders whose sales of fossil fuels will be monitored through a paper trail. The Congressional Budget Office, in comparing different policy architectures, agreed that this would be the easiest one to administer. Administrative costs in running an upstream cap-and-trade regime will be low, both for the government and the private sector, in part because fossil fuel sales are already reported and monitored for

various other purposes. Sales of domestically produced and imported fuels will be matched annually against permits held by the seller.

5. An upstream system can be equitable.

National climate policies will have significant and long-lasting economic implications, so widespread concerns about fairness are understandable. By keeping economic impacts low and spreading them broadly throughout the economy by price increases in all fossil fuels, an upstream policy is fairer than one that concentrates reductions and impacts on a smaller segment of the economy. Every household will bear part of the burden in proportion to its direct and indirect use of fossil fuels. Those who use a lot of energy, one way or another, will bear a larger share of the burden. Though energy represents a slightly higher percentage of monthly expenditures for lower-income households than for upper-income households, these regressive effects can easily be offset.

Equity can be improved by auctioning off a large percentage of the permits. If permits were all distributed free to sellers of fossil fuels, a process known as “grandfathering”, they would receive from government a very valuable, salable asset. Annual carbon emissions in the United States are more than 5 billion tons. If the initial carbon permit price established through trading were $20 per ton, then oil, gas, and coal companies would

receive a windfall on their balance sheets of $100 billion. This asset gain would be reflected in their stock prices, as experience in the European Emission Trading System has shown. The beneficiaries would ultimately be their shareholders, a relatively wealthy group, while the costs would be borne by energy users.

If a substantial fraction of the permits are auctioned off, some of the resulting revenues can be used to cushion impacts on relatively vulnerable households, through any one of several fiscal measures. The earned income tax credit could be expanded, the personal and child exemptions could be raised, or the income tax rates at the low end could be reduced.

Another significant portion of revenues derived from a permit auction can be used to reduce other marginal tax rates or to forestall tax increases. Recycling auction revenues in this way will also reduce the burden on households or businesses, depending on which taxes are lowered. In addition, it will significantly limit the overall economic impact of the regime by stimulating household consumption and labor supply and business investment, depending on the specific tax offsets chosen. Many economic studies have concluded that recycling auction revenues through offsetting tax cuts markedly increases the cost-effectiveness of a cap-and-trade program.

Though permits to emit sulfur and nitrogen oxides were grandfathered to electricity generators in cap-and-trade programs under the Clean Air Act, a cap-and-trade program for carbon dioxide would have substantially different implications. First of all, carbon dioxide emissions are far greater and the total value of carbon permits would also be much greater, so grandfathering would represent a larger windfall for carbon permit holders. Also, since the sulfur and nitrogen cap-and-trade programs required much larger percentage cuts in emissions than the carbon program would require in its early decades, there were fewer sulfur and nitrogen permits left on the companies' books than carbon permit holders would have.

It would only be necessary to grandfather a small fraction of permits to oil, gas, and coal companies to compensate them fully for their losses in sales. The reason is that an upstream cap-and-trade company would be equivalent to a government-enforced cartel for those industries. OPEC is a cartel. Its members agree to limit production and sales of petroleum in order to maintain higher prices. Its weakness is that members cheat by surreptitiously selling more petroleum than their agreed quotas, and there is nothing that other members can do about it except sell even more oil themselves to drive down the price.

An upstream cap-and trade regime would also limit sales and drive up prices in the United States market. The difference is that the government would enforce the quotas and prevent cheating. The cartel would be more effective. The higher prices would largely or entirely compensate the sellers for the loss in sales, so little further compensation would be required in the form of free permits.

Another fraction of the permits could be awarded free to compensate or reward those companies that are able to demonstrate effective early action in reducing greenhouse gas emissions. These will mostly be “midstream” energy-intensive industrial companies. In order to differentiate between these early action reductions and reductions that would have taken place to reduce costs in the normal course of business, only absolute reductions in carbon emissions below a baseline year such as 2000 should be eligible for such rewards.

In such a way, an upstream cap-and-trade regime can be made equitable to energy companies, energy-using companies, households in general, and low-income households in particular.

6. An upstream cap-and-trade approach is politically viable.

An upstream cap-and-trade program is simple to explain to the electorate, because it deals directly with the problem at its source: fossil

fuels are the source of carbon emissions, and to reduce those emissions fossil fuel use must be reduced. The policy does that.

Its broader effects, however, work through a chain of cost and price adjustments by downstream industries. Unlike a carbon tax, which would be economically efficient but is politically impossible, the cap's effects on prices of various commodities and services will be brought about through market processes, not a government edict. In that respect, an upstream cap-and-trade system will have political implications more like those of environmental regulations, which also generally result in higher costs and prices, but which are strongly supported politically, in part because the price effects are not readily perceptible. To put in another way, by moving the environmental restrictions far upstream, the government largely removes its fingerprints from the resulting downstream price effects. In this way, an upstream cap-and-trade system differs dramatically from a carbon tax in the political sphere, though its economic effects and workings are similar.

At the same time, as the preceding section illustrates, the government can use permit allocations to compensate groups that are particularly vulnerable or industries that are potentially powerful in opposition to the policy, such as the energy industries.

E. Design Features of an Upstream Cap-and-Trade Regime

1. Exemptions for exports and non-fuel uses

In the United States, a small fraction of energy products are exported or used as feedstocks in the chemical industry. These sales will be tracked and credited against the sellers' permit accounts. A mechanism will be needed to ensure that sales to industrial companies outside the permit system are not used as a conduit to resell products for fuels, circumventing the permit system.

2. Duration and banking of permits

Permits should be valid for a five-year period. Permits should be bankable across five year periods, allowing unused permits to be used in subsequent periods. A five year period of validity balances the need for sufficient stability to allow energy companies to plan ahead, and sufficient flexibility to allow the government to reduce permit availability as required to follow a stabilization trajectory, respond to new information, and engage in international negotiations.

Permits should be fully bankable in order to allow energy markets to respond to economic fluctuations and to allow energy companies to plan their operations efficiently. Banking will also increase liquidity in the permit

market, reduce price volatility, and attract capital from investors wishing to use the permit market for hedging or speculation.

3. Extension of the regime to other greenhouse gases, carbon capture and sequestration

Other powerful greenhouse gases, such as methane, nitrous oxide and the halofleurocarbon gases should be brought into the regimen because they are a significant, growing component of U.S. emissions and some emissions can be controlled very cost-effectively. Establishing caps for these gases is difficult because there are many small dispersed sources. Therefore, incentives to control them should be created through an offset mechanism. Documented reductions in emissions of these greenhouse gases will be rewarded with tradable permits based on the equivalent carbon dioxide warming potential. This is essentially the same approach that would be used if the carbon cap-and-trade system were established mid-stream, or if a carbon tax were adopted.

It is also important to provide incentives for carbon capture and storage and other forms of carbon sequestration, especially since coal is likely to remain an important fuel for electricity generation for decades. An offset mechanism is again the appropriate way to provide incentives. Documented sequestration of carbon, either through carbon capture and

storage or through changes in land use, will be rewarded with tradable permits denominated in tons of carbon. Selling these permits would provide the economic reward for sequestration activities. However, the same issues of permanence of sequestration and monitoring would arise, as in other policy approaches.

4. Linkage to other Systems

A national system should supersede other domestic cap-and-trade systems established on the state or regional level, in order to avoid duplication and conflicting requirements, targets and timetables. It will not be appropriate to have a national upstream cap-and-trade system operating in tandem with a regional cap-and-trade system covering just power plants and large industrial establishments. A national system will confront national companies with fewer compliance burdens and will obviate problems of inter-regional leakage that geographically limited systems would have to face. A national upstream cap-and-trade system will also obviate the need for sector-specific regulations, such as CAFE standards, because higher fuel prices will provide more comprehensive and flexible incentives for drivers and auto makers to reduce automotive emissions. The system will also provide strong incentives for energy efficiency improvements, though complementary policies to reduce market frictions, such a government

procurement policies and minimum efficiency standards, might still have a role.

Nonetheless, a national upstream cap-and-trade system will link easily with international programs established under the Kyoto Protocol or through other agreements. Since permits will be denominated in tons of carbon equivalent, they will be fully tradable internationally. Permit holders in the United States would be able to augment their domestic holdings with permits purchased abroad or sell permits into international markets. Similarly, since the U.S. regime will include offset mechanisms, permit holders would be able to participate in international offset markets, purchasing certified emissions reductions generated through the Clean Development Mechanism. This will greatly increase the overall cost-effectiveness of the regime by allowing the United States to stimulate and take advantage of low-cost abatement opportunities in non-Annex I countries.

5. Targets and timetables

The timing and trajectory of emissions reduction should be calibrated toward a long-term stabilization goal that balances the risks of damages from climate change against the feasibility and cost of a rapid transformation of the energy system. Since there is now little consensus on either, the regime must have flexibility to adapt to new and emerging information about both

abatement costs and climate change risks. According to the recent Stern Review, recent assessments find that the risks of serious damages from climate change rise rapidly as concentrations rise from 450 ppm CO2e toward 550.

Moreover, since the achievement of any stabilization goal requires international cooperation by major emitters in Annex I and non-Annex I countries, flexibility is also required to enable the United States to participate effectively in international negotiations. Such negotiations would make more aggressive targets in the United States contingent on similar or matching actions in other key countries.

For this reason, an upstream cap-and-trade system would reasonably establish in its legal architecture a minimum and maximum rate of emissions reduction to be achieved in each five-year period, delegating responsibility to establish the specific target within that range to the executive branch. Doing so would create a robust expectation of continuing progress toward stabilization while still allowing sufficient flexibility.

It is well beyond the scope of this paper to attempt to estimate what that range should be. Nonetheless, for illustrative purposes, one could imagine that after an initial five-year period in which emissions are stabilized, the minimal rate prescribed for emissions reductions would be

equivalent to a one-percent annual reduction. This would be consistent with scenarios in which atmospheric concentrations were stabilized at or below 550ppm with international cooperation. Within the United States, most economic studies imply that emissions reductions of 20 to 25 percent over a twenty year period can be achieved with little diminution in the rate of economic growth. Yet, continued over five decades this rate could lead to stabilization of atmospheric concentrations. The prescribed maximum rate might be significantly higher, say 1.5 percent per year, to provide the needed flexibility. This range is consistent with the range that the European Union has announced as its preliminary target range for the period ensuing after the end of the Kyoto Protocol compliance period in 2012 and would be needed if CO2 concentrations were to be kept at around 450.

6. Doing without a price cap

In an upstream cap-and-trade system, there is no need for a price cap or "escape valve" created by sales by government of additional permits into the permit market whenever permit prices reach a ceiling. Such an escape valve mechanism would weaken the effectiveness of the system. Price stability would be maintained instead by linkages into offset and international markets and permit banking. In addition, revision of reduction targets every five years could limit undue price escalation.

Energy companies will maintain reserves of permits as backing for forecasted sales. Arbitrageurs and speculators will also maintain reserves to support positions in the permit market. These reserves will limit price fluctuations. In addition, the cap-and-trade system will be linked to a much larger domestic and international market, consisting of domestic offsets generated by carbon sequestration and abatement of other greenhouse gases, certified emission reduction credits generated by the Clean Development Mechanism, credits generated through Joint Implementation, and carbon permits available in the European Union Emission Trading System and in other national markets. The size and diversity of these markets will increase liquidity and limit price fluctuations. Moreover, since many low-cost abatement opportunities are available in international markets other than in Western Europe and Japan, these linkages will have a moderating effect on permit prices in the United States.

If a price cap or escape valve were to be adopted, it would make linkage to international carbon markets difficult, if not impossible. If the price cap were set at a level above international permit prices, it would be ineffective. U.S. permit holders would buy permits internationally at the lower price. However, if the price cap were set lower than the international price, then a mechanism would be needed to prevent U.S. traders from

buying permits for resale in Europe or another foreign market. Such a trading ban would undermine the market. It is far better to rely on international markets and banking to maintain price stability.

F. Dealing with Energy Subsidies

American energy markets are distorted by subsidies of all kinds: producer subsidies, consumer subsidies, and subsidies to competing energy sources, conveyed through all sorts of tax, credit, and expenditure vehicles. These subsidies have accreted over time, justified as serving many purposes and interests, and persist through lavish lobbying by beneficiaries. Their net effect is a complete mystery, except that they very likely raise domestic energy production and consumption. Energy markets in other countries are similarly distorted.

A beauty of an upstream cap-and-trade regime is that the effects of all energy subsidies on fossil fuel production and consumption are negated. Aggregate production and consumption of carbon fuels are limited by the caps, so long as permit prices remain positive. Energy subsidies primarily influence the profits made by various energy sellers and the costs borne by consumers. Though they may also affect the relative market shares of oil, gas and coal in energy markets within the overall carbon limit, subsidies

would no longer affect carbon emissions in an upstream cap-and-trade system. The Gordian knot would be cut.

Then, since the politics of energy subsidies would be almost entirely distributive, it might be considerably easier to simplify the system. Subsidies to producers and sellers of fossil fuels could be replaced by grandfathered permit allocations. The value of permits to sell carbon fuels will be sufficiently valuable that allocating a fraction of such permits free to sellers would provide compensation for the loss of subsidies. Similarly, the higher returns afforded to producers of energy alternatives because of higher fossil fuel prices would compensate them for the loss of their subsidies. Making use of these trade-offs would greatly reduce distortions in U.S. energy markets and simultaneously relieve the federal government of a heavy fiscal burden.

Reducing energy subsidies in this way could best be done through international negotiations. Either in the context of WTO negotiations over subsidies or more directly in the context of climate negotiations, the U.S. might offer to reduce energy subsidies in return for equivalent reductions in energy subsidies by other countries. Like negotiations over reciprocal reductions of distorting international trade barriers, reciprocal reductions in energy subsidies would be “win-win” for negotiating partners. The U.S., for

example, would benefit if other countries reduced energy subsidies that raised carbon emissions and distorted world energy markets. It would also be relieved of a fiscal and economic burden if it reduced its own energy subsidies. Using the permit allocation process to compensate companies that lose advantages would make the medicine go down more easily.

G. Dealing with "Competitiveness" Issues

Obviously, the policy approach described above would benefit some U.S. businesses, especially those engaged in producing renewable and low-carbon fuels systems, improved equipment, appliances and controls for energy efficiency, design and construction of "green" buildings, and the like. These "cleantech" sectors are already growing at rapid rates, attracting a flood of capital investments, and creating a lot of promising, well-paying jobs.

Nonetheless, despite very little empirical support, other business interests vigorously predict the loss of industrial competitiveness if the United States adopts policies to force reductions in carbon emissions. They have made similar intimidating predictions over past decades regarding enactment of all other major pieces of environmental legislation. Yet, numerous studies have found either no or negligible impacts from

international differences in environmental standards on patterns of trade, investment, or industrial location. The explanation is simple: trade and investment flows are much more greatly influenced by differences in labor costs, differential access to raw materials and natural resources, and the need for proximity to growing markets than those flows are influenced by differentials in environmental compliance costs, which usually have small implications for overall production costs.

The effect of domestic controls over carbon emissions on international trade and investment would also be small. The most important reason for this is that the sectors most adversely affected by such controls do not enter significantly into international trade. Electric power is produced domestically; very little is imported or exported across U.S. borders. Transportation services are produced domestically. Vehicles are traded internationally (although most “foreign” auto makers have domestic U.S. production facilities) but the vehicles sold in the U.S. are driven and emit carbon dioxide in the United States. Buildings, which account for another large share of energy consumption, generally stay where they are. Those organizations that do establish office or commercial facilities in other countries generally do so for other reasons than to save on energy costs. Government services, which represent another 20 percent of the economy,

generally do not lose share of the U.S. market to other governments with lower energy costs. Wholesale and retail trade, as well as a host of other services, are anchored to the consumer and the nearest shopping malls.

Even within the industrial sector, energy costs represent a small percentage of total production costs, well below 5 percent, in most industries. In most of the dynamic, technologically advanced manufacturing and service industries in which the United States has a comparative advantage, energy costs represent an even lower share in production costs. In those sectors, international differences in energy costs make up only a fraction of that small percentage, not enough to affect trade or investment decisions significantly. Only for a subset of heavy industries, such as chemicals, metals, cement and other non-metallic minerals are energy costs really significant. And for some of these, such as cement, high transportation costs relative to value make production largely a national affair.

Even in these sectors, another important reason to discount the threat of competitive impacts is that other countries, including our most important trading and investment partners in Europe, Canada and Japan have already adopted or agreed to adopt their own mandatory limits on carbon emissions. Among the Annex I countries, which account for the large majority of international trade and investment flows, it is only the United States (and

Australia) which has not adopted mandatory limitations. Fuel prices and electricity rates in countries that have already adopted mandatory carbon controls tend to be higher, and sometimes considerably higher, than they are in the United States. That being so, if competitiveness impacts were indeed important, one would expect to see a flight of industry to this country. That has obviously not happened. The past decade has seen record trade deficits and net capital outflows.

Moreover, the European Union has already made clear that it is prepared to order steeper cuts in the next phase following 2012 if the United States adopts mandatory limits. China and India have also signaled that their actions are conditional on actions taken in the United States and other rich countries. Competitiveness fears are misplaced.

Nonetheless it is important for the United States, along with other Annex I countries, to negotiate with large non-Annex I countries such as China, India, Mexico and Brazil for their significant participation and cooperation in the next phase of greenhouse gas emission reduction. Emissions from those countries are large and growing. Over time, unless they are reduced, it will be impossible to achieve global climate stabilization at any relatively safe level. That fact, rather than fears of competitive impacts, should underlie negotiations.

H. Conclusion

It is extremely important that the U.S. adopt a good policy architecture for greenhouse gas control. The costs of not doing so will be very large and will persist for decades, adding up to many trillions of dollars, because any policy architecture put in place will be very hard to change later.

An upstream cap-and-trade system along the lines outlined above is a good policy architecture. It will be effective, ensuring comprehensive control of carbon emissions. It will be cost-effective, allowing maximum flexibility for market responses and providing continuing incentives for development of alternative energy and energy efficiency technologies. It will be relatively easy to administer and enforce. It will provide ample opportunities to ensure fairness. It is politically viable. It links readily to domestic and international offset programs. It deals effectively with the problem of energy subsidies.

The advantages of an upstream system have been recognized by public and private policy research groups, including the Congressional Budget Office, Resources for the Future, and the Climate Policy Center.

The National Commission on Energy Policy has also endorsed a comprehensive nation-wide cap-and-trade program, implying an upstream approach. However, all these envisage price caps and other features that would make the architecture less effective and less cost-effective.

Illustrating the policy risks, few of the legislative proposals that have been introduced so far into the Congress have been based on a comprehensive upstream approach. The exception is the bill proposed by Senator Bingaman, which is based on an upstream cap-and-trade system. Also, the proposal sponsored by Senators McCain and Lieberman embodies a mixed cap-and-trade, located partly upstream and partly midstream. Much would be gained if supporters of mandatory emission limits, whether in government, the private sector, or in policy research bodies, could coalesce around an upstream cap-and-trade system similar to that outlined in this paper.