CONGRESSIONAL TESTIMONY

September 20, 2005

Testimony on Senate Amendment 866

Statement of Richard D. Morgenstern,
Senior Fellow, Resources for the Future

Prepared for the Senate Committee on Energy and Natural Resources

1616 P St. NW
Washington, DC 20036
202-328-5000 www.rff.org

RESOURCES FOR THE FUTURE

Mr. Chairman: I am pleased to appear before this committee to comment on the recently adopted Senate resolution calling for a "…national program of mandatory market-based limits and incentives on greenhouse gases that (1) will not significantly harm the United States economy; and (2) will encourage comparable action by other nations that are major trading partners and key contributors to global emissions."

To set the context, I will briefly discuss a number of policy developments since the late 1990s, when the Kyoto Protocol was being negotiated. Then, I will turn to some design issues relevant to the implementation of the new Senate Resolution, including the mechanisms that will encourage the development and adoption of new technologies and the use of a safety valve or price cap as an integral part of a cap-and-trade system. Finally, I will comment on possible means of encouraging comparable mitigation actions by other large emitters.

I speak as an economist who has been involved with the issue of climate change for almost two decades. Previously a tenured college professor, I have also had the privilege of serving in senior policy positions under prior Republican and Democratic administrations. Currently, I am a senior fellow at Resources for the Future (RFF), a 53-year-old research institution headquartered here in Washington, DC, that specializes in energy, environmental, and natural resource issues. RFF is both independent and nonpartisan and shares the results of its economic and policy analyses with members of both parties, as well as with environmental and business advocates, academics, members of the press, and interested citizens. RFF encourages scholars to express their individual opinions, which may differ from those of other RFF scholars, officers, and directors. I emphasize that the views I present today are mine alone.

Let me begin by observing what many recent press reports have failed to note: recent policy proposals, such as those advanced by the National Commission on Energy Policy (NCEP), differ dramatically from the Kyoto Protocol. While the details of Kyoto are well known to members of this committee, the NCEP proposal is novel in a number of respects, as it combines federal support for innovative technologies with a program to

reduce greenhouse gas emissions that involves a cap on costs. Overall, the NCEP program would have a minimal impact on the U.S. economy and is revenue neutral with respect to the federal budget. Whereas the Kyoto Protocol involves fairly steep short-term reductions and, correspondingly, potentially high costs, the NCEP proposal calls for relatively modest initial emissions reductions which are, in fact, quite similar to the voluntary intensity reductions proposed by the Bush administration. Because of the more modest start, combined with the safety valve, the costs of the NCEP proposal are much lower.

To see this point more clearly, consider the results of three separate analyses by the independent Energy Information Administration (EIA) of the costs of alternative climate proposals conducted over the past several years. Relying on its standard National Energy Modeling System, EIA compared the effects of implementing the Kyoto Protocol, the Climate Stewardship Act introduced by Senators McCain and Lieberman (S. 139), and the NCEP proposal. Although the EIA studies were conducted in different years and involve slightly different baselines, the results are quite illuminating (see the accompanying table).

EIA's Analysis of the Kyoto Protocol, S. 139, and Energy Commission Proposals: 2020

	NCEP	S. 139	Kyoto (+9%)
GHG emissions (% domestic reduction)	4.5	17.8	23.9
GHG emissions (tons CO_2 reduced)	404	1346	1690
Allowance price (2003$ per ton CO_2)	8	35	43
Coal use (% change from forecast)	-5.7	-37.4	-72.1
Coal use (% change from 2003)	14.5	-23.2	-68.9
Natural gas use (% change from forecast)	0.6	4.6	10.3
Electricity price (% change from forecast)	3.4	19.4	44.6
Potential GDP (% loss)	0.02	0.13	0.36
Real GDP (% loss)	0.09	0.22	0.64

SOURCES. NCEP: GHG emissions and allowance price is from EIA, *Impacts of Modeled Recommendations of the National Commission on Energy Policy*, Table 118 (May 2005). All other data is from Table 1, "AEO 2005 Reference Case," and "Greenhouse Gas Policy." (EIA, April 2005). This is available at www.eia.doe.gov/oiaf/servicerpt/bingaman/index.html.
McCain Lieberman (S. 139): From EIA, *Analysis of S.139, the Climate Stewardship Act of 2003*. Emissions data and allowance price is from Table B20. GDP is from Table B21. All other data is from Table B1. (EIA, May 2004). This is available at www.eia.doe.gov/oiaf/servicerpt/ml/pdf/sroiaf(2003)02.pdf.
Kyoto Protocol: From EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*. Emissions data is from Table B19. Allowance price and GDP is from Table ES-2. All other data is from Table B1. (EIA, October 1998). This is available at www.eia.doe.gov/oiaf/kyoto/pdf/sroiaf9803.pdf

For the Kyoto Protocol, EIA forecast greenhouse gas reductions of 23.9 percent in 2020. Under Kyoto, allowance prices were predicted to reach $43 per ton of carbon dioxide, while coal use was expected to decline by 68.9 percent below 2003 levels. Real GDP was forecasted to decline by 0.36 percent. In analyzing the NCEP proposal, EIA foresaw smaller emissions reductions and, most importantly, quite different economic impacts. Allowance prices were effectively capped at $7 per ton of carbon dioxide; coal use was forecast to *increase* by 14.5 percent above 2003 levels by 2020, and real GDP losses were considerably smaller (0.09 percent). EIA noted that this policy would not "materially" affect average economic growth rates for the 2003 to 2025 period (p. *xi*). For McCain Lieberman, EIA forecast impacts that would fall between Kyoto and NCEP, although they were considerably closer to Kyoto in terms of both emissions reductions and costs.

The principal reason that NCEP's approach is so much less costly than Kyoto or S. 139 is that it is not designed to avert climate change over the next 20 years. Rather, the focus is on developing and deploying technologies needed to address the problem in the decades beyond. NCEP does this primarily in two ways: 1) by directly subsidizing a wide range of new technologies including coal, nuclear energy, fuel-efficient vehicles, biofuels, and others; and 2) by encouraging private-sector research and development through incentives for the deployment of cost-effective carbon saving technologies of all types. NCEP's cap-and-trade system has the added benefit of generating a revenue stream to fund the technology subsidies.

It is widely recognized that major progress on climate change will not be possible without new technologies. It is also widely recognized that government has an important role to play in spurring the development and diffusion of these technologies. Without additional incentives, the private sector typically will under-invest in research, development, and demonstration because innovators cannot reap the full benefits to society of their advances. The existence of these "spillovers" reduces private incentive to pursue innovation, as others will mimic the innovation without compensating the inventors. While patents and similar means are used to protect investments in innovation, that protection is limited. A successful innovator typically captures substantial rewards, but those gains are sometimes only a fraction of the total benefits to society arising from the innovation. This rationale underlies government support of research, development, and demonstration programs, including the National Science Foundation, public universities, and others.

Environmental and knowledge externalities have long been at the center of debates about technology policy. More recently, we have come to understand some additional market failures that may operate in the adoption and diffusion of new technologies. For a variety of reasons, the cost or value of a new technology to one user may depend on how many other users have adopted the technology. Generally speaking, users will be better off the more others use that same technology, as this increases what is known as "learning-by-doing" and "network" externalities. Typically, it takes time for potential users to learn of

a new technology, try it, adapt it to their particular circumstances, and become convinced of its superiority. Consequently, the early adopter of a new technology creates a positive benefit for others by generating information about the existence, characteristics, and likely success of the new technology.

The argument for public support is even stronger in the case of climate change technologies, where not only do inventors fail to capture all the gains from their investments but also the gains themselves are not fully translated to the firms' bottom line because there is no market value associated with emissions reductions. Further, the prospect of future value—which is driven by policy outcomes—is uncertain.

Absent government incentives, corporate concern for the environment may overcome some hurdles. Working against this kind of "corporate altruism," however, is the need to compete in the marketplace. A company that puts meaningful effort into reducing greenhouse gas emissions, rather than reducing costs, may eventually lose out to one that only seeks to reduce costs.

It is exactly this need to align public and private interests that underlies the argument for an emissions trading program, or similar mechanism, alongside technology development and demonstration programs. While the government seeks technologies to cut carbon emissions, the private sector seeks technologies to cut costs. Market-based policies that put a value on emissions reductions encourage firms to conserve energy, reduce emissions from existing technologies, and adopt new low-carbon or no-carbon technologies. In contrast, policies that only focus on technology adoption fail to take advantage of reductions that could come from existing technologies and conservation.

Market-based policies to reduce emissions have two distinct effects: they reduce emissions in the near term *and* they alter the incentives that firms have for developing and adopting new technologies for the future. Few would disagree that it is the private sector, not the government, that has driven innovation and growth in modern economies. Industry, according to data from the National Science Foundation, funded 63 percent and

performed 68 percent of all research and development in 2003 (the latest year for which data is available).[1] Even as the government tries to encourage greenhouse gas-*reducing* technologies, private efforts to improve greenhouse gas-*increasing* technologies will likely continue unless firms see some kind of value associated with emissions reductions.

Technology programs alone may succeed in bringing down the cost of integrated gasification and combined cycle (IGCC) coal plants so that they eventually overtake conventional pulverized coal. That said, how can technology programs ever make capture and sequestration cheap enough so that firms will voluntarily capture and sequester emissions? The real choice is whether capture and sequestration will eventually be required under a command-and-control style regulation, or whether a market-based system will be used to flexibly encourage adoption of the cheapest option. There is growing evidence on the performance of these alternative approaches, including a volume I recently co-edited that compares the U.S. and European records of both command-and-control and market-based mechanisms.[2] Overall, the analysis finds that market-based programs are considerably cheaper than command-and-control alternatives. For example, the U.S. sulfur dioxide program achieved savings of over 40 percent compared to the command-and-control alternatives. Additionally, market-based programs have the advantage of encouraging innovation in a direction that minimizes costs and reduces emissions.

Another point sometimes overlooked is the opportunity for relatively inexpensive emissions reductions right now. Emissions reductions using more conventional technologies may not provide a complete solution to the climate problem, but by delaying the accumulation of greenhouse gases in the atmosphere, they provide additional time to develop long-term solutions. Even if a major technology breakthrough is needed to reach climate stabilization goals, there are many small- and medium-sized innovations—the type typically associated with learning by doing—that can yield significant benefits.

---

[1] www.nsf.gov/sbe/srs/infbrief/nsf04307/start.htm.

[2] Harrington, Winston, Richard Morgenstern, and Thomas Sterner. 2004. *Choosing Environmental Policy: Comparing Instruments and Outcomes in the United States and Europe*. Washington DC: RFF Press.

Sending a signal about the value of emissions reductions provides the right information to the private sector about the importance of undertaking those activities.

Consistent with this logic, the NCEP proposal tries to link the technology development and mitigation sides of the problem into a coherent policy framework. By coupling technology incentives with an emissions trading program they provide significant incentives—along with the necessary funding—to develop new technologies that are essential to the long-term success of any effort to reduce greenhouse gases.

As a final point on the link between R&D and mitigation, I will mention one particular line of thought in circulation these days that is somewhat at odds with the ideas laid out here. Because climate change is such a long-term problem, the thinking goes, it is not appropriate to encourage emissions reductions now—the policy focus should, instead, be entirely oriented to technology development. Although there are many complex issues here, the single point I would make is that even this view supports near-term emissions reductions as long as the cost is no higher than the expected value of future mitigation benefits. While one can debate the true magnitude of these benefits, the economics literature on this issue would certainly support the $7 per ton of carbon dioxide proposed by NCEP.

I now turn my focus to a discussion of the use of a safety valve or price cap to avoid unpleasant cost surprises. In the context of a mandatory cap-and-trade system, a safety valve would specify a maximum market price at which the government stands ready to sell additional emissions allowances in order to prevent excessive prices.

At the outset, one must ask a basic question: given the success of cap-and-trade programs without a safety valve, such as the one for sulfur dioxide, what is the basis for including a safety valve to control carbon dioxide and other greenhouse gases? The answer is simple and straightforward: carbon controls are potentially more costly to the economy than these other programs, and, most importantly, there is greater uncertainty about the true costs. Unforeseen events such as a warm

summer or cold winter, a spurt in economic growth, or a technological failure of some sort, may drive up control costs dramatically. One needs only point to the unforeseen events in California's RECLAIM program that propelled the prices of permits for nitrogen oxides above $80,000 per ton, or the similar, albeit less costly, problems that arose in comparable programs on the East Coast. Because of these concerns a number of nations are considering safety valves. For example, Canada recently announced it would incorporate such a mechanism in its domestic program.

As Harvard economist Martin Weitzman pointed out three decades ago, when higher control costs are of concern but the potential environmental damages are not particularly sensitive to short-term emissions fluctuations, it is unnecessary to impose strict quantity-based controls. Although the experience with sulfur dioxide trading suggests that the actual costs may be lower than expected, recent Congressional debates indicate a clear concern that mandatory carbon mitigation policies may become quite costly—even those involving modest targets. Part of the cost uncertainty arises from uncertainty about the level of future baseline emissions that would occur even in the absence of new policies. There are also uncertainties about the cost of reducing emissions below baseline and the overall efficiency of the emissions trading system.

One way to address this issue is by using a safety valve that fixes binding emissions targets as long as costs remain reasonable and allows the target to rise if costs are unexpectedly high. In practical terms, the safety valve would involve an initial allocation of permits followed by the subsequent sale of additional permits that would become available at a fixed trigger price. Several of my RFF colleagues and I first proposed applying this mechanism to the control of carbon dioxide back in 1997.[3] Recently, NCEP has embraced the idea as part of a broader package that involves incentives for technology development, as described previously.

[3] Kopp, Raymond J., Richard D. Morgenstern, and William Pizer 1997. "Something for Everyone: A Climate Policy that Both Environmentalists and Industry Can Live With," *Weathervane*, September 29, available at www.weathervane.rff.org/features/feature015.html. Kopp, Raymond J., Richard D. Morgenstern, and William Pizer. 2000. "Limiting Cost, Assuring Effort, and Encouraging Ratification:

In daily life, most individuals like to avoid unpleasant surprises (hence the popularity of insurance). It is possible to use certain policy options to avoid unpleasant surprises in the broader economy as well. Just as the Federal Reserve protects against wide swings in bond and currency prices, the incorporation of a safety valve in a greenhouse gas mitigation policy would prevent sharp increases in energy prices. The ideal climate policy is one that sets an upper limit on mitigation expenditures. Most consumers are interested in reducing their out-of-pocket expenditures for energy as well as other goods and services, and most businesses are interested in maintaining a stable environment for purposes of planning and investment. The risk of unexpectedly high compliance costs under a strict permit system would threaten that stability.

The safety valve approach guarantees that emissions will not exceed the target as long as the price of the tradable permits does not rise above the trigger price. It differs in a few important respects from a well-known provision in the 1990 Clean Air Act Amendments that establishes a $2,000 per ton penalty (1990$) for violations of the stipulated sulfur dioxide emissions standards. Since the Clean Air Act penalty is far above the expected marginal control cost, it has a very low probability of being invoked. The notion of a safety valve reflects the society's willingness to pay for carbon mitigation. It is not intended strictly as a punitive measure. For those who believe that the costs of reducing greenhouse gas emissions are relatively low, permit prices would never reach the trigger level and emissions would remain capped.

One thing that has plagued policy proposals in the past is that different analysts using different models can produce quite disparate results. For example, in analyzing the Kyoto Protocol, President Clinton's Council of Economic Advisers forecasted allowance prices below $7 per ton of carbon dioxide as compared to EIA's $43 estimate. Interestingly, with the safety valve, the emissions estimates may vary among models but the costs

---

Compliance under the Kyoto Protocol," *Weathervane*, June 26, available at www.weathervane.rff.org/features/parisconf0721/KMP-RFF-CIRED.pdf.

cannot rise above the price cap. Observe that the EIA estimates of the NCEP proposal, which contains a safety valve, are extremely close to those of the respected consulting firm, Charles River Associates, which conducted the macro-economic analysis for NCEP. Similarly, recent EIA sensitivity analyses of the NCEP proposal reveal that compliance costs are virtually invariant with respect to a wide range of assumptions about natural gas supplies, the availability of non-carbon offsets, and other factors.

A final point about safety valves concerns the claim by some that such a mechanism is unnecessary as long as banking and offsets are allowed. Citing the successful sulfur dioxide trading system, unexpected events of the type that doomed the RECLAIM program in California are dismissed as the product of a flawed design—namely, the absence of provision for emissions banking and offsets—rather than as an inherent problem of applying a fixed quantity trading system to control emissions. The alternative view, espoused by at least two former chairmen of the President's Council of Economic Advisors, is that banking or offset systems cannot reasonably adapt to unexpected events such as higher energy demand or inadequate technology as effectively as a safety valve. According to this view, offsets can reduce the *expected* cost of a particular goal, but they cannot address concerns about *unexpected* events. In fact, if the system becomes dependent on such offsets, their inclusion can actually increase uncertainty about program costs if the availability and cost of the offsets themselves is not certain. In regard to the banking or borrowing of emissions, the two Council chairmen note that "… [The]…features that…provide additional allowances when shortages arise…are helpful, but only to the extent they can ameliorate sizeable, immediate and persistent adverse events."[4] That is, offsets or banking systems may reduce the problem, but they may not be sufficient to address all the uncertainties arising from unexpected spurts in economic growth, weather variations, or other events.

Finally, I will briefly comment on the challenges of bringing developing countries into an emissions limiting agreement. While this is clearly a critical need for long-term success

[4] Hubbard, R. Glenn and Joseph E. Stiglitz. 2003. "Letter to Honorable John McCain and Honorable Joseph Lieberman," June 12.

of any effort to address climate change, so far, no proposal has made much headway in this area. Developing nations are certainly not lining up behind the idea of binding emissions limits as laid out in the Kyoto Protocol. The president's proposed use of intensity targets, which takes into account economic growth when measuring environmental performance, is more attractive to some developing nations than fixed emissions levels. However, there is no serious indication that developing nations are prepared to adopt this approach either. Senators McCain and Lieberman's Climate Stewardship Act incorporates some limited incentives for developing nations by allowing up to 15 percent of the total emissions to come from offsets, including offsets from abroad. Recent proposals by Senator Bingaman incorporate a similar mechanism, albeit at a lower (3 percent) level. How well such international offsets would compete against domestic agricultural and forestry projects, or against domestic non-carbon dioxide sources is an open question. Nonetheless, this approach clearly has some appeal.

The recent Senate resolution on climate change represents an important step forward in redefining the initial terms of developing-country participation in greenhouse gas mitigation by opening the door to potential linkages between climate change and other issues of international concern. The original Byrd-Hagel language requiring "new specific scheduled commitments to limit or reduce greenhouse gas emissions" by developing countries has been replaced by the stipulation that U.S. policies "encourage comparable action by other nations that are major trading partners and key contributors to global emissions." This new language lowers the bar somewhat for developing countries and creates a more realistic expectation for participation by these countries. At the same time, it properly focuses attention on major trading partners with large emissions.

Consistent with this new Senate language, a proposal advanced by Senator Bingaman calls for periodic Congressional review of the new U.S. mandatory program. Under this mechanism Congress would make a determination every five years to accelerate, decelerate, or leave unchanged the key program parameters, including the emissions target and the safety-valve price. In making this determination, Congress would review a wide range of factors, including recent technological advances. Of particular interest

would be the mitigation actions of other nations, both developed and developing, to reduce emissions. Further, if the United States or other developed nations had established a program to support clean energy projects in a poor nation, that, too, would become part of the review. If one believes, as I do, that the key to international cooperation on climate change is linkage on a broad range of issues, including global trade, development aid, and technology transfer, then such a procedure would potentially provide Congress an opportunity to influence the actions of both developing and developed nations as climate policies evolve over the next few years, all the while avoiding, in EIA's words, “material” impacts on the U.S. economy.

In sum, Mr. Chairman, we have come a long way since the early discussions on the Kyoto Protocol. We are no longer talking about steep near-term emissions reductions with the concurrent dangers for the U.S. economy. Rather, the debate has now shifted to motivating both the public and private sectors to pursue technology innovation over the long term and capturing the low-hanging fruit of cheap emissions reductions in the near term, all the while protecting the economy from unwarranted burdens. Such an approach has great potential to encourage the development and adoption of new technologies that can put the United States and other nations on a long-term path to address the climate change issue.

I thank you for the opportunity to appear before this committee and I would be pleased to answer any questions.