CARBON CAPS AND EFFICIENCY RESOURCES: HOW CLIMATE LEGISLATION CAN MOBILIZE EFFICIENCY AND LOWER THE COST OF GREENHOUSE GAS EMISSION REDUCTION[‡]

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INTRODUCTION

There are very good reasons why national climate legislation, as well as governors, legislators, and environmental advocates, are focusing on the power sector to lead the move to a lower-emissions economy. The power sector is the largest single source of industrial pollution, accounting for 37% of U.S. global warming gas emissions.[1] Carbon dioxide emissions from the U.S. power sector exceed the *total national* greenhouse gas (GHG) emissions of every other nation except China.[2]

The electric-power sector is also traditionally regulated, is not vulnerable to international competition, and consists of a reasonably small number of known sources. It is not a surprise that major cap-and-trade efforts on both coasts have begun first with the power sector, as it is probably the easiest large sector to manage. The power sector is also expected to supply a large fraction of total emissions reductions sought under national climate bills.

However, significantly reducing emissions from the power sector will not be easy. About half of the nation's electric power comes from coal generation, and coal use continues to grow.[3] For a decade, natural-gas

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1. *See* U.S. ENVTL. PROT. AGENCY, EMISSIONS & GENERATION RESOURCES INTEGRATED DATABASE YEAR 2004 SUMMARY TABLES (2007), *available at* http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2006V2_1_Summary_Tables.pdf (providing detailed air emissions data for the electric power sector); U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2004, at ES-14 tbl.ES-6 (2006), *available at* http://epa.gov/climatechange/emissions/downloads06/06_Complete_Report.pdf.

2. EARTHTRENDS, WORLD RESOURCES INST., CARBON DIOXIDE EMISSIONS BY ECONOMIC SECTOR 2005, 1–2 (2005), *available at* http://earthtrends.wri.org/pdf_library/data_tables/cli2_2005.pdf.

3. *Coal: America's Energy Future*, COAL LEADER, Apr. 2006, at 1, 6, *available at*

combined-cycle plants provided the large majority of new capacity additions.[4] However, gas prices and availability concerns are now driving renewed interest in coal for new generation, with "upwards of 90 GW [of new coal generation capacity] on the boards."[5] Load growth continues, renewable sources can cover only a part of the new demand, and nuclear power is unlikely to provide significant new capacity to regional grids.[6] Meanwhile, fossil-fuel prices continue to rise.

This Article focuses on how cap-and-trade systems for the power sector can be designed to accelerate investments in energy efficiency, which would permit more-rapid carbon reductions at a lower cost to consumers and the American economy. It advances four key points:

(1) Energy efficiency is the low-cost equivalent of a "carbon scrubber for the electric power sector."[7] It is the most important resource to look to as the bridge fuel to the low-carbon power sector we need in coming decades.

(2) The cap-and-trade architecture used in the U.S. Acid Rain Program, and copied in other systems such as the EU Emissions Trading Scheme, is not optimal for carbon management. By focusing on smokestacks and awarding carbon allowances to emitters on the basis of their historic pollution, these programs cost consumers more than needed to achieve a given level of reduction.

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http://coalleader.com/2006/apr06_cover_story.htm (scroll down to second article).

4. *See id.* at 6 (tracking the fluctuations in natural gas production).

5. *Id.* While project announcements alone are not a reliable indicator of capacity additions, as of June 2008, there were roughly twenty-nine new coal plants under construction and another twenty-three plants already permitted and/or near construction. ERIK SHUSTER, NAT'L ENERGY TECH. LAB. U.S. DEP'T OF ENERGY, TRACKING NEW COAL-FIRED POWER PLANTS 6 tbl.1 (2008), *available at* http://www.netl.doe.gov/coal/refshelf/ncp.pdf. These projects would add approximately 16,500 megawatts (MW) and 10,000 MW of new capacity respectively. *Id.*

6. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2008 WITH PROJECTIONS TO 2030, at 67–68 (2008), *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2008).pdf. *See also* PAUL L. JOSKOW, THE FUTURE OF NUCLEAR POWER IN THE UNITED STATES: ECONOMIC AND REGULATORY CHALLENGES 1–2 (2006), *available at* http://tisiphone.mit.edu/RePEc/mee/wpaper/2006-019.pdf (predicting that the supply of electricity from nuclear power will reach zero in about 2030 if investment in new plants is not forthcoming).

7. Scrubbing emissions of conventional pollutants does not materially alter the carbon content of the emission stream, and carbon capture-and-storage (CCS) options are at present too costly to be realistic as add-on options for existing power plants. CCS may well be important to long-term GHG management in the United States, but most experts do not foresee more than pilot projects for CCS for at least a decade. NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, CARBON SEQUESTRATION TECHNOLOGY ROADMAP AND PLAN 5 (2007), *available at* http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project portfolio/2007/2007Roadmap.pdf (noting that much work remains to "enable the large-scale deployment of CCS technologies").

Furthermore, they miss an important opportunity to enhance energy efficiency, which is the least-expensive and most-effective way to lower carbon output.

(3) Although adding a carbon price signal to the cost of electricity is directionally correct, cap-and-trade programs that try to reduce emissions through price alone will be much more costly and will save less carbon than a cap-and-trade program that includes proven techniques to deliver low-cost efficiency resources. At the consumer level, higher power prices alone will not reduce demand nearly enough to meet our carbon goals. At the generator level, only a very high carbon price would make a meaningful change in the dispatch of the existing-generation fleet or in the mix of new-generation additions. At all three levels—consumer demand, dispatch, and new construction—the high prices required to produce the deep reductions now called for by climate science would face formidable political barriers.

(4) Fortunately, there are alternatives. Modified cap-and-trade designs are being developed in the Northeast, in California, and elsewhere that would make efficiency an integral part of the carbon-reduction program and lower the cost of GHG reductions by allocating allowances for consumer benefit and investing allowance values in programmatic efficiency measures. Congress should build on this state and regional experience by creating a performance-based "efficiency allocation" of carbon credits in any national cap-and-trade program now being developed.

I. THE CENTRAL ROLE OF END-USE EFFICIENCY IN MEETING CARBON-REDUCTION GOALS

A. The Efficiency Reservoir

To many knowledgeable observers, the obvious solution to power-system challenges is aggressive, accelerated investments in energy efficiency. Several well-documented studies demonstrate that the cost-effective reservoir of efficiency opportunities is large enough to meet 50% to 100% or more of all new electric demand.[8]

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8. *See, e.g.*, MARILYN A. BROWN & MARK D. LEVINE, INTERLABORATORY WORKING GROUP, SCENARIOS OF U.S. CARBON REDUCTIONS: POTENTIAL IMPACTS OF ENERGY TECHNOLOGIES BY 2010 AND BEYOND 1.5, tbl.1.1 (1997), *available at* http://enduse.lbl.gov/projects/5lab.html (scroll to bottom

In addition to being quite large, the efficiency reservoir can be tapped at low cost. End-use efficiency is the least-costly means to significantly reduce carbon emissions from the power sector. Cost-effective efficiency provides "avoided tons" of carbon at negative cost. By any measure, this approach is less expensive than low-emission generation alternatives. In electricity markets, the efficiency savings potential has been shown to be on the order of 25% of total electricity usage at a levelized cost of about three cents per kilowatt-hour (kWh).[9] This is much less than the average national retail price of electricity, which as of August 2008 was more than ten cents per kWh.[10] This is also less than the marginal generation cost of new power plants, estimated, depending on the technology, to cost five to ten cents per kWh or more.[11] Energy efficiency is the equivalent of a low-cost "carbon scrubber" for the power sector.

The emissions reduction potential is also significant. Intergovernmental Panel on Climate Change (IPCC) studies reveal that across many sectors, the efficiency potential is quite large; the buildings sector provides one of the largest sources of GHG emission reductions occurring through efficiency actions.[12] Another recent study conducted by the McKinsey consulting firm for the Natural Resources Defense Council (NRDC) found that by 2050, energy efficiency could reduce U.S. carbon dioxide emissions

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of page and follow "Chapter 1 - Analysis Results" hyperlink under "Publications" heading) (comparing the country's projected energy usage in both "business-as-usual" and "efficiency" scenarios between 1997 and 2010). More-recent studies in the western and northeastern U.S. have reached similar conclusions. *See* THE SW. ENERGY EFFICIENCY PROJ., THE NEW MOTHER LODE, at 1-6 (2002), *available at* http://www.swenergy.org/nml/New_Mother_Lode.pdf (stating that "there is large potential for increasing the efficiency of electricity use and reducing load growth in the southwest region"); OPTIMAL ENERGY, INC., ECONOMICALLY ACHIEVABLE ENERGY EFFICIENCY POTENTIAL IN NEW ENGLAND 5 (2005), *available at* http://www.neep.org/files/Updated_Achievable_Potential_2005.pdf (explaining that there are numerous opportunities to obtain energy savings in the residential, commercial, and industrial sectors).

9. *See* MARTIN KUSHLER ET AL., FIVE YEARS IN: AN EXAMINATION OF THE FIRST HALF-DECADE OF PUBLIC BENEFITS ENERGY EFFICIENCY POLICIES 29, 30 tbl.5 (2004), *available at* http://aceee.org/pubs/u041.pdf (stating that the efficiency programs in the aggregate are very cost-effective, with savings ranging from $0.023 to $0.044/kWh).

10. Energy Info. Admin., *Executive Summary*, ELECTRIC POWER MONTHLY, Nov. 2008, at 3, *available at* http://www.eia.doe.gov/cneaf/electricity/epm/execsum.pdf. *See generally* ENERGY INFO. ADMIN., TOTAL ELECTRIC POWER SUMMARY STATISTICS, http://www.eia.doe.gov/cneaf/electricity/epm/tablees1a.html (providing periodically updated reports on average electricity prices).

11. LAZARD, LEVELIZED COST OF ENERGY ANALYSIS—VERSION 2.0, at 2 (2008), *available at* http://www.narucmeetings.org/Presentations/2008 EMP Levelized Cost of Energy Master June 2008 (2).pdf.

12. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS, *in* CLIMATE CHANGE 2007: MITIGATION (CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE IPCC) 9, 10 tbl.SPM.3 (Bert Metz et al. eds., 2007), *available at* http://www.ipcc.ch/ipccreports/ar4-wg3.htm (follow "Summary for Policymakers" hyperlink). This is partly attributable to the fact that the IPCC's methodology includes electricity-generation-related GHG emissions in the end-use sectors rather than in the energy-supply sector. *Id.* at 10.

by 40%: 16% from buildings; 13% from transportation and smart growth communities; and 11% from industrial efficiency.[13] The NRDC study found its projections to be consistent with those of the McKinsey analysis, which examines emissions reductions through 2030.[14] The results of this analysis are depicted in Figure 1 below.[15]

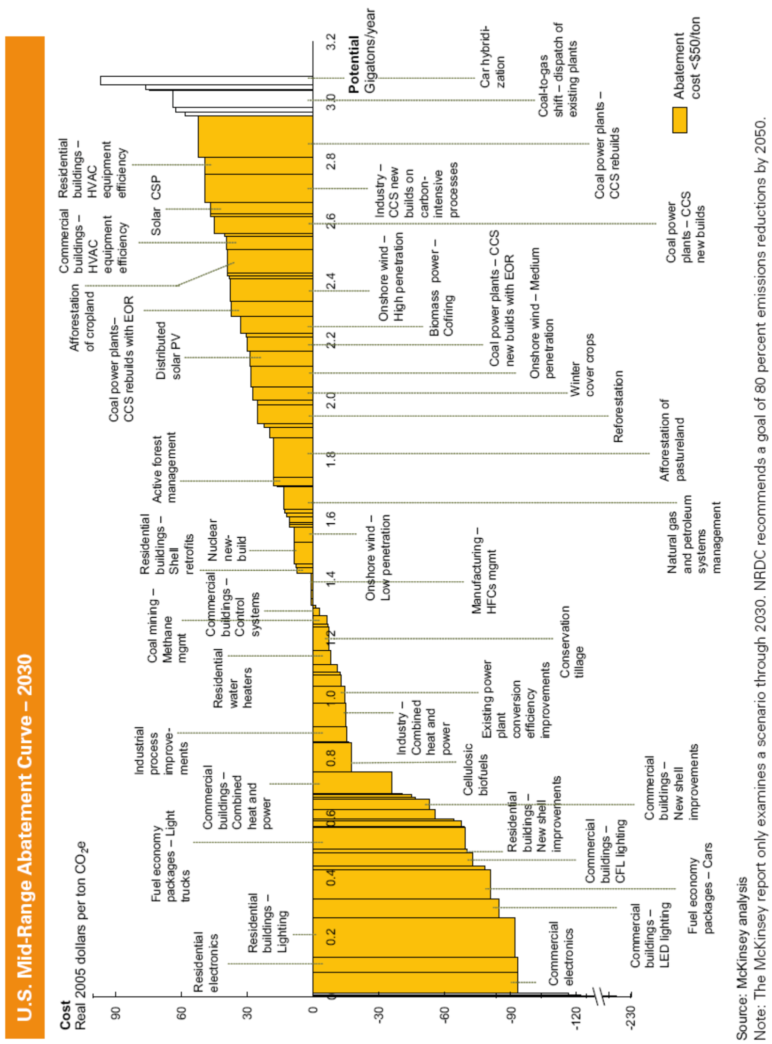

Figure 1: Cost of Energy Efficiency Measures and Scale of Potential in the United States Through 2030.

13. RICK DUKE ET AL., NATURAL RES. DEF. COUNCIL, THE NEW ENERGY ECONOMY: PUTTING AMERICA ON THE PATH TO SOLVING GLOBAL WARMING 6 fig.1 (2008), *available at* http://www.nrdc.org/globalWarming/energy/eeconomy.pdf.

14. *Id.* at 20.

15. *Id.* at 21 fig.9.

Figure 1 ranks GHG reduction potential by cost from left (greatest savings to implement) to right (most expensive to implement). The width of the bars represents the magnitude of potential GHG reductions in each category of actions. The carbon-reduction options on the left end of the graph are almost all energy-efficiency technologies. These efficiency options show a negative net cost of CO_2 abatement and account for almost half of the total emission reductions on the graph. Importantly, the net financial savings from the efficiency options offset the costs of the emission reductions on the right side of the graph—those with net positive costs. These efficiency technologies are therefore essential to achieving an entire package of emissions reductions at a low net cost to the economy.

Analyses in the United States, as in most countries, "have shown that the efficiency potential has been tapped only in small measure."[16] These analyses, coupled with the IPCC and McKinsey studies, confirm that efficiency presents a major opportunity for addressing climate change.[17] Furthermore, these studies show that with policy commitments, aggressive efficiency investments can meet most of the expected growth in U.S. energy demand.[18] Accelerated energy-efficiency technology development can arrest the growth in GHG emissions that would otherwise occur with continuing demand growth, especially in the power sector.[19]

One of the principal aims of cap-and-trade programs is to lower the overall societal cost of environmental improvement. Efficiency studies and two decades of utility Demand Side Management (DSM) experience remind us that it will cost far less to avoid carbon emissions through energy efficiency than by adding or substituting expensive low-emissions generation on the grid. Thus it is entirely consistent with the overall goals of cap-and-trade to design a trading system that builds directly on efficiency as a resource. Simply stated, a carbon program that directly mobilizes end-use efficiency will cost less and achieve more than one that focuses only on

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16. Steven R. Schiller, Bill Prindle, Richard Cowart, & Arthur H. Rosenfeld, Energy Efficiency and Climate Change Mitigation Policy 3 (Aug. 17 2008), (unpublished manuscript, *available at* http://www.schiller.com/images/Schiller_et_all_energy_efficiency_climate_paper.pdf) (recommending reducing greenhouse gas emissions through increased energy efficiency). *See also* STEVEN NADEL ET AL., THE TECHNICAL, ECONOMIC AND ACHIEVABLE POTENTIAL FOR ENERGY-EFFICIENCY IN THE U.S. 1 (2004), *available at* http://aceee.org/conf/04ss/rnemeta.pdf (explaining that "a very substantial technical, economic and achievable energy efficiency potential remains in the U.S."); INTERLABORATORY WORKING GROUP ON ENERGY-EFFICIENT AND CLEAN-ENERGY TECHNOLOGIES, SCENARIOS FOR A CLEAN ENERGY FUTURE 7.1 (2000), *available at* http://www.ornl.gov/sci/eere/cef/ (follow "Chapter 7—Electricity Sector" hyperlink under "Main Report" heading) (noting that "[s]ignificant opportunities exist to reduce the demand for electricity").

17. Schiller, *supra* note 16, at 3.

18. *Id.*

19. *Id.*

generators. However, realizing these opportunities will take policy actions, including improvements in the allocation of carbon credits in any national cap-and-trade program.

B. Cap-and-Trade Basics: Why Cap-and-Trade Must Be Modified to Support Efficiency

There is pretty broad agreement among air experts that the U.S. Acid Rain Program and similar programs modeled on it—including the Nitrogen Oxide (NO_x) trading program—have successfully lowered emissions at a lower cost than historic command-and-control systems.[20] The success of this model has led many decision makers to conclude that carbon cap-and-trade programs should be built on the same basic structure. However, this does not mean that we should extend this model directly to carbon cap-and-trade systems. There are several crucial differences.

First, carbon-reduction programs are going to involve a lot more dollars including much larger economic transfer payments over time. Any flaws in architecture will have a much greater impact on both efficiency and equity goals.

Second, energy markets are profoundly different today. When the Acid Rain Program was designed, almost all generators were part of vertically integrated, rate-regulated companies. Generators compliant with their emissions allotment did not need to purchase additional allowances. Generators needing to purchase allowances could pass through their direct costs in rate cases on a cost-of-service basis. In either case, vertically integrated utilities—regulated on a cost-of-service basis—could charge consumers only their direct compliance costs. Today, U.S. power markets are much more complex, and a large fraction of the power sold passes through wholesale markets that are not rate regulated. In those markets, carbon policy can raise the price of all power sold in the market, including power from plants that have no carbon costs. As a result of these market effects, cap-and-trade designs that might work well in about half the nation would confer windfall gains on generators and inequitable results for consumers in the other half.[21]

20. *See, e.g.*, Press Release, The White House, Executive Summary—The Clear Skies Initiative (Feb. 14, 2002), *available at* http://www.whitehouse.gov/news/releases/2002/02/clearskies.html (stating that the Acid Rain Program "achieved significant reductions at two-thirds of the cost to accomplish those reductions using a 'command and control' system").

21. Using the single-price auction rules now governing organized wholesale markets, all generators get the benefit of higher clearing prices, and all consumers have to pay (some immediately, some later when long-term contracts turn over). If fossil units setting the clearing price raise their bids due to the value of allowances that they must use, costs will rise for consumers across all megawatt-

Third, control options for carbon and conventional pollutants are quite different. Sulfur Oxide (SO_x) and NO_x reductions can usually be attained by generators at power stations through changes in fuel inputs—switching to low-sulfur coal, for example—or plant modifications, such as scrubbers. In contrast, there is today no practical way to add a carbon scrubber to a conventional power plant.[22] Real reductions in carbon intensity will come primarily from actions taken mostly by power buyers. Such actions include substituting gas or renewables in the resource mix of a load-serving entity or adding more efficiency and reducing consumption generally. Consumers—not fossil generators—will need to take and pay for these actions. It is widely understood that the Acid Rain Program did almost nothing to promote end-use efficiency.[23] A climate-change program will have to inspire substantial end-use efficiency improvements in order to be effective.

For these reasons, it is increasingly apparent that national climate legislation will need to (1) include design elements to avoid windfall gains to generators in states with competitive wholesale markets; (2) promote renewable power and other portfolio improvements among utility load-serving entities; and (3) deliver much more energy efficiency than we could expect from an Acid Rain-style cap-and-trade program alone.

C. Cap and Market Realities: Why Carbon Prices Alone Will Not Deliver Needed GHG Reductions in the Power Sector

Economists and policy makers often assume that a carbon tax or its equivalent, such as an auction of pollution credits,[24] will significantly

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hours (MWh) sold in that market. These costs to consumers can be much higher than the actual cost of allowances to generators, especially if the allowances were awarded to emitters for free. *See infra* Part II.D.

22. *See supra* note 7.

23. *See generally* Dallas Burtraw et al., *Allocation of CO_2 Emissions Allowances in the Regional Greenhouse Gas Cap-and-Trade Program* 15–21 (Resources for the Future Discussion Paper 05-25, 2005), *available at* http:/www.rff.org/documents/RFF-DP-05-25.pdf [hereinafter ALLOCATION OF CO_2 EMISSIONS ALLOWANCES] (discussing the negatives of the Acid Rain Program compared to the RGGI).

24. These effects are expected whether tradable allowances are sold at auction or distributed to emitters for free. Most economists agree that once credits are made tradable through a cap and trade system, they represent an opportunity cost to emitters and will put upward pressure on power prices in wholesale markets regardless of whether they were initially sold to emitters or distributed for free. CONG. BUDGET OFFICE, SHIFTING THE COST BURDEN OF A CARBON CAP-AND-TRADE PROGRAM 17 (2003), *available at* http://www.cbo.gov/doc.cfm?index=4401. *See also* Dallas Burtraw et al., *The Effect of Allowance Allocation on the Cost of Carbon Emission Trading* 15–25 (Resources for the Future Discussion Paper 01-30, 2001), *available at* http://www.cba.ufl.edu/purc/docs/presentation_2004Palmer_Effect.pdf [hereinafter *The Effect of Allowance Allocation*] (analyzing three different approaches for distributing carbon emission allowances under an emission-trading program in the electricity sector).

reduce the electric-power sector's carbon footprint if set at a realistic level. Those reductions are expected to come chiefly from two sources: demand reductions by consumers and changes in the generation mix. In reality, it is very difficult to produce significant reductions in either location at carbon prices that governments in the United States can realistically expect to impose.

1. Carbon Prices Alone Will Not Deliver an Adequate Consumer Conservation Response

On the demand side, it is difficult through price signals alone to inspire a conservation response among consumers that will deliver the socially optimal level of investment in end-use efficiency. Cap-and-trade architects know that lowering carbon emissions from power plants will raise the cost of electricity, and they assume that those price increases will reduce consumption.[25] Influenced by standard economic theory on internalized external costs, they often view increased power prices as desirable, and any resulting demand reductions as merely a consequence of the program.[26] A better approach is to view avoidable increased costs as undesirable, and efficiency as an integral component of the cap-and-trade program.

There are two related reasons for this approach. To begin with, there are numerous, well-documented market barriers to cost-effective efficiency investments. Those market barriers are not removed by carbon prices being applied to power generators. They will continue to block needed improvements, despite any rate increases that could possibly be expected to flow from a politically acceptable carbon cap-and-trade program.[27] Builders do not pay the energy bills in the offices and homes they build. Consumers are confused by energy choices and apply very high discount rates to incremental costs for energy efficiency. Many homeowners do not expect to live in a home long enough to recover the savings from efficiency improvements, even though the investment may be cost-effective over the

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25. *See generally* Dallas Burtraw & Karen Palmer, *Compensation Rules for Climate Policy in the Electricity Sector* 1–2 (Resources for the Future Discussion Paper 07-41, 2007), *available at* http://www.rff.org/rff/Documents/RFF-DP-07-41.pdf [hereinafter *Compensation Rules For Climate Policy*] (discussing the effects of cap-and-trade strategies); *The Effect of Allowance Allocation*, *supra* note 24, at 2 (discussing the potential pitfalls of cap-and-trade).

26. *See The Effect of Allowance Allocation*, *supra* note 24, at 2.

27. There is extensive literature detailing these market barriers, including access to information, high first-cost problems, consumers' high discount rates, unpriced externalities, the landlord-tenant problem, and others. *See, e.g.*, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., QUANTIFYING THE EFFECTS OF MARKET FAILURES IN THE END-USE OF ENERGY, at iii-vi (2007), *available at* http://www.aceee.org/energy/IEAmarketbarriers.pdf (detailing the various types of market barriers to end-use energy efficiency).

life of the structure. A new American Council for an Energy-Efficient Economy (ACEEE) study reports that up to 50% of residential energy use in the United States is affected by such barriers.[28] Even large industrial customers tend to underinvest in efficiency and need further technical and financial incentives to apply energy-saving solutions.[29]

Moreover, whether due to market barriers or not, there is solid evidence extending over several decades that demand for electricity in our modern economy is relatively inelastic. Demand does respond somewhat to price, but the long-term reduction due to price increases is relatively small.[30] Over twenty years, a 10% increase in power prices will reduce demand by just 2.5% to 3%.[31] This would only offset the normally expected load growth in less than two of those twenty years. It would take a much larger rate increase just to offset expected load growth, much less to produce reductions in demand that could permit absolute reductions in emissions from the nation's huge generation fleet.

2. Carbon Prices Delivered to Generators Must be Quite High to Significantly Alter Generator Dispatch

The second problem with cap-and-trade designs that rely on carbon prices to alter power-sector emissions results from the make-up of the U.S. generation fleet. It takes a very high carbon price to materially alter the dispatch order, and therefore emissions, resulting from generation in the usual course of business. Although this fact can be demonstrated through complex power models, the reasons are logical and straightforward:

- On a daily and hourly basis, power plants are dispatched largely in the order of their marginal operating costs. In competitive wholesale markets, they are dispatched in the order of their bid prices, which are logically based on those marginal costs.

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28. *See id.* at v–vi (noting that among the various types of market barriers, principal-agent barriers—one that results from agents failing to make energy decisions on behalf of their principal—affects up to 50% of U.S. energy usage).

29. *Id.* at vii.

30. The long-term price elasticity of demand is approximately –0.25 to –0.32. The U.S. Department of Energy's National Energy Modeling System (NEMS) has price elasticity built into it. Their long-run elasticity (assuming price effects remain for twenty years) are –0.31 for residential electric use and –0.25 for commercial electric use. Steven H. Wade, *Price Responsiveness in the NEMS Buildings Sector Model*, *in* ENERGY INFO. ADMIN., ISSUES IN MIDTERM ANALYSIS AND FORECASTING 1999 (1999) 55, 58 tbl.1, *available at* http://www.eia.doe.gov/oiaf/issues/pdf/060799.pdf.

31. See *id.*

- Because they do not burn fossil fuels, power plants with the lowest GHG emissions—such as hydro stations and wind farms—tend to have low marginal costs. Therefore, they are dispatched whenever they are available. Nuclear units are also dispatched whenever they are available. Thus, the existence of high carbon prices does little to cause these low-emitting units to run more often.

- Carbon prices will force modest improvements in the performance of fossil plants. Some relatively efficient plants will displace less-efficient plants in the dispatch order. However, these impacts will be small in GHG terms. To greatly improve the emissions profile of the existing U.S. power fleet, it would be necessary for a large number of lower-emitting gas units to displace a large number of higher-emitting oil and coal units in the dispatch.

- Carbon taxes and allowance auction prices affect all fossil units to some degree. Therefore, carbon prices would drive up the cost of gas as well as coal. It would take a relatively high price to cause the marginal price of coal generation to exceed the marginal price of gas generation.

Applying that high carbon price across all generation can greatly raise the price of power, particularly if the total cost to consumers is measured in terms of cost per ton of avoided GHG emissions. This problem has been documented in a variety of studies. One report from the Electric Power Research Institute modeled the effect of various levels of carbon taxes or allowance prices in the upper Midwest, which is highly dependent on coal, and in Texas, which relies heavily on gas.[32] That study found that in the upper Midwest, a carbon charge of $25 per ton would raise wholesale power prices by $21 per MWh.[33] This would almost double the wholesale price of electricity in that region, but have little impact on emissions. "[E]ven a CO_2 value of $50/ton would produce only a 4 percent reduction in regional emissions given the current generation mix."[34] In Texas, the problem is different, but the result is similar. Because gas plants comprise a large fraction of the ERCOT mix, and are at the margin already, high carbon prices raise the price of power with very little impact on overall emissions: "When gas is selling for around $8/Mmbtu [million British

32. Victor Niemeyer, *The Change in Profit Climate: How Will Carbon-Emissions Policies Affect the Generation Fleet?*, PUB. UTILS. FORTNIGHTLY, May 2007, at 20, 24.

33. *Id.* at 24.

34. *Id.*

Thermal Units], even a CO_2 value of $40/ton produces little emissions reduction" from the existing mix.[35]

3. The Good News: Efficiency Programs are More Powerful than Price Increases or Supply-side Carbon Prices

The existence of market barriers and inelastic demand does not mean that the efficiency resource is small. It must, however, be tapped through proven techniques that surmount those obstacles. More than two decades of experience with utility DSM programs has demonstrated in practice that well-managed efficiency programs can deliver significant savings to the power grid, and thus can lower carbon emissions at a low cost to the nation.

The power system will realize about five to seven times more savings from each dollar spent in a well-managed efficiency program—in MWhs and resulting GHG emissions—than it will through a generalized, across-the-board price increase. The following example illustrates this reality. The example calculates the reductions in GHG emissions likely to result from two cases using the generation, rates, and sales characteristics of a large U.S. Midwestern state:

(a) Adding a 3% increase in prices, such as might result from a rate increase or a small increase in fuel prices due to an upstream carbon tax or auction price; and

(b) Taking the same 3% rate increase or carbon cost, but assuming that the revenue is invested in utility-sponsored or third-party energy efficiency programs at a cost of 3 cents/kWh.[36]

Due to the low price elasticity of demand for electricity, the rate increase itself would result in a small decrease in demand and a corresponding reduction in emissions. If the proceeds from a system-benefit charge or carbon-credit auction are invested in programmatic energy efficiency, however, the savings are much greater—in both MWhs and in GHG emission reductions.[37] Figure 2 illustrates that investing the proceeds of a carbon charge in energy efficiency in this manner will in fact increase

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35. *Id.*

36. Many successful efficiency programs deliver significant savings at an average cost of roughly three cents per kWh saved. MARTIN KUSHLER ET AL., *supra* note 9, at 30 tbl.5.

37. "A [system-benefit charge is a] charge on a consumer's bill from an electric distribution company to pay for the costs of certain public benefits such as low-income assistance and energy efficiency." N.H. Pub. Util. Comm'n, Terms and Definitions, http://www.powerischoice.com/pages/glossary.html#Systems_Benefits (last visited Nov. 28, 2008).

the savings by a factor of five in the first decade.[38] Extended over a longer time frame, the savings will grow to seven times larger through intentional efficiency programs than through the price increase alone.[39]

Pollution programs that focus only on the supply side raise the price of electricity, but only incidentally reduce demand. For a given cost to consumers, society can reduce much more carbon pollution through energy-efficiency programs than it can through cap-and-trade programs that focus only on the supply side. Cap-and-trade programs raise the price of electricity, but only incidentally reduce demand.

II. CAP-AND-TRADE DESIGN CHOICES FOR EFFICIENCY

How can cap-and-trade architecture mobilize efficiency for carbon reduction?

A. *Lessons from RGGI and the Northeast States: The Consumer Allocation*

The Regional Greenhouse Gas Initiative (RGGI) is the leading effort in the United States to cap GHG emissions from the power sector. The RGGI region now extends to ten states, stretching from Maine to Delaware.[40] The RGGI Memorandum of Understanding sets out the essential elements of a proposed model rule, which are being adopted by each participating state.[41] Rulemakings have been completed across the region, with cap-and-trade implementation set to begin in 2009.[42]

One of the key achievements of the RGGI process has been the creation of a formal consumer allocation of carbon credits, rather than the automatic allocation of all credits to generators on the basis of their historic

38. Given Ohio's consumption levels and power mix, raising rates without adding programmatic energy-efficiency investments would save about 83 million tons of CO_2 between 2007 and 2018; raising rates along with energy-efficiency investment would save nearly 420 million tons over the same period.

39. Over a twenty-year period the ratio stabilizes at about 7:1. This is because some of the early efficiency measures are retired, and program funds are used to replace the savings they were delivering.

40. Six states in New England, plus New York, New Jersey, Delaware, and Maryland, have enacted implementing regulations. Pennsylvania is officially an observer state, and unlikely to join RGGI soon. Reg'l Greenhouse Gas Initiative, The Ten States, http://www.rggi.org/states/ten_states (last visited Nov. 28, 2008).

41. REG'L GREENHOUSE GAS INITIATIVE, MEMORANDUM OF UNDERSTANDING, 6–7 (2005), *available at* http://www.rggi.org/docs/mou_12_20_05.pdf [hereinafter MEMORANDUM OF UNDERSTANDING]. Although styled as a "regional" effort, there is no regional governmental body with regulatory authority to implement RGGI. Individual states must enact their own regulations, simply agreeing to recognize carbon-credit trading with credits from other states on a reciprocal basis. *Id.* at 7.

42. Press Release, Reg'l Greenhouse Gas Initiative, RGGI States Announce Preliminary Release of Auction Application Materials (July 11, 2008), *available at* http://www.rggi.org/docs/20080711news_release.pdf.

emissions.[43] This is a significant departure from previous cap-and-trade regimes. Depending on how states implement this objective and the market price of allowances, it could substantially advance investments in energy efficiency in the RGGI region. A recent analysis by the RGGI state staff

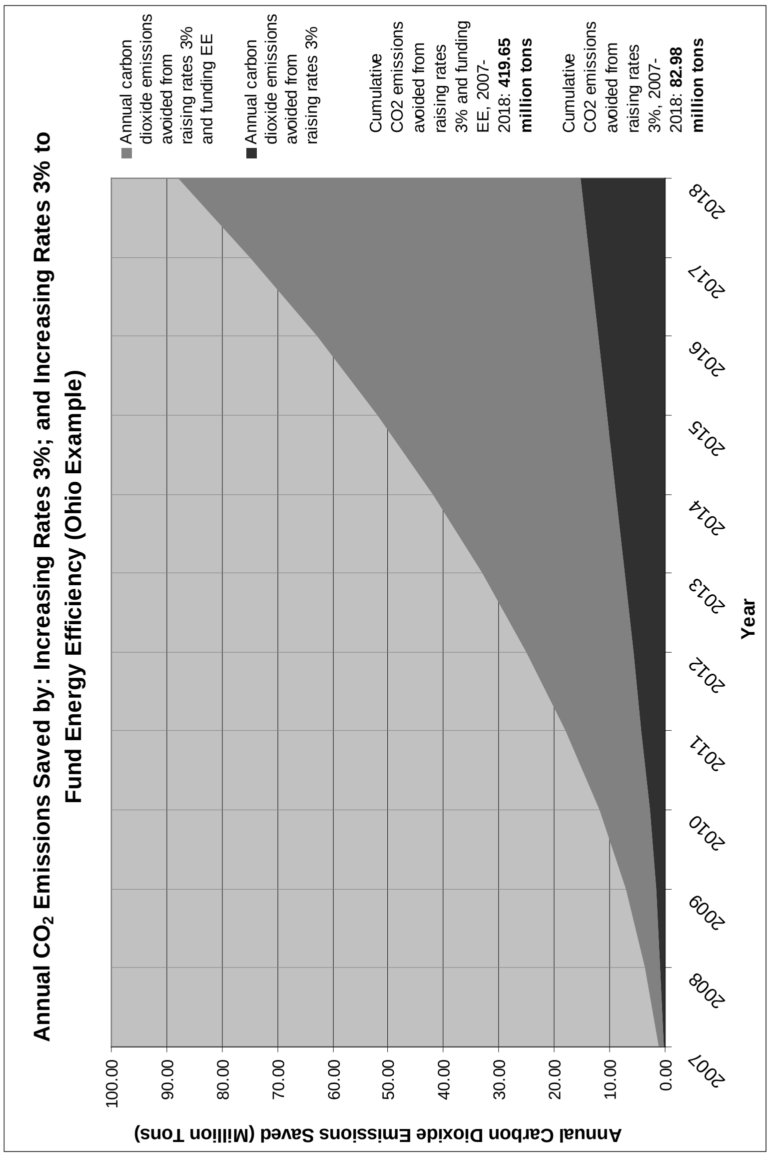

Figure 2: Efficiency programs save five to seven times more carbon than carbon taxes or auction prices (for the same consumer cost).

43. MEMORANDUM OF UNDERSTANDING, *supra* note 41, at 6.

found that if 100% of RGGI allowances were auctioned in each state, per-capita energy-efficiency program spending could increase by 10% to 443% for each state if allowances sell for $2 per ton; or by 15% to 664% if allowances sell for $3 per ton.[44]

1. Two Purposes for the Consumer Allocation: Recapturing Windfalls and Promoting Efficiency

Both experience and economic studies show that there can be very large generator windfalls from the wrong type of carbon allocation. Several studies on the free allocation of carbon allowances to generators have found the likelihood of substantial windfall gains to such generators. One study prepared for RGGI estimated that total generator windfalls from 100% historic free allocation could total $1 billion or more annually.[45] More generally, the Congressional Budget Office found that for the nation as a whole, "[p]roducers would have to receive only a modest portion of the allowances to offset their costs from a cap on carbon emissions."[46] European governments that initially allocated allowances to generators on a free, historic basis are now having second thoughts based on their experiences.[47]

The simplest way to solve these problems, and reduce the unnecessary rate impacts of a generator-based cap, is to award a large fraction of allowances in each compliance period to consumers, represented by their distribution companies or other supervised trustees acting on their behalf. By then selling these allowances in the credits market to generators, consumers' agents can recover through the credits market some of the generator windfalls that flow from the structure of today's wholesale power market. This revenue-recapture mechanism is essentially a market-based means of doing through program design what regulators historically would have done through cost-of-service ratemaking.

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44. REG'L GREENHOUSE GAS INITIATIVE, POTENTIAL EMISSIONS LEAKAGE AND THE REGIONAL GREENHOUSE GAS INITIATIVE 19 (2008), *available at* http://www.rggi.org/docs/20080331leakage.pdf.

45. ALLOCATION OF CO_2 EMISSIONS ALLOWANCES, *supra* note 23, at 52 tbl.19 (2005).

46. CONG. BUDGET OFFICE, ISSUES IN THE DESIGN OF A CAP-AND-TRADE PROGRAM FOR CARBON EMISSIONS 3 (2003), *available at* http://www.cbo.gov/ftpdocs/48xx/doc4861/11-25-CapTradeBrief.pdf. Others have found that generators would require as little as 11% of allowances to recover their compliance costs in a cap-and-trade program. *Compensation Rules For Climate Policy*, *supra* note 25, at 41.

47. *See, e.g.*, ENVIRONMENTAL AUDIT COMMITTEE, THE INTERNATIONAL CHALLENGE OF CLIMATE CHANGE: UK LEADERSHIP IN THE G8 & EU, 2004–05, H.C. 105, at 17, *available at* http://www.publications.parliament.uk/pa/cm200405/cmselect/cmenvaud/105/105.pdf ("[T]he use of grandfathering as a means to allocate emissions permits is likely to result in substantial windfall profits for power generators throughout the EU.").

2. Using the Consumer Allocation to Support Efficiency and Lower the Cost of Carbon Management

Recapturing and recycling generators' price increases to consumers will lower the consumer cost of a carbon-capture program. But in what form should those benefits be returned to consumers? Some consumer advocates will naturally propose that revenues from the sale of carbon credits should be returned to consumers in the form of rate rebates. However, this will not produce the best long-term results for consumers.

The best outcome for consumers as a whole, and the best way to lower the societal cost of carbon reduction, is to invest carbon-credit revenues in low-carbon resources—especially low-cost energy efficiency measures. There is good evidence for this conclusion. For example, modeling runs conducted by ACEEE for RGGI revealed that increasing the region's spending on energy efficiency was the key to lowering the overall cost of RGGI's planned carbon reductions to the economy. That study found that doubling investments in energy efficiency throughout the RGGI region would lower projected load growth by two thirds by 2024.[48] Efficiency also reduces carbon emissions, holding them roughly constant during the same period—compared to a 15% rise in the base case—and greatly reducing the cost of meeting RGGI's overall carbon objectives.[49] The ACEEE study also concluded that doubling efficiency could avoid around 8,000 MW of new capacity additions, and by 2021 would reduce the average annual household power bill by over $100.[50]

Although the nation's supply of low-cost efficiency investment opportunities is not infinite, the untapped efficiency reservoir is quite large. Additional investments in cost-effective efficiency measures will provide a large initial block of carbon reduction at the lowest cost to consumers and the economy. Governments can provide a greater long-term benefit to consumers by selling carbon credits to emitters and investing the revenues in low-cost efficiency rather than using the funds to provide short-term consumer rebates. Recycling the credit revenues through efficiency services can lower the cost of carbon reduction to consumers and the economy. It can also advance other goals, including lower power bills, avoiding

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48. WILLIAM R. PRINDLE, ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., ENERGY EFFICIENCY'S ROLE IN A CARBON CAP-AND-TRADE SYSTEM: MODELING RESULTS FROM THE REGIONAL GREENHOUSE GAS INITIATIVE, at iii (2006), *available at* http://aceee.org/pubs/e064.pdf.

49. *Id.*

50. *Id.* at iv.

expensive transmission and distribution upgrades, and greater power-system reliability.[51]

3. The Current Status of the Consumer Allocation

In December 2005, the governors of seven of the RGGI states signed the RGGI Memorandum of Understanding, which includes a provision requiring each state to assign at least 25% of its carbon allowances to a consumer allocation.[52] Shortly thereafter, Vermont enacted legislation confirming Vermont's participation in RGGI and creating a 100% consumer allocation of carbon credits to be applied entirely to energy efficiency.[53] The legislation stated:

> In order to provide the maximum long-term benefit to Vermont electric consumers, *particularly benefits that will result from accelerated and sustained investments in energy efficiency* and other low-cost, low-carbon power system investments, the public service board . . . *shall establish a process to allocate 100 percent* of the Vermont statewide budget of tradable power sector carbon credits and the proceeds from the sale of those credits through allocation to one or more *trustees acting on behalf of consumers* . . . .[54]

Vermont thus became the first jurisdiction to create a substantial consumer allocation of power-sector carbon credits and the first to use those credits to finance expanded investments in energy efficiency.[55]

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51. Reduced consumption will lower power-market clearing prices, producing an anti-windfall effect benefiting all consumers. It will also lower power bills for consumers who install efficiency measures and it will lower demands on transmission facilities and improve reliability. *See generally* RICHARD COWART, REGULATORY ASSISTANCE PROJECT, EFFICIENT RELIABILITY: THE CRITICAL ROLE OF DEMAND-SIDE RESOURCES IN POWER SYSTEMS AND MARKETS (2001), *available at* http://www.raponline.org/Pubs/General/EffReli.pdf (providing an overview of the multiple benefits of power-sector end-use efficiency).

52. *See* MEMORANDUM OF UNDERSTANDING, *supra* note 41, at 6. In 2007, Massachusetts, Rhode Island and Maryland signed the Memorandum of Understanding and joined the initiative. Reg'l Greenhouse Gas Initiative, History, http://www.rggi.org/about/history (last visited Dec. 9, 2008).

53. 2006-123 Vt. Adv. Legis. Serv. 1 (LexisNexis) (codified at VT. STAT. ANN. tit. 30 § 255(c)(2) (2007).

54. *Id*. at 90 (emphasis added).

55. In 2008, the Vermont legislature revisited this issue, confirmed the consumer allocation for efficiency, and directed that the credit value be used to support efficiency in buildings across all fuels on a "whole buildings" basis. *See* Vermont Energy Efficiency and Affordability Act, 2008-92 Vt. Adv. Legis. Serv. 11, 15 (LexisNexis) (to be codified at VT. STAT. ANN. tit. 30 § 235) (stating that "programs, measures, and compensation mechanisms shall include fuel efficiency services that . . . produce whole building and process heat efficiency").

Other states in the RGGI region are also allocating a significant percentage of allowance proceeds to energy efficiency. For example, in New York, the largest RGGI state, up to 97% of allowances will be auctioned, with up to 100% of auction proceeds dedicated to improving energy efficiency.[56] In Connecticut at least 70% of allowance proceeds will be invested in energy efficiency and conservation programs.[57] In Maine, most allowance proceeds will be transferred to a consumer-benefit account, with a portion targeted at manufacturing facilities' combined usage of heat and power.[58] Massachusetts Department of Energy Resources regulations express an intention to use the proceeds for energy efficiency, and additional legislation is pending.[59] Currently, most states are in the process of codifying how allowances are used through proposed legislation and rulemaking proceedings. Between 90% and 100% of allowances currently are expected to be auctioned in each state. Some of the states are directing a percentage of allowances for certain set-asides or direct allocations, but these are transitional and are expected to phase out over time. In every state that is in the more advanced stages of its decision making, energy efficiency is the primary activity for RGGI allowance proceeds. Across the ten-state RGGI region, approximately 90% of total allowances will be auctioned, with as much as 80% of auction revenues dedicated to investments in end-use energy efficiency.[60]

B. *Creating a Performance-Based Efficiency Allocation in National Climate Legislation*

A number of observations can be drawn from the experience of power-sector efficiency programs, from the history of air-quality programs, and from the efforts underway in the RGGI and western states to design state and regional cap-and-trade programs.[61] Congress can build on those experiences in enacting cap-and-trade legislation. It should create a national, performance-based carbon allocation for efficiency with a significant fraction of carbon allowances. The purpose of this allocation is

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56. ENV'T NE., STATE POLICY STATUS (2008), *available at* http://www.env-ne.org/public/resources/pdf/ENE_RGGI_StatePolicyStatusTable_082908.pdf.

57. *Id.* For a complete summary of state allocation policies as of November 2008, see *infra* app. 1.

58. Press Release, Me. Dep't of Envtl. Prot., DEP Issue Profile: Regional Greenhouse Gas Initiative (July 23, 2008), *available at* http://maine.gov/dep/air/greenhouse/pdf/RGGI issue profile (2).pdf.

59. Mass. Dep't of Envtl. Prot., Frequently Asked Questions: Regional Greenhouse Gas Initiative (RGGI), http://www.mass.gov/dep/air/climate/rggifaq.htm (last visited Nov. 28, 2008).

60. *See infra* app. 1.

61. Although the focus in this testimony is on the power sector, there could be separate allocations for improved efficiency in the utility sectors as well as in the buildings and transportations sectors.

to encourage states and utilities to accelerate the delivery of energy efficiency services to families and businesses in their states. Accelerated investments in efficiency, as shown above, will:

- Reduce power-sector GHG emissions at a lower cost than other options;
- Lower bills for consumers by offsetting other energy cost increases stemming from world market forces or climate-change legislation;
- Lower price pressure on carbon allowances, providing a cost-containment benefit to the entire climate program;
- Reduce demand growth on power grids, improving reliability and reducing the need for generation and transmission investments that are more expensive and present greater economic risks; and
- Improve the nation's energy security by reducing demand for imported energy.

Under this proposal, a significant fraction of allowances created in a national cap-and-trade system would be allocated annually to states and/or local electric and gas utilities. This policy would promote and reward the multitude of state and local actions that are necessary to deliver greater energy efficiency in millions of customer locations and communities across the nation.

The efficiency allocation should be performance based. At first, allowances could be allocated to every state based on its population and historic energy consumption. After an initial ramp-up period of four to five years, the national program administrator should establish standard measures for the distribution of allowances to states to reflect their rate of improvement in efficiency. Each state's annual allocation would be based on demonstrated improvement against that state's own historic baseline, providing an even-handed way to encourage greater efficiency in each jurisdiction. This approach would neither favor today's most-efficient states nor grandfather a high level of emissions allocations to today's high-emitting states. The administrator should take recent state efficiency initiatives into account by setting the baseline years prior to their implementation.

The least-expensive method for attaining national emission reductions is through improved energy efficiency, but most of the work has to be done locally and through state policies. At least 30% of allowances should be distributed to states to encourage aggressive state action. The national program would not need to dictate methods or means of achieving efficiency goals. States, local governments, utilities, and third parties should be free to use a variety of techniques and to experiment. Building codes, standards, incentives, utility programs, ratemaking, smart-growth policies, competitive acquisition, and other techniques can all be supported without the need for national rules or standards.

With respect to the use of allowance values, national legislation could either establish eligible categories of expenditures or categories of recipients, or leave distributional questions to the states. If distribution among the states is performance based—and based on the right criteria—then national objectives will be met regardless of how states distribute allowances or spend the revenue.

CONCLUSION

National climate-change legislation faces the daunting challenge of setting a path to achieve deep reductions in GHG emissions while moderating both societal economic costs and consumer costs from the program. Greatly enhanced end-use energy efficiency is critical to achieving all of these goals, and national climate legislation should be designed to capture efficiency resources. It could do so both through direct federal actions and by providing incentives to states, utilities, and other service providers. Policy makers and program designers should take account of the following lessons in crafting carbon cap-and-trade and other national climate legislation:

- A carbon program that directly mobilizes end-use efficiency will cost less and achieve more than one that focuses only on generators.

- Portfolio management policies such as renewable standards, environmental dispatch, loading orders giving priority to efficiency investments, and efficiency resource standards will provide the most carbon savings and lower the cost of any power-sector cap-and-trade system.

- Free allocation of carbon credits to generators based on historic emissions can lead to substantial windfall gains to generators, especially in today's organized wholesale markets.

- Merely increasing the price of fossil power through carbon taxes or credit auctions will not significantly reduce demand and will therefore be an expensive path to GHG reductions.

- An auction of emissions allowances with revenues devoted to energy efficiency is a positive way to use the "polluter pays" principle and to fund low-cost GHG reductions at the same time.

APPENDIX 1

Allowance Allocations, Auction Fractions, and Revenues for Energy Efficiency in the Ten States of The Regional Greenhouse Gas Initiative (as of October 31, 2008)

(A) State	**(E) Annual Allocation (short tons)**[*]	**(F) Percentage of Allowances to be Auctioned**	**(G) Percentage of Auction Proceeds for Energy Efficiency**	**(H) Net RGGI Funding for Energy Efficiency**[**]
Connecticut	10,695,036	77%	69.5%	53.5% up to $5[λ]
Delaware	7,559,787	60% (increasing to 100% by 2014)	Up to 65%[†]	39% in 2009, increasing to 65% in 2014[†]
Maine	5,984,902	100%	Up to 88%[α]	Up to 88% up to $5[λ]
Maryland	37,503,983	85%	46%	39%
Massachusetts	26,660,204	98%	Not less than 80%	Not less than 78.4%
New Hampshire	8,620,460	At least 71% through 2011, at least 83% thereafter	Up to 90%	Up to 63% through 2011, up to 75% thereafter[ω]
New Jersey	22,892,730	Up to 99% (with $2 allowances set aside for CHP and direct allocation to Co-generation)[δ]	Up to 80%	Up to 79%
New York	64,310,805	97%	Up to 100%[†]	Up to 97%[†]
Rhode Island	2,659,239	99%	Up to 95%[ρ]	Up to 94%[ρ]
Vermont	1,225,830	99%	100%[θ]	99%[θ]
RGGI Total	188,112,976			
RGGI Weighted Average[π]		91%	80%	74%

* ENVIRONMENT NORTHEAST, STATE POLICY STATUS (2008), *available at* http://www.env-ne.org/public/resources/pdf/ENE_RGGI_StatePolicyStatusTable_082908.pdf.

** The product of column (F), the percentage of allowances to be auctioned, and column (G), the percentage of auction proceeds earmarked for energy efficiency.

† Means that energy efficiency is one option on a list that includes renewable energy and other clean energy investments and details on distributions of the proceeds are yet to be worked out. ENVIRONMENT NORTHEAST, STATE POLICY STATUS (2008), *available at* http://www.env-ne.org/public/resources/pdf/ENE_RGGI_StatePolicyStatusTable_082908.pdf.

α In Maine 10% portion of allowances will go to incentives for combined heat and power (CHP) facilities at integrated manufacturing facilities and 2% portion of allowances will go to VRECs.

λ Revenue raised from allowance prices exceeding $5 must be returned to ratepayers as rebates. ENVIRONMENT NORTHEAST, STATE POLICY STATUS (2008), *available at* http://www.env-ne.org/public/resources/pdf/ENE_RGGI_StatePolicyStatusTable_082908.pdf.

ω Early reduction allowance not to exceed 2.5 million tons in 2009-2011 and 1.5 million tons thereafter may be granted to Public Service of New Hampshire.

δ NJSA 26:TC-52 mandates a two-part rulemaking; first, the DEP will promulgate Priority Ranking Guidance, and second, DEP, BPU, and EDA will conduct funding rulemakings. ENVIRONMENT NORTHEAST, STATE POLICY STATUS (2008), *available at* http://www.env-ne.org/public/resources/pdf/ENE_RGGI_StatePolicyStatusTable_082908.pdf.

ρ Rhode Island's RGGI auction proceeds have been put into a restricted receipt account, which is subject to a potential 10% reduction for use in the general fund.

θ In Vermont net proceeds, after administrative costs associated with Vermont's participation in RGGI and any awards to state agencies for innovative carbon abatement technologies are deducted, are earmarked for energy efficiency.

π The weighted average based on allowances allocated, assuming maximum proceeds in discretionary states, at initial percentages.