Xcel Energy

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Dear Chairmen Dingell and Boucher:

Thank you for the opportunity to respond to your thoughtful questions on the advisability of an electricity generation "portfolio standard" as a means of achieving sound energy policy goals for our nation.

For more than a year, our company has been working to develop and evaluate a "clean energy portfolio standard" (CEPS) proposal. We are greatly encouraged by the results of our efforts and believe the CEPS concept could be an effective tool in helping to achieve a wide diversity of energy and environmental policy goals, including the goal of reducing greenhouse gas emissions from the utility industry. Details of our proposal have been provided to your staffs. Our responses to your questions (enclosed) include the results of various modeling efforts and provide further evidence in support of the CEPS concept.

In short, CEPS builds on the model of a traditional renewable portfolio standard (RPS), but gives credit to additional non-emitting technologies and activities, including fossil generation with carbon capture, and new nuclear generation. By widening compliance options, we think CEPS would provide more emission-free electricity generation than a simple RPS, but at a lower cost. More compliance options rectify the problem of regional resource disparity that plagues most "one size fits all" RPS proposals. Finally, CEPS improves on traditional RPS proposals by giving explicit credit for demand reduction and efficiency efforts.

Through extensive analysis, we have also found that a well-designed CEPS proposal dramatically reduces carbon emissions from the electricity sector at a small fraction of the cost imposed by carbon "cap-and-trade" schemes or tax regimes.

As a carbon control strategy, we believe that the principal advantages of CEPS are the following:

- CEPS reduces utility sector carbon dioxide emissions, but does not impose any direct costs on the emissions of carbon dioxide from existing fossil generating plants, many of which must continue to operate for years to come;

- CEPS deploys new, clean electric technology expeditiously, but reasonably;
- CEPS will not encourage switching from coal-fired to natural gas-fired electric generating plants and thus, will not drive up natural gas demand and price;
- CEPS will encourage domestic energy production and help improve the nation's energy security;
- CEPS will help assure a continued role for new, clean coal as a generation fuel;
- CEPS will be relatively easy to administer and will avoid the looming battle over allowance allocations under a cap-and-trade program; and
- CEPS directly rewards energy efficiency and conservation.

We are not alone in our assessment of the value of a CEPS. The Department of Energy's Energy Information Agency modeled a moderate version of CEPS as well as a cap-and-trade proposal introduced by Senator Jeff Bingaman earlier this year. Using identical modeling and assumptions, CEPS provided more renewable energy to the system, greater carbon reductions, and lower natural gas prices (even as compared to a "Business-as-Usual " base case) at extraordinarily low cost to the economy.

We believe the CEPS proposal worthy of your review as you grapple with these important issues. Thank you once again for your consideration of our views in this matter.

Sincerely,

John A. O'Donnell
Managing Director, Federal Public Affairs
Xcel Energy, Inc.

1. Purpose of Portfolio Standards Proposals

a. **Do you believe that adopting one or more Federal "portfolio-standard" requirements applied to sources of retail electricity, mandating that a given percentage of the power sold at retail come from particular sources, is an advisable Federal policy? Why or why not?**

   Response: Xcel Energy believes that Congress should adopt a Federal Clean Energy Portfolio Standard (CEPS). A properly designed CEPS would simultaneously achieve the goals of both climate change regulation and renewable portfolio standards (RPS): It would address the utility industry's contribution to climate change and promote technological transformation. The Department of Energy's Energy Information Administration (EIA) has analyzed one version of CEPS and confirmed Xcel Energy's own analysis. CEPS would: (1) reduce CO_2 emissions from the utility industry at least as well as CO_2 cap-and-trade programs; (2) cut demand for natural gas for use in generation of electricity, thereby reducing the price of natural gas and demand for natural gas imports; (3) provide compliance options for every region of the nation; and (4) promote the effective and efficient deployment of clean generation technologies and conservation. A copy of the EIA analysis is attached as Exhibit 1.

b. **Is it appropriate for Government to impose generation-source conditions or energy savings requirements on load-serving utilities in order to serve public-policy purposes such as promotion of renewable energy production, energy efficiency and reduction of carbon emissions? Why or why not?**

   Response: Xcel Energy believes that a technology-based standard (like CEPS) that promotes clean generation of electricity and conservation is an appropriate and cost-effective way for the nation to address utility sector emissions that may contribute to climate change. As set forth above, if designed properly, CEPS would also create the conditions to promote the development of technologies that could transform the utility industry and its generating fleet. EIA has found that CEPS would be very effective in mandating the use of renewable energy. However, unlike RPS proposals or carbon trading programs, CEPS would also directly promote energy efficiency and conservation by making conservation a compliance option. By comparison, an RPS is silent on conservation, while carbon caps or taxes would promote conservation only by raising the cost of electricity to a very high level so that electricity customers would be encouraged to conserve. Conservation achieved through high prices would also cause economic hardship, particularly to low-income electricity customers. Finally, CEPS would reduce utility greenhouse gas emissions at very low cost – much lower than any comparable carbon cap-and-trade program.

c. If you favor such a policy, how would you define its specific purpose?

Response: The purpose of the CEPS policy should be to directly encourage the use of clean energy and conservation to meet retail customers' energy needs. The policy should allow utilities to comply using traditional renewable energy such as wind, biomass or solar energy. It should also create a simple mechanism to encourage the use of conservation. It should allow for the use of other low-emissions technologies, such as clean coal with carbon capture and sequestration or advanced nuclear. In this way, the policy would allow utilities a diverse set of resources available throughout the country for compliance. The policy should also allow for the use of verifiable carbon offsets to provide additional opportunities, and maximize flexibility through the use of clean energy credit trading markets.

A CEPS policy should reward the use of new generation and energy efficiency technologies. It should immediately begin to slow the growth of emissions of CO_2 from the utility sector and mandate reductions as clean technologies become more available. The policy should not encourage increased use of natural gas for generation of electricity. Nor should it punish customers relying on existing coal-based electricity generation resources by imposing a tax on the emissions from these facilities. CEPS should be fair to all regions of the country by providing diverse options for compliance. It should be flexible and use the power of clean energy credit trading markets to its advantage.

Most importantly, CEPS should ensure continued transformation of utility electricity generating technology. If successful, CEPS would help create a new American utility industry, one that provides electricity that is reliable, reasonably priced, and nearly emissions free.

d. If Congress were to adopt an economy-wide policy mandating reductions in emissions of greenhouse gases, including the electricity industry, would such a portfolio standard remain necessary or advisable?

Response: Ideally, CEPS should be the only greenhouse reduction program applicable to the utility industry. As demonstrated in EIA's analyses of both CEPS and Senator Bingaman's carbon reduction bill, the CEPS is much less costly than a comparable cap-and-trade program. A copy of EIA's analysis of Senator Bingaman's bill is attached as Exhibit 2. Because a cap-and-trade program would impose costs on carbon dioxide emissions, cap-and-trade would encourage utilities to switch from coal to natural gas – a higher priced fuel. It also acts as a tax on emissions that, while increasing costs, would not result in any significant emissions reductions. Cap-and-trade, unless it is so draconian that it ceases to be politically viable, would simply increase the price of electricity cap-and-trade acts as a tax on emissions that requires substantial increases in electricity costs before significant emissions reductions will occur. At more politically viable carbon dioxide prices, a cap-and-trade may simply tax electricity without substantial change in carbon dioxide emissions. We think CEPS is a better alternative, and should stand alone.

e. What analysis has been done of any portfolio standards requirement you endorse to demonstrate:

Response: There have been two major analyses of the CEPS policy performed to date. EIA published results from an analysis of the CEPS policy in January of 2007. In this analysis, the EIA analyzed a version of the CEPS policy with a maximum clean energy requirement of 20% by 2025.

Xcel Energy has also sponsored an independent analysis of the CEPS performed by the consulting firm ICF International, with recently completed results from February of 2007. A summary of the ICF results is attached as Exhibit 3. The Xcel Energy-sponsored work analyzed a later version of the CEPS, notably featuring a 25% rather than a 20% clean energy requirement by 2025. Per Xcel Energy's instructions, ICF International adopted, to the greatest extent possible, the same assumptions used by the EIA for both their CEPS analysis and their latest Bingaman cap-and-trade analysis, which are in turn based on EIA's Annual Energy Outlook 2006. These adopted assumptions include coal and natural gas price forecasts, electricity demand forecasts, and new power plant cost and performance expectations. ICF International performed the analysis based on the CEPS proposal as specified by Xcel Energy.

(i). Its economic costs to consumers, nationally, and in various regions, in electricity rates?

Response: The EIA's analysis of the 20% CEPS forecasted low costs to consumers nationally. From the year 2006 to 2030, the cumulative additional cost to the electric power sector and its customers was less than 0.5% compared to the reference case on a net present value basis. For the same period, the total cumulative cost to residential consumers was 0.3% greater than in the reference case. The EIA's analysis forecasted an increase of approximately 1% in electricity costs in some years between 2020 and 2029, but a very small 0.02¢/kWh or 0.3% increase in electricity rates by 2030.

The Xcel Energy/ICF International analysis also forecasted small cost increases to consumers. The estimated average retail price impact from the CEPS was slightly negative in most years through 2012, then showed a 2% to 4% increase from 2016 to 2025. Based on a cumulative cost metric for the electric utility sector accounting for capital investment, fuel costs, operating costs, and other major costs, the CEPS cost about 0.6% more than the reference case from 2006 to 2025 on a net present value basis, a result very close to the EIA prediction. Compared to dramatic price increases felt recently by consumers in some markets, cost increases of the CEPS would be barely perceptible

The EIA did not publish regional cost results for its analysis, and Xcel Energy has not sponsored a regional examination of consumer costs from the 25% CEPS. Xcel Energy believes that cost impacts should not vary widely from region to region for three reasons. First, the CEPS allows for a wide variety of clean generation options including new nuclear and carbon-capturing coal-fired generation giving each region more flexibility for cost-effective compliance. Also, the CEPS policy would be implemented with a national credit trading system for compliance, helping to equalize costs; a load-serving entity in a region can develop clean generation, or purchase credits from lower-cost regions. Finally, CEPS allows utilities to comply by investing in energy efficiency and carbon dioxide offset purchases, which are broadly accessible to all regions in the U.S. at roughly equivalent costs.

(ii). Its benefits in greenhouse gas emission reductions?

Response: Both the EIA and the Xcel Energy CEPS analyses show significant greenhouse gas emissions reductions from the electric power sector. The EIA analysis of the 20% by 2025 CEPS forecast a 14.7% decrease in carbon dioxide emissions from the electric sector by 2030, a savings of nearly 500 million metric tons per year. The Xcel Energy/ICF International analysis of a 25% by 2025 CEPS predicted a 19.2% reduction in carbon dioxide emissions, a savings of about 560 million metric tons per year by 2025.

Xcel Energy believes that based on the data from the answers to (1)(e)(i) and (1)(e)(ii), a CEPS compares very favorably to results from cap-and-trade policy analyses in terms of cost-effectiveness.

(iii). Its implications for electricity reliability, security, and grid management?

Response: Based on the analysis available to date, the implications of the CEPS for electric reliability and grid management are minor. The CEPS encourages dispatchable baseload technologies such as fossil generation with carbon capture and sequestration, new nuclear, and biomass. None of these technologies will negatively impact reliability or grid management.

The CEPS also encourages intermittent resources like wind generation, a resource that does not always match well to load requirements. Unlike current compliance patterns under state RPS laws where wind typically dominates, we expect wind to be merely one component of CEPS compliance. Both the EIA and the Xcel Energy/ICF International analysis of the CEPS predict that less than 4% of all U.S. generation will come from wind by 2030 under the CEPS. U.S. utilities are managing similar or greater levels of wind energy in some territories today. Also, the Xcel Energy/ICF International analysis limited wind capacity installations to 30% of system peak load in any reliability region, roughly equivalent to 15% of total energy from wind, in order to simulate credible limits to wind integration under the CEPS policy. In addition, the Xcel Energy/ICF International analysis explicitly included costs associated with the integration of wind energy, with its intermittent generation pattern, onto the grid. Most regions did not reach the assumed limits for wind. As the number one utility wind energy provider in the nation today (according to the American Wind Energy Association), we at Xcel Energy believe that the wind integration issues presented by both RPS and CEPS policies, while real, are manageable.

Nevertheless, one of the advantages of CEPS is that, unlike an RPS, it allows for greater use of clean baseload facilities in addition to intermittent renewable resources. This diversity would provide superior reliability and grid management.

Both CEPS analyses also predict that CEPS would enhance energy security. In particular, the CEPS tends to reduce natural gas consumption for electricity generation. The EIA analysis showed a 10.5% decrease in natural gas-fired generation and a 2.4% reduction in natural gas wellhead price in 2030 compared to the reference case. The Xcel Energy/ICF International analysis results were similar - a 13.3% decrease in natural gas-fired generation and 6.2% reduction in natural gas price relative to the reference case in 2025. The analysis results are even more striking when compared to cap-and-trade bills like Sen. Bingaman’s proposal, which is projected to *increase* natural gas generation by 20% and natural gas prices by 11% over the reference case in 2030. The reduction in natural gas for electricity generation is likely due to CEPS-qualifying generation displacing natural gas-fired generation in the power plant dispatch order, and also due to reduced overall demand for electricity under the CEPS policy case.

Reduced natural gas dependence has positive effects on the national balance of energy trade in the future. Most U.S. reference forecasts, including EIA’s Annual Energy Outlook 2007, predict significantly increased overseas imports of natural gas in the form of liquefied natural gas. Most CO_2 cap-and-trade policy analyses forecast even greater natural gas consumption and increased foreign dependence. By contrast, natural gas consumption reductions under a CEPS policy will tend to mitigate this impending new dependence on foreign energy sources.

The CEPS also enhances energy security by promoting a diverse set of clean generation options. Both analyses predict much greater levels of renewable energy generation, especially significantly increased levels of wind and biomass generation. They also predict increased installations of new-generation nuclear generating capacity, and the Xcel Energy/ICF International analysis predicted significant development of fossil generation with carbon capture and sequestration.

(iv). Its implications for jobs and economic development?

Response: While our analysis did not explicitly address questions of employment or economic development, evidence we do have suggest that CEPS would have positive effects on job creation and economic activity compared to alternatives.

By incenting deployment of new technologies like clean coal plants with carbon capture, new nuclear plants, wind, biomass, and other renewables, the CEPS would create many thousands of new construction jobs. At the same time, modeling shows that while these types of facilities have relatively high capital costs compared to existing alternatives otherwise likely to be built (i.e., combined-cycle gas generation plants), the lower fuel cost risk of coal and nuclear leads to lower overall costs to consumers mitigating the threat to economic development posed by cap-and-trade and tax schemes.

(v). Its implications for utility capital investment?

Response: The analyses of the CEPS policy predict increased capital investment in the utility sector. The EIA analysis forecast $22 billion total additional capital expenditures in the utility sector from 2006 to 2030 on a net present value basis. The Xcel Energy/ICF International analysis showed $11.5 billion total additional capital expenditures in the utility sector from 2006 to 2025 on a net present value basis. Decreased total fuel costs under the CEPS policy of $7-$14 billion on a net present value basis over the forecast period tend to partially offset increased capital costs, contributing to overall low costs to consumers.

(vi). Other relevant factors?

Response: The CEPS creates a viable development path for fossil generation with carbon capture and sequestration, a technology that many experts consider crucial for provision of reliable, cost-effective electricity in a carbon-constrained world. The U.N. Intergovernmental Panel on Climate Change has found that carbon capture and sequestration has the potential to be one of the largest contributors to worldwide carbon dioxide emission reductions. Please see Exhibit 4. While EIA's analysis did not predict that coal with carbon capture and storage would be economical under the CEPS, Xcel Energy/ICF International's analysis forecasted development of significant amounts of carbon capture and sequestration in conjunction with both new integrated gasification combined cycle and new pulverized coal development. The Xcel Energy/ICF International analysis effort also concluded that carbon capture and sequestration could promote enhanced oil recovery and increase domestic U.S. oil production.

2. Portfolio Inclusions and Exclusions

a. What is the principle that should determine inclusion or exclusion of any energy source from an adopted portfolio standard? (i.e. excludes all fossil-fired generation, includes all generation that emits no GHG, excludes all generation below given energy-conversion efficiency, etc.)

Response: We believe strongly that any portfolio standard should be considered in the context of whether it helps advance a sound energy and environmental policy broadly and not simply as to whether it might advance a narrower objective (e.g., promotion of renewables) to the exclusion of other important objectives. A sound, comprehensive energy and environmental policy for the electric sector should, among other things, do the following: (1) reduce our dependence on foreign sources of energy; (2) lessen the upward pressure on demand for increasingly expensive natural gas; (3) reduce the environmental footprint of the electric generation fleet, including reducing GHG emissions; (4) preserve an appropriate role for coal, our most abundant fossil fuel used for the generation of electricity; (5) encourage conservation and efficiency; (6) promote the deployment of new technologies that help advance the objectives mentioned above; (7) be fair to all regions of the country; and (8) be affordable to consumers.

A portfolio standard should be designed, to the maximum extent practicable, to advance all of these objectives, not just some of them. Qualifying resources that fit within these tenets would include traditional renewables (wind, solar, biomass, geothermal, incremental hydropower); new nuclear; clean coal to the extent GHGs are captured and sequestered; and energy efficiency, the cleanest of all energy resources. CEPS is an example of a portfolio standard that would help advance all of the objectives of a sound energy and environmental policy described above, not just a narrow subset of these objectives.

b. What generation sources for retail electricity suppliers (including efficiency offsets) should be included and should be excluded from any mandatory portfolio requirement that is adopted? Please provide your reasons for excluding any sources.

Response: As described above in the answer to (a), any generation resource should qualify under a utility portfolio standard to the extent it uses clean or low-emission (including low-GHG emission) technology; reduces our dependence on foreign sources of energy; and reduces our increasing dependence on expensive natural gas as a generation fuel. Conservation should be a qualifying resource because it potentially is one of the cheapest and most environmentally friendly of all potential sources of energy. Traditional renewables obviously should qualify but also new nuclear, incremental production from existing renewables, including hydropower, and clean coal, to the extent GHGs are captured and sequestered. These resources all help reduce our increasing dependence on natural gas, reduce the environmental footprint of the electric generation sector and help reduce GHGs. Moreover, a broader definition of eligible resources will help give regions of the country that do not have access to indigenous sources of traditional resources alternative compliance mechanisms beyond simply sending money to other parts of the country or to the federal government, the likely outcome under many proposals currently under consideration.

c. To the extent that multiple renewable energy sources and efficiency or other sources are eligible for inclusion, should any tiers among them or separate sub-requirements be adopted?

Response: Depending on how they are constructed, tiers could amount to a mandatory set-aside for a particular favored resource. This could reduce overall program efficiency and increase consumer cost. Tiers could also be constructed by providing certain resources with extra portfolio credits. Extra credits may make sense in order to provide incentives necessary to speed the deployment of promising technologies that currently are more expensive than others. Although tiers may play some role in design of a portfolio standard, experience with state RPS policy shows that tiers and sub-requirements can seriously impair utility decision-making and cost-effectiveness, while adding unnecessary administrative burdens and increasing the contentiousness of administrative processes.

d. Should there be any distinction between existing and new sources of generation eligible for inclusion in the portfolio? If so, what would be the threshold date for eligibility?

Response: Approximately 24 states have already adopted variations of an RPS. State RPSs exist to accomplish the same policy goals that would underlie a federal portfolio standard like CEPS. They are designed to encourage the use of new, clean generating technologies, promote energy independence and economic development and reduce environmental impact and emissions. In fact, most states view their RPS a central component of their efforts to control GHG emissions.

For these reasons, at a minimum, any federal portfolio standard should give full credit to the resources the consumers in these states are already paying for. Unless full credit is given, consumers in these states will be paying twice, once for qualifying state resources and once for qualifying federal resources. This makes no sense. In order to fully give credit to existing state programs, any renewables in operation prior to the date of enactment should qualify. Beyond traditional renewables, however, there does not seem to be a strong public policy justification for giving credit for existing resources that may qualify under a federal portfolio standard since we are unaware of any state program that has mandated the purchase or construction of these resources.

e. Would the electricity equivalent of useful thermal energy from eligible sources be credited against the requirement? Why or why not?

Response: Providing credits for useful thermal energy from eligible resources would greatly complicate the administration and enforcement of any portfolio standard. To the extent credits are provided, it should be for efficiency gains, not simply total thermal energy production. A well-designed program awarding credits for efficiency gains would be the approach we would recommend, not total thermal production.

In our CEPS proposal, Xcel Energy recommends that Congress allow utilities to use carbon dioxide emissions offsets to generate clean energy credits that can be used for compliance with the standard. Among other things, eligible offsets would include offsets generated from emission reductions at industrial or other emitting sources. Thus, CEPS contemplates that improved efficiencies in thermal energy use should be eligible as offsets.

f. To the extent energy efficiency is included:

(i). How would the required savings be measured and verified?

(ii). Against what base consumption period (historic or projected)?

Response: We believe that establishing base periods and measuring and verifying energy efficiency at the federal level is likely to be fraught with complexity and ultimately prove to be unworkable. We believe that a more simple approach that is likely to be just as effective is to give credits to a utility based on the amount of state approved energy conservation program expenditures. A state utility commission is unlikely to approve program expenditures (which would be funded by ratepayer or customers monies) that do not have a positive consumer return. In addition, an approach that may work in Florida given its load profile, may not work in Virginia, with a different load profile and different potential energy efficiency approaches. CEPS contemplates such an approach.

3. Percentage Requirement and Timing

a. What target percentage of total retail power deliveries should be achieved by the required portfolio?

b. What is the target year for reaching the ultimate mandated portfolio percentage?

Response: Xcel Energy believes the target percentage(s) and the target year(s) should be driven by the policy objectives established for the program. We further believe a careful balance is required between the environmental benefits desired from the portfolio requirement, the effects on energy technology advancement, the consequences for national energy security, and the likely economic cost impacts. Based on the analyses sponsored by the company, we have concluded that a comprehensive CEPS that begins at 10% of total retail power deliveries in 2015 (adjusted for special cases of small and very slow growing retail power providers) and increases to an ultimate 25% requirement in 2025 achieves an appropriate balance. A copy of our CEPS proposal is attached as Exhibit 5.

The above percentages and target years, together with accompanying policy provisions proposed by Xcel Energy, create an energy technology pathway that enables a deflection in the historical upward trajectory in power sector CO_2 emissions beginning as early as 2010 (in anticipation of the requirement), a peaking of utility emissions between 2015 and 2020, and finally a sustainable downward trend in emissions by 2025. Moreover, the Secretary of Energy would be authorized to set further, second phase clean energy delivery requirements for 2030, 2035, and 2040, such that electric utility greenhouse gas emissions would return to 1990 levels by the end of the policy period and contribute to a stabilization of global CO_2 concentrations.

According to company-sponsored modeling analysis, these beneficial emission reductions are feasible at a very modest increase in electricity prices – a projected increase of approximately one fourth of a cent per kilowatt hour (0.25c/kwh) in 2025 – while the demand for and the cost of natural gas actually decrease under the requirement compared to business as usual.

c. Should there be a straight-line, accelerating, or other form of ramp-up to the ultimate target percentage?

Response: Xcel Energy's proposed CEPS would gradually increase in step-wise fashion from 10% in 2015, to 17% in 2020, and to 25% in 2025. The banking and borrowing provisions incorporated in the company's

CEPS proposal allow for “smoothing” of this step-up in requirement and also accommodate the “lumpiness” in the creation of clean energy compliance credits that can occur with large clean energy projects that take years to construct, such as nuclear power plants.

Any portfolio standard should set more aggressive goals in later years once technology has had a chance to develop. For this reason, CEPS requires more stringent clean energy requirements – linked directly to significant emission reductions – in later years. We believe that requiring greater clean energy production and sales in later years will allow for the technological advancement necessary to increase clean energy penetration on the utility system and reduce its emissions without causing the economic disruption that would arise from earlier, more stringent requirements.

d. Should there be any off-ramps or other built-in automatic changes in requirements as a function of contingencies? If so, what should they be? (e.g., price or cost thresholds, contingencies for natural or climate conditions, lack of adequate transmission, etc.)

Response: We believe that such “off-ramps” are appropriate and necessary to help protect the economy and, therefore, the integrity and political viability of the program. Xcel Energy’s CEPS proposal provides a number of mechanisms that help to address and reduce possible contingencies. These include:

- A wide diversity of compliance options, providing compliance flexibility to different companies and different regions of the country
- A national clean energy credit trading program
- Clean energy credit banking and borrowing provisions
- A safety valve option allowing credits to be obtained from the federal government at a reasonable “backstop” cost
- Opportunity for a power provider to earn additional credits by increasing their investment in energy conservation programs
- Special accommodation of small or very slow growing retail power providers
- A provision for states to petition the Secretary of Energy to be excused from the program if the requirements result in severe economic hardship

Further, in the second phase of the policy, the Secretary of Energy is given discretion with regard to establishing increased clean energy targets after 2025, and an automatic, three-year review period is also placed on any newly-established targets to allow action by Congress if it feels the targets are unreasonable or inappropriate or if it finds that the structure of the program should be replaced by a different architecture, e.g. a cap-and-trade program.

4. Relationship to State Portfolio Standards and Utility Regulation

a. **Should an adopted Federal portfolio set:**

   (i). A minimum standard, allowing States to set or maintain higher targets?

   (ii). A preemptive standard, prohibiting States to set higher or different targets?

   (iii). Merely a mandate for a standard, allowing States to set their own targets at any level?

   (iv). Merely a given percentage target, allowing States to elect generation or efficiency sources eligible to meet it?

   (v). A standard applying only to States without prior portfolio requirements, grandfathering all prior standard programs?

   Response: We favor a minimum federal standard, with states free to set or maintain a higher target. In addition, we believe that any federal program must give full credit against any federal obligation for all existing resources and expenditures made under state programs. If full credit is not given, consumers in some states will essentially be paying twice for the same obligation. We also believe that states should be given the opportunity to petition the Secretary of Energy for relief from any federal standard in the event of a major disaster, major economic dislocation or other circumstance which would cause consumer rates to increase dramatically. Integration of existing state programs into a federal program needs to be done carefully with an eye toward treating the consumers in these states fairly.

b. **Can and should State regulatory agencies be required to pass through the costs of complying with Federal portfolio standards requirements in retail rates?**

   Response: Utilities will not be able to financially shoulder this burden without being able to recover the increased costs associated with a portfolio obligation from their customers. In addition, purchases of this power would be wholesale purchases, which are entitled to be recovered under existing Supreme Court precedent. State regulatory treatment of environmental compliance costs has been largely supportive, although uncertainty and delay can increase costs and interfere with efficient utility decision-making. Further Congressional clarification regarding the ability of utilities to recover these costs would be helpful.

5. Utility Coverage

a. **Should any retail sellers of electricity be exempt from the portfolio requirement? (e.g., municipal utilities, rural cooperatives, utilities selling less than a minimum volume of power, unregulated marketers in States with competitive retail markets, etc.)**

   Response: Exemptions from a national standard necessarily increase the costs of the standard and the overall complexity of the program. In order to achieve maximum environmental benefit at the least overall cost, exemptions should be kept to a minimum. Generally, one powerful argument for a Congressionally mandated national policy is the ability of a national statute to include rural cooperatives, public power and competitive marketers that are partially or entirely exempt from state regulation. We do not believe that entire classes of emitting sources should be exempted from climate regulation merely because of their ownership status, whether competitive or public. Such exemptions invite the transfer of emitting assets to non-regulated entities, and can create a major 'leakage' effect that damages the policy's environmental effectiveness.

   However, we do agree that very small utilities with low levels of sales should be exempt from the portfolio standard requirement. The benefits of including such utilities in the standard are outweighed by the administrative costs associated with their participation in the program. We also believe that slow-growing utilities should not be forced to supply more clean energy than the growth in their customers' energy consumption. For this reason, we incorporated a small and slow growing utility exemption in CEPS. We limited a slow growing utility's CEPS portfolio requirement to its total incremental sales (sales growth over its base sales) so that such a utility would not be forced to shut down or sell off existing generation in order to made way for qualifying resources under CEPS. In cases such as this, a utility would not be forced to purchase CEPS qualifying resources in excess of its load growth. We believe this is only fair.

b. **Should any standard apply to wholesale power markets or sales?**

   Response: The CEPS policy is designed as a requirement for retail service providers. Wholesale power markets and sales would be affected only to the extent that demand for CEPS-compliant resources would increase and demand for non-compliance resources would decrease. The importance of wholesale markets for efficient price signaling and technology development is critical for the overall success of any climate policy, but a properly designed retail sales requirement should suffice to create the appropriate wholesale incentives.

c. **Should there be any basis for discretionary exemptions of certain States or utilities?**

Response: Under CEPS, a state that is subject to excessive economic hardship as a result of the standard would be allowed to petition the Secretary of Energy to be excluded for a short period of time from the requirements of the standard. The Secretary would have discretion regarding whether to grant the exemption based on the state's showing of hardship. We believe that such a limited exemption is appropriate, but no other exemptions make sense in the context of this policy.

6. Administration and Enforcement

a. **Should a Federal Government entity enforce the requirement and decide on any exemptions?**

(i). If so, which one? (e.g. the Environmental Protection Agency? The Department of Energy? The Federal Energy Regulatory Commission? A newly created office or entity?)

(ii). If not, should enforcement be delegated to the States or regional transmission of electric-system-operation entities?

Response: The Department of Energy should be the enforcement and administrative entity for the CEPS statute. With a clear Congressional mandate, the Department of Energy would have the requisite authority, and already has the data collection and mandatory reporting experience, to carry out this duty.

b. **How should Federal and State enforcement be coordinated in States with their own portfolio requirements?**

Response: The need for such coordination should be minimal. There is no reason why Federal enforcement should be affected by State action or vice versa. Information on the compliance status of affected entities may be of interest to the relevant authorities at both Federal and State levels, but there is no necessary coordination requirement under Xcel Energy's CEPS proposal, or under a more limited national portfolio standard.

c. **What penalties should apply for failure of utilities to meet the percentage mandate?**

Response: The most appropriate penalty would be a fine of up to twice the cost of meeting the standard, as assessed by the enforcing entity (Department of Energy). By providing DOE with the discretion to impose costs of up to twice the cost of compliance, the standard would create an incentive for utilities to comply with the mandate rather than forcing the enforcing entity to undertake time-consuming and costly enforcement proceedings.

7. Credits and Trading

a. Should tradable credits for qualifying generation be utilized as the mechanism for establishing compliance?

Response: Yes. Tradable clean energy credits will ensure that clean energy implementation, technology development, and carbon dioxide emissions reductions are achieved in the lowest-cost manner possible. In addition to credits for qualifying generation, credits should be granted for energy efficiency and credible greenhouse gas offsets.

b. Should credit trading be permitted or required on a national basis in order to achieve least-cost compliance with the portfolio standards?

Response: Yes. We strongly recommend national trading to achieve least-cost compliance with any federal portfolio standard.

c. Should there be a cap on credit values to limit costs?

Response: Yes. Xcel Energy recommends that the credit value cap be structured so that unlimited additional credits are available at the cap (or safety valve) price. The cap on credit values should be low enough to prevent harm to the economy in the event that compliance is more costly than anticipated. However, the cap on credit values should be high enough to strongly encourage achievement of the clean energy targets. Our analysis indicates that achieving full compliance with the targets leads to more cost-effective clean energy implementation, technology development, and emissions reductions. A 2.5¢ per credit cap on clean energy credit values beginning in the year 2015 with the first CEPS target, escalating at inflation, is a reasonable credit value cap.

d. As between a utility purchaser and a qualifying power generator, to whom should the portfolio standard credits be initially allocated?

Response: Unless otherwise specified in power purchase agreement, the portfolio standard credits should be initially allocated to the utility purchaser. The utility purchaser may subsequently transfer the credits under a power purchase agreement, sell the credits, or trade them.

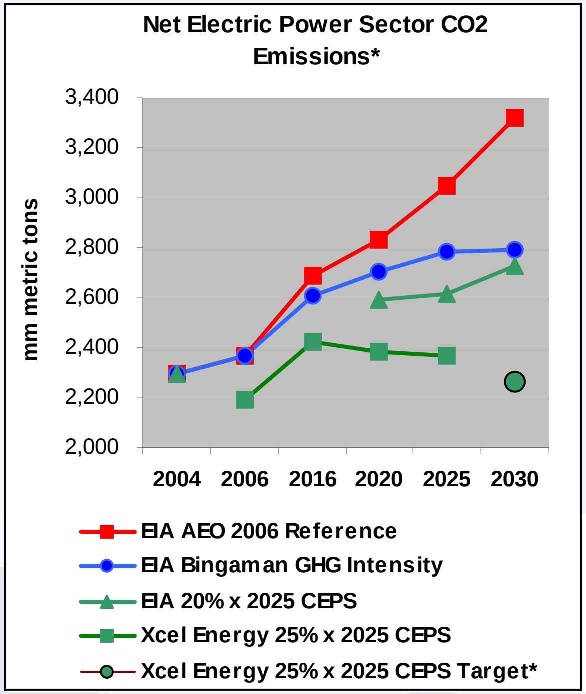
e. **What relationship, if any, should portfolio standard credits have to other State and Federal credit trading programs for SO2, greenhouse gases, or biofuels?**

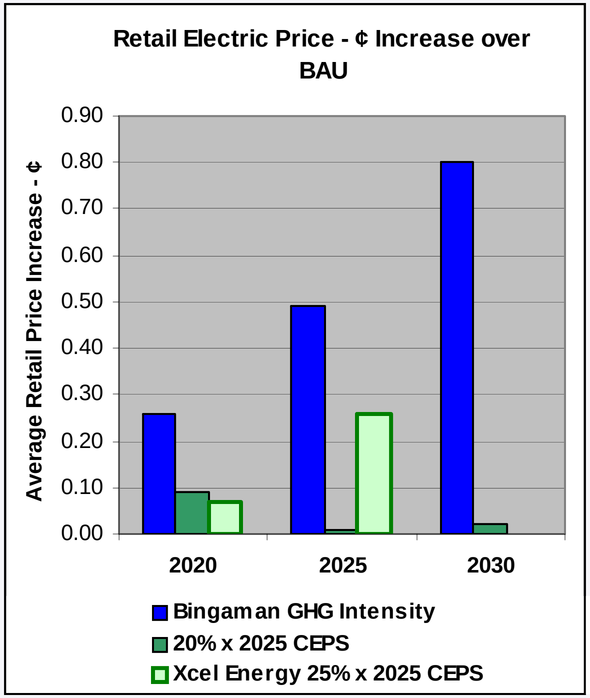
Response: The existing federal and state electric utility trading programs for SO_2 and other non-greenhouse emissions commodities can operate in parallel to the CEPS. Biofuels programs should be considered in transportation policies, which are not directly related to the utility sector. The CEPS can be an effective greenhouse gas emissions reduction policy, and can eliminate the need for greenhouse gas-specific trading programs in the utility sector, or entirely if used in conjunction with other sector-specific policies.

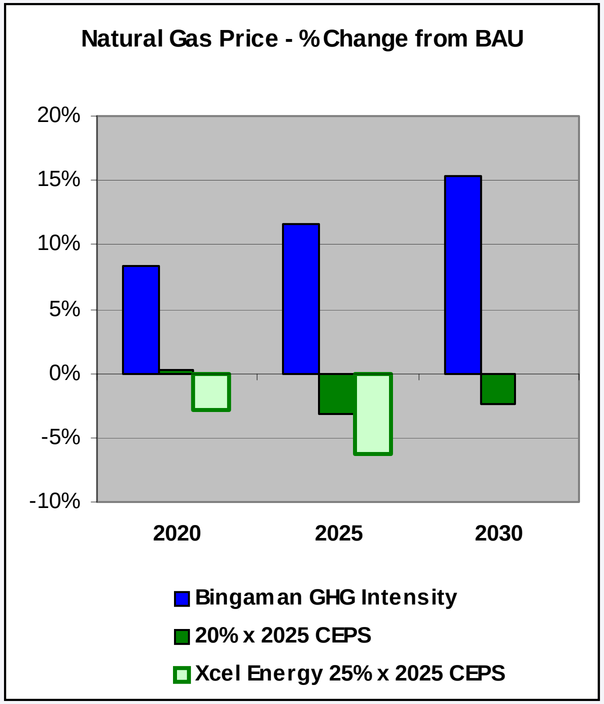
f. **What requirements, if any, would there be concerning the length of contracts for qualifying generation and ownership of credit rights?**

Response: There should be no requirements concerning the length of contracts for qualifying generation and ownership of credit rights. Generation owners and power purchasers should be free to negotiate ownership of credit rights as they currently do.

Preliminary Analysis of 25% by 2025 CEPS







Notes:

- Xcel Energy preliminary results are based on a slightly smaller set of national generation resources than used by EIA models, and thus both base year and forecast emissions tend to be lower than EIA results.
- *Net emissions are adjusted to account for CO2 reductions due to biological sequestration offsets
- **Reflects future CO_2-specific target equivalent to 2.5 billion short tons (not modeled result). Additional targets include utility sector emissions of 2.5 B short tons in 2030, 2.25 B short tons in 2035, and 2.0 B short tons in 2040.

SR/OIAF/2007-02

Energy Market Impacts of a Clean Energy Portfolio Standard

- Follow-up -

January 2007

Energy Information Administration
Office of Integrated Analysis and Forecasting
U.S. Department of Energy
Washington, DC 20585

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Preface and Contacts

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The model projections in this report are not statements of what will happen but of what might happen, given the assumptions and methodologies used. The reference case projections are business-as-usual trend forecasts, given known technology, technological and demographic trends, and current laws and regulations. Thus, they provide a policy-neutral starting point that can be used to analyze policy initiatives. EIA does not propose, advocate, or speculate on future legislative and regulatory changes. All laws are assumed to remain as currently enacted; however, the impacts of scheduled regulatory changes, when defined, are reflected.

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Executive Summary

This report responds to a request from Senator Coleman (MN) to analyze a proposed clean energy portfolio standard (CEPS). The proposal, a copy of which is provided in Appendix B, requires electricity suppliers to increase their share of electricity sales that is generated using clean energy resources, including: nonhydropower renewable resources, new hydroelectric or nuclear resources, fuel cells, and fossil-fired plants that capture and sequester carbon dioxide emissions.[1] Electricity suppliers may also comply by purchasing tradable clean energy generation credits from other sellers or by buying credits from the Federal government at a price of 2.5 cents per kilowatthour (2005 dollars, with inflation adjustment). Suppliers are not required to hold credits in excess of their total incremental sales growth from their baseline levels, which is the average of their sales from 2008 to 2011. Electricity suppliers with fewer than 500,000 megawatthours of sales are exempt from these requirements. Suppliers can also accumulate credits from eligible generation in the five years before program enactment, which they may use freely throughout the subsequent periods. This analysis is based on the reference case from the *Annual Energy Outlook 2006* and is a follow-up to an earlier analysis of a clean energy portfolio standard prepared in June 2006.[2, 3]

The key findings include:

- Beginning in 2015, the first year of mandatory program compliance, the proposal spurs the development of clean energy resources well above reference case levels. By 2030, projected renewable energy generation is nearly double the level in the reference case and nuclear generation is 27 percent greater (Table ES-1) than in the reference case.

- Early credits earned during the 5 years preceding 2015 can be used throughout the 2015 to 2030 period, but they are expected to be most heavily used between 2020 and 2025 when the program targets increase sharply.

- During the first phase of the CEPS, from 2015 through 2019, credit prices range from 0.4 to 1.0 cent per kilowatthour. During the second phase of the program, from 2020 to 2024, credit prices rise, but stay below 2.0 cents per kilowatthour. During the third phase of the program, 2025 and beyond, credit prices temporarily hit the 2.5-cents-per-kilowatthour price cap when the required share first increases to 20 percent; however, as fossil fuel prices increase and new nuclear and renewable facilities are built, credit prices fall.

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[1] The program targets formally begin in 2015. The credits from carbon sequestration and retrofit technologies are limited to 10 percent of the retailer supplier's obligation according to section "c.2." The percentage shares of clean fuel use prescribed are: for 2015-2019, 10 percent; for 2020-2024, 15 percent; for 2025 and thereafter, 20 percent.

[2] Energy Information Administration, *Annual Energy Outlook 2006*, DOE/EIA-0383(2006) (Washington, DC, February 2006). Web site http:// www.eia.doe.gov/oiaf/aeo/index.html.

[3] Energy Information Administration, *Energy Market Impacts of a Clean Energy Portfolio Standard*, SR/OIAF/2006-02 (Washington, DC, June 2006). Web site http://www.eia.doe.gov//oiaf/servicerpt/emice/index.html.

- Biological sequestration programs supply 10 percent of the credit requirements – the maximum share permitted – in all years. While there is uncertainty about the potential of such projects and their ability to sequester carbon, the 1,000 clean energy credits they earn for each metric ton sequestered make them economically attractive.

- Almost 76 percent of generation eligible for credits in 2030 is from nonhydropower renewable technologies (669 billion kilowatthours of the required 883 billion kilowatthours). Most of this is from biomass, both dedicated and co-fired, (366 billion kilowatthours) and wind (210 billion kilowatthours) generation.

- New nuclear plants, which receive one-half credit per kilowatthour of generation, account for 291 billion kilowatthours of eligible generation.

- Additional compliance generation comes from geothermal technologies (60 billion kilowatthours), with lesser amounts from landfill gas and solar technologies.

- From 2006 to 2030, the CEPS has a cumulative total cost to the electric power sector of approximately $7.8 billion (all prices and costs are in 2004 dollars and cumulative calculations are discounted at 7 percent to 2006). This is less than 0.5 percent of the cumulative discounted industry costs in the reference case. This estimation includes $22 billion in higher capital and fixed operations and maintenance expenditures that are partially offset by $14 billion in lower fuel costs.

- Compared to reference case figures, cumulative residential expenditures on electricity from 2006 through 2030 are $4.7 billion (0.3 percent) higher.

- Average end-use electricity prices increase with the proposal requirements, but the impact is small and it varies over time. The largest increases are in 2020 through 2022 and in 2029, when annual electricity prices are slightly more than 1 percent (nearly 0.1 cent) above reference case levels. However, by 2030 end-use electricity prices are only 0.02 cents (0.3 percent) higher.

- In 2030, electricity sector carbon dioxide emissions are 14.7 percent lower in the CEPS case than in the reference case, but still 23.1 percent higher than 2004 levels. Between 2006 and 2030, total cumulative U.S. electricity sector carbon dioxide emissions are 4,162 metric tons lower (5.8 percent) than in the reference case.

Table ES-1. Key CEPS Analysis Results, 2020, 2025 and 2030

	2004	2020 Reference	2020 CEPS	2025 Reference	2025 CEPS	2030 Reference	2030 CEPS
Generation (billion kilowatthours)							
Coal	1,977	2,505	2,302	2,896	2,547	3,381	2,803
Petroleum	120	107	109	108	103	115	108
Natural Gas	702	1,103	1,090	1,070	968	993	889
Nuclear Power	789	871	892	871	967	871	1,109
Conventional Hydropower	269	303	302	303	302	303	302
Geothermal	14	34	37	47	55	53	60
Municipal Solid Waste/Landfill Gas	22	29	34	30	36	30	37
Dedicated Biomass	36	51	53	63	119	77	285
Biomass Co-Firing	1	36	177	29	188	26	126
Solar[A]	1	3	3	4	4	6	6
Wind	14	60	97	63	201	65	210
Total	3,955	5,108	5,104	5,492	5,498	5,926	5,944
Clean Energy Portfolio Standard Compliance							
Electricity Sales (billion kilowatthours)	3,567	4,629	4,621	4,956	4,945	5,341	5,326
Percent Clean Energy Required[B]	0.0	0.0	9.4	0.0	13.8	0.0	16.6
Generating Capacity (gigawatts)							
Coal Steam	310	345	336	390	365	457	394
Other Fossil Steam	124	80	81	79	78	75	74
Combined Cycle	159	214	208	226	215	231	218
Combustion Turbine/Diesel	130	149	150	159	160	174	174
Nuclear Power	100	109	112	109	122	109	139
Other	0	1	1	2	3	6	7
Conventional Hydropower	78	78	78	79	78	78	78
Geothermal	2	5	5	6	7	7	8
Municipal Solid Waste/Landfill Gas	3	4	5	4	5	4	5
Wood and Other Biomass	6	8	10	10	19	12	42
Solar	1	1	1	2	2	3	3
Wind	7	19	30	20	60	20	63
Total	936	1,027	1,032	1,098	1,126	1,186	1,215
Price (2004 cents per kilowatthour)							
Credit Price	0.00	0.00	1.25	0.00	1.98	0.00	1.52
Retail Electricity Price	7.6	7.2	7.3	7.4	7.4	7.5	7.5
Electric Power Sector Emissions (million metric tons)							
Carbon Dioxide	2,299	2,835	2,649	3,052	2,711	3,318	2,830
Fuel Prices							
Natural Gas Wellhead Price (2004 dollars per thousand cubic feet)	5.49	4.90	4.91	5.43	5.26	5.92	5.78
Coal Minemouth Price (2004 dollars per ton)	20.07	20.20	19.71	20.63	19.53	21.73	20.17

[A]Includes solar thermal power, utility-owned photovoltaics, and distributed photovoltaics.
[B] Incremental legislative target expressed as share of total same-year sales, accounting for exempt small retail suppliers and biological sequestration.

Source: National Energy Modeling System runs: AEO2006.D111905A and AEO06_NWCOLES.D111606A

1. Background

This report responds to a September 12, 2006, request from Senator Norm Coleman for an assessment of a proposed clean energy portfolio standard (CEPS) that would require each retail electricity supplier to provide an increasing share of its sales from zero and low-carbon dioxide (CO_2) emitting sources. In June 2006, EIA provided analysis of an earlier proposal along similar lines.

Proposal Summary

This proposal applies to retail electricity suppliers with sales exceeding 500,000 megawatthours. Smaller suppliers, accounting for 270 billion kilowatthours (7 percent) of electricity sales in 2005, are exempt.

Covered retail electricity suppliers must submit to the Secretary of Energy clean energy credits in proportion to their total electricity sales. For each retail supplier, the number of clean energy credits required is either the specified share of sales during each phase of the program or the growth in electricity sales above their baseline, whichever is smaller. For example, if the share required were 20 percent in a particular year, but a retail electricity suppliers sales had only increased ten percent above its baseline sales, its required share would be limited to ten percent. Each retail electricity seller's baseline is its average annual sales during the 2008 to 2011 period.

Suppliers earn clean energy credits for renewable electricity generation, generation from fossil plants employing CO_2 capture and storage, new nuclear generation, and a limited amount of biologic sequestration. Electricity generated from solar thermal, photovoltaic, wind, ocean, geothermal, biomass, solid waste, landfill gas, and incremental hydropower technologies is counted as clean energy and is eligible to receive full compliance credits. Coal and natural gas plants that capture and transport their CO_2 emissions to permanent underground storage formations receive credits in proportion to their total CO_2 emissions. For example, a coal integrated gasification combined cycle (IGCC) plant capturing 90 percent of its carbon emissions receive 9/10 of a credit for each kilowatthour of electricity generated. Electric generation from new nuclear plants receives credits at the rate of one-half credit per kilowatthour of generation. Additionally, renewable projects on Indian lands receive two credits per kilowatthour generated. Biological carbon sequestration is eligible to earn credits to meet up to ten percent of the requirement. Examples of this include carbon stored through tree plantings and forest preservation. These sequestration programs receive 1,000 credits for each metric ton of carbon dioxide stored. The proposal also allows participation in international offset programs and carbon trading markets.

Under this revised proposal, an escalating percentage of total electricity sales must come from clean energy generation beginning in 2015. The required share of clean energy generation as a percentage of sales is:

2015-2019	10 percent
2020-2024	15 percent
2025 and thereafter	20 percent

The final requirements of this plan do not expire, unlike the previous proposal, which contained a 2030 sunset date.

Retail electricity suppliers are able to earn credits for future use by generating power with qualifying resources prior to the beginning of the program in 2015. Electricity suppliers are also free to sell, transfer, or exchange their credits. If a retail seller is not able to meet the standard, it may borrow from future anticipated credits, while submitting a plan ensuring future compliance, or it may buy credits from the program administrator. Credits purchased from the program administrator cost 2.5 cents per kilowatthour in 2005 dollars, with an adjustment for inflation.

The proposal allows credits earned from meeting State renewable portfolio standards to count towards the minimum renewable generation requirement as long as the energy meets the definition of a clean energy resource described above. Suppliers must still comply with the State renewable portfolio standard if it is more stringent than the Federal requirement. Compliance credits earned toward State requirements, including through acquisition, payment of non-compliance penalties, or the use of financial compliance mechanisms (that is, “alternative compliance payments”) are valid for use in compliance with the Federal requirement. Therefore, providers may pay more than the Federal allowance market price if they fail to reach the State-mandated share of clean/renewable energy. If the State’s credit requirement exceeds the Federal requirement, the retailer may transfer the excess credits to an associated company.

Implementation Issues

EIA’s National Energy Modeling System (NEMS), which provides the projections in the *Annual Energy Outlook*, cannot represent all the provisions of the proposed CEPS. For example, the proposal requires the Secretary of Energy to establish rules and procedures for implementing and enforcing the requirements. This will necessitate the development of a system to establish unique sales baselines, monitor annual electricity sales growth, estimate the required level of qualifying generation, and ensure compliance for each retail electricity supplier in the country. The required qualifying sales shares may differ for each supplier because of differences in their sales growth from the baseline period. For new, merged, or divested suppliers, or suppliers whose customer base simply changes, special procedures will be required for determining the appropriate baselines and incremental annual sales growth. Given the frequency of companies’ recent history of entering and leaving the retail electricity marketplace, this process could require significant effort.

In this analysis, it is assumed that all applicable suppliers’ sales grow at the same average annual rate each year. Actual data, however, show that this is unlikely to occur, with some suppliers not growing and others showing negative growth. Data reported for electricity suppliers between 2000 and 2004 show great diversity in sales growth. Moreover, electricity restructuring has increased sales volatility, causing periods of rapid negative and positive growth, which are difficult to predict. Although EIA models the requirement as the lesser of aggregate national sales growth from the baseline period and the percent of total sales on a national scale, each supplier is different. Some suppliers' sales will likely grow slowly enough that the proposed legislation will not require them to hold the share of credits as a percentage of total sales. EIA cannot predict which requirement each company will have and, therefore, takes the lesser of the average national estimates for all providers.

As noted, the proposal allows electricity suppliers to borrow clean energy credits against future compliance. Specifically, the Secretary of Energy may allow retail suppliers to borrow excess future compliance credits with submission of a plan to ensure compliance with both current and future targets up to three years into the future. The program administrator has discretion to extend the three-year borrowing limit where the plan specifies new nuclear generation as the proposed compliance option. The borrowing option is not represented in this analysis.

Model Application

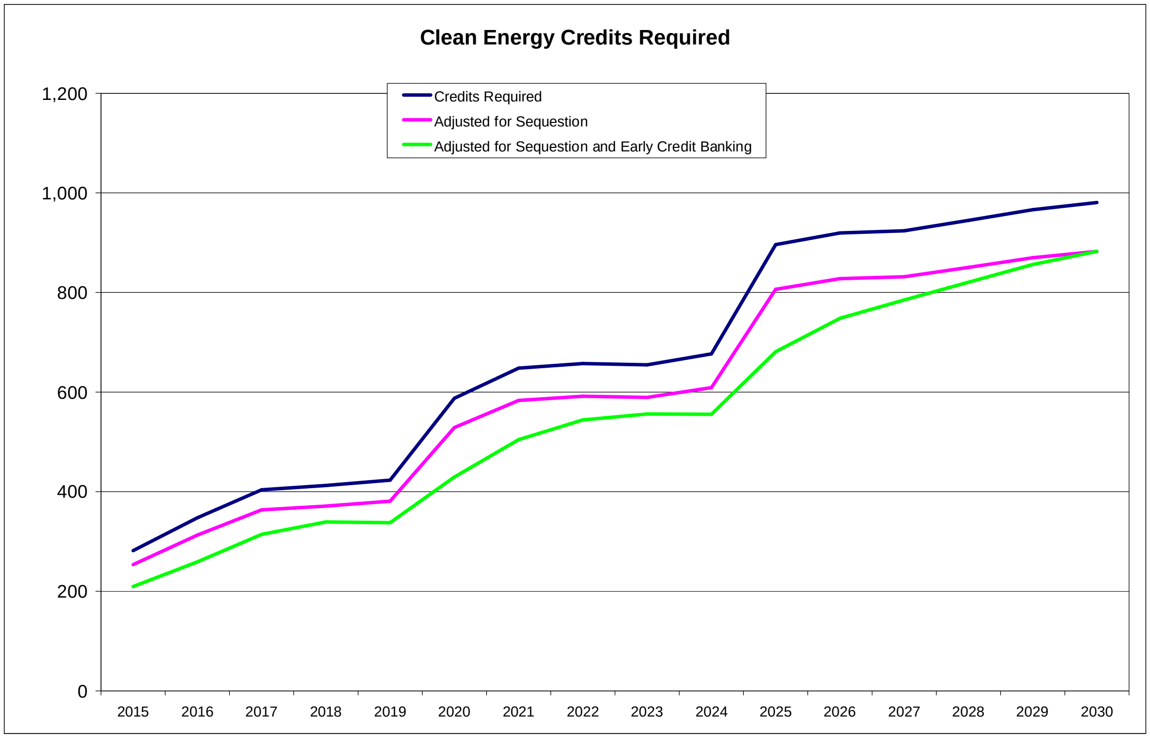
EIA made several simplifying assumptions to model the proposal. Since the model does not represent individual electricity suppliers, EIA calculated a target share for aggregated electricity sales. Suppliers with aggregate annual sales less than 500,000 megawatthours would remain at the 2005 level of 270 billion kilowatthours throughout the projection period.

The calculated minimum renewable generation requirement share is based on the lesser of the required annual percentage share of the prior years total sales or 100 percent of sales growth from the average 2008 through 2011 baseline using the *Annual Energy Outlook 2006* reference case projections. For the first 2 years of the program, the required annual percentage share of total sales is higher than incremental sales, therefore, the requirement is limited to the sales growth relative to the baseline period.

In the early action period between 2010 and 2015, electricity suppliers have the opportunity to earn credits before the first compliance period (2015-2019) begins. A large number of credits are expected to be banked through 2015. EIA projects generation of approximately 828 billion kilowatthours of eligible power during this five-year period. This analysis assumes that suppliers use these credits to minimize compliance cost over the subsequent 15 years. It was also assumed that biological sequestration would supply the ten-percent maximum share of credits allowed by the program. Marginal abatement curves for CO_2 sequestration projects provided by the U.S. Environmental Protection Agency showed that nearly double the maximum allowable biological sequestration allocation would be available at less than half the average credit price, suggesting ample opportunities to utilize this mechanism, even given significant uncertainty in the estimates of sequestration opportunities and costs. Figure 1 shows the qualifying generation requirement used in this analysis, which assumes uniform national growth rates, a 10-percent share accounted for by biological sequestration, and the utilization of early credits to reduce compliance costs.

Figure 1: Estimated National Target of Clean Energy Generation

(billion kilowatthours)



Source: Energy Information Administration, Office of Integrated Analysis and Forecasting

This analysis does not address the potential impacts of issuing double credits for qualifying resources developed on Indian lands. If such resources are developed, the amount of qualifying generation stimulated by the CEPS will be lower. This report also does not consider the potential development of ocean energy technologies.

This report, like other EIA analyses of clean energy and environmental policy proposals, focuses on the impacts of those proposals on energy choices made by consumers in all sectors and the implications of those decisions for the economy. This focus is consistent with EIA's statutory mission and expertise. The study does not account for any possible health or environmental benefits that might be associated with reducing emissions or the siting implications resulting from changes in electric power sector capacity expansion plans.

NEMS, like all models, is a simplified representation of reality. Projections are dependent on the data, methodologies, model structure, and assumptions used to develop them. Since many of the events that shape energy markets cannot be anticipated (including severe weather, technological breakthroughs, and geopolitical developments), energy markets are subject to significant uncertainty. Moreover, future developments in technologies, demographics, and resources cannot be foreseen with certainty.

Nevertheless, well-formulated models are useful in analyzing complex policies, because they ensure consistency in accounting and represent key interrelationships, albeit imperfectly, to provide insights.

EIA's projections are not statements of what will happen, but what might happen, given technological and demographic trends and current policies and regulations. EIA's reference case is based on current laws and regulations. Thus, it provides a policy-neutral starting point that can be used to analyze energy policy initiatives. EIA does not propose, advocate, or speculate on future legislative or regulatory changes within its reference case. Laws and regulations are generally assumed to remain as currently enacted or in force (including sunset or expiration provisions); however, the impacts of scheduled regulatory changes, when clearly defined, are reflected.

2. Energy Market Impacts of a Clean Energy Portfolio Standard

The proposed CEPS leads to extensive growth in renewable and nuclear generation. Since this proposal calls for a higher share of clean energy than the earlier proposal[4], the new generation mix further deviates from reference projections. Both renewable and nuclear energy grow more strongly with the new proposal. The expansion of these two technologies slows growth in coal and natural gas generation. As a result, carbon dioxide emissions are significantly less than in the reference case. The CEPS does raise electricity prices above those in the reference case, but only slightly (0.3 percent by 2030).

Generation and Capacity

The proposed CEPS results in changes to the fuels used for electricity generation and the mix of generating capacity added to meet growth in electricity demand. In 2030, this plan requires nearly a trillion kilowatthours of generation from qualifying sources. This is approximately double the requirements of the earlier proposal, and represents a 700-billion kilowatthour increase in qualifying generation compared to the reference case projections in 2030. These new goals, however, are moderated by the allowed 10-percent contribution from biological sequestration projects and the use of early clean energy credits accumulated in the five-year period before mandatory program compliance begins. Therefore, after starting out at 250 billion kilowatthours in 2015 (based on the incremental sales growth from the baseline-period sales), the adjusted targets reach about 880 billion kilowatthours of sales in 2030. The required amount increases the most in 2020 and 2025, as the milestones become more stringent.

Renewable generation grows much more quickly in the CEPS case than in the reference case. Total annual generation from renewable sources in 2030, including hydropower, reaches 1,026 billion kilowatthours (Figure 2) in the CEPS case, nearly double the 560 kilowatthours projected in the reference case. The earlier proposal only resulted in 592 billion kilowatthours of renewable generation in 2030.

Total nonhydropower renewable generating capacity grows by 759 percent between 2005 and 2030 in the CEPS case. Adding new renewable generating capacity becomes the compliance option of choice for the majority of the clean energy credits required because renewable technologies receive full credits and the share targets are higher in the revised CEPS. Renewable generating capacity grows from 97 gigawatts in 2004 to 124 gigawatts in the reference case and 198 gigawatts in the CEPS case. This is especially notable since hydropower capacity, currently the largest source of renewable generation, remains essentially flat over the period at 78 gigawatts.

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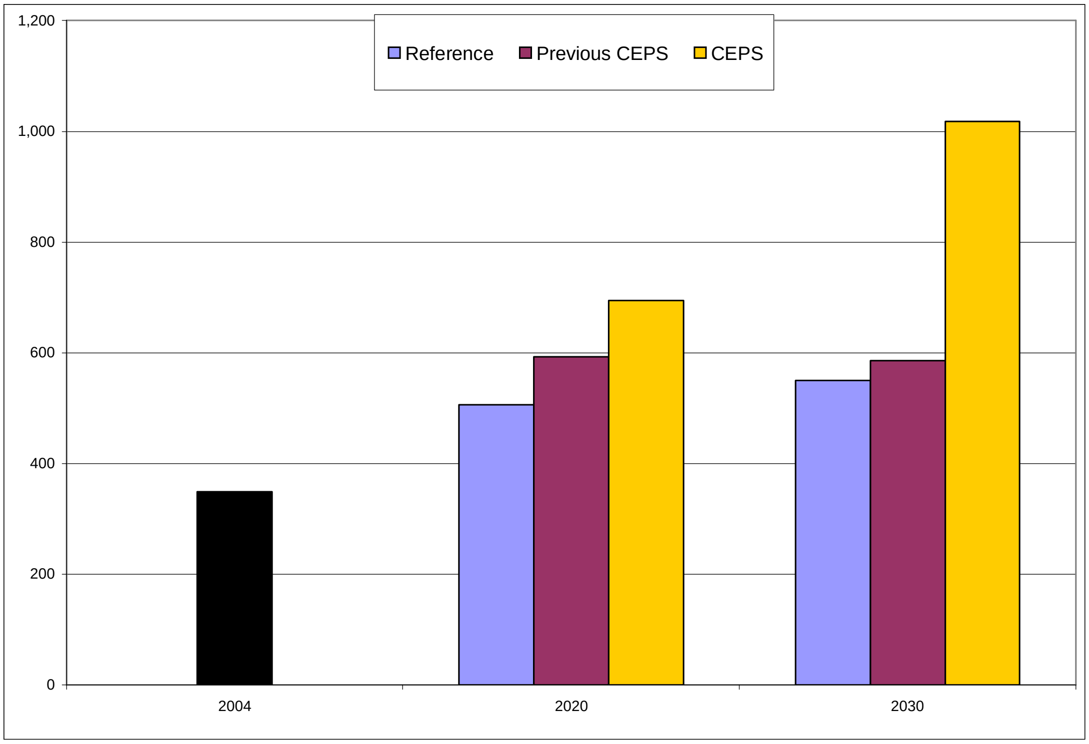
[4] Energy Information Administration, *Energy Market Impacts of a Clean Energy Portfolio Standard*, SR/OIAF/2006-02 (Washington, DC, June 2006). Web site www.eia.doe.gov//oiaf/servicerpt/emice/index.html.

Figure 2. Renewable Generation in Alternative Cases
(billion kilowatthours)



Source: National Energy Modeling System runs: AEO2006.D111905A, AEO06_COLE.D050906A, and AEO06_NWCOLES.D111606A

Electricity from biomass accounts for a large component of the growth in renewable generation. Initially, the targets are met through biomass co-firing in fossil fuel plants. In 2015, 55 billion kilowatthours of electricity come from co-firing in the CEPS case. By 2020, generation from biomass co-firing increases to 177 billion kilowatthours and it continues to rise to more than 200 billion kilowatthours over the next 2 years. Gradually, as more dedicated biomass plants come online, generation from co-firing decreases. By 2030, 126 billion kilowatthours of electricity are generated from co-firing biomass. Compared to the reference case, electricity from biomass co-firing is higher in all years. Reference case levels are 35 billion kilowatthours, 36 billion kilowatthours, and 26 billion kilowatthours in 2015, 2020, and 2030, respectively.

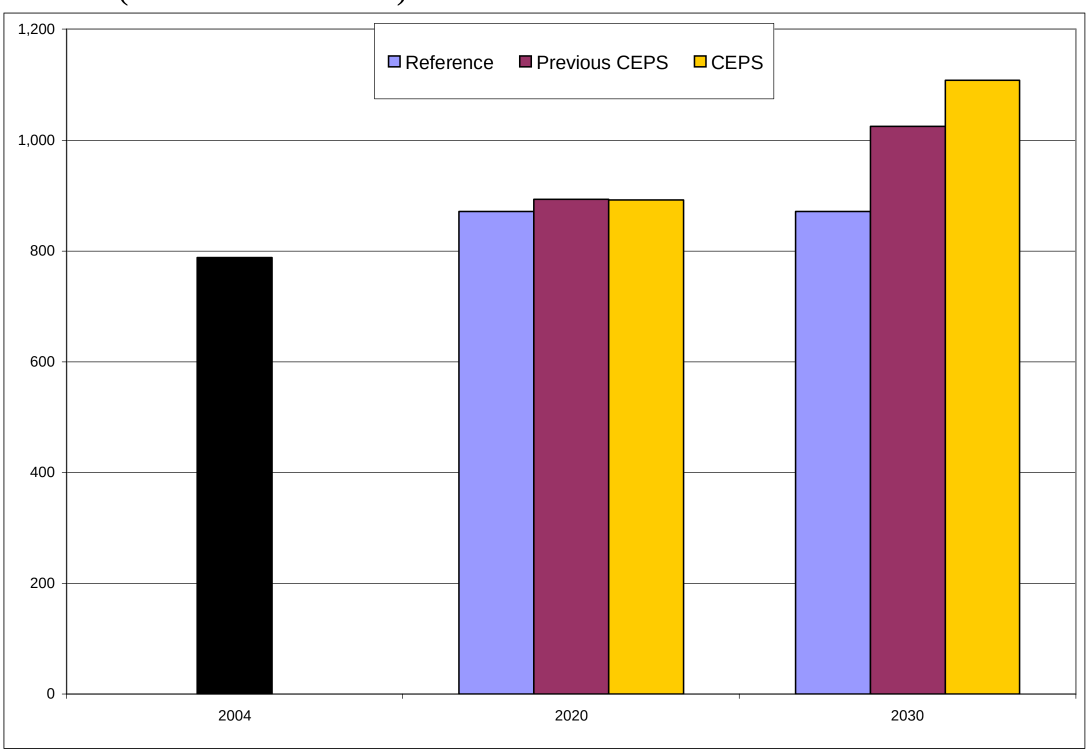
Dedicated biomass plant generation growth remains slow until the final years in the CEPS case, with the first new plants coming online in 2019. In 2015, the first year of mandatory compliance, dedicated plants generate 8 billion kilowatthours of electricity. This rises to 15 billion kilowatthours by 2020 and 78 billion kilowatthours by 2025 in the CEPS case. By 2028 in the CEPS case, dedicated biomass generation is double the 2025 levels, and it reaches 240 billion kilowatthours in 2030. The combined generation totals for dedicated and co-firing biomass facilities displace hydropower as the largest source of renewable generation in 2030 in the CEPS case. Capacity growth for dedicated plants mirrors the trend in generation. There are slightly more than 6 gigawatts of dedicated biomass facilities in 2004, and it increases slowly to nearly 8 gigawatts of capacity in

2015 in the CEPS case. However, by 2020 in the CEPS case, there are 10 gigawatts of dedicated biomass capacity, and by 2030 it increases to nearly 42 gigawatts of capacity. This contrasts with the slow, steady growth of dedicated capacity in the reference case, which projects nearly 12 gigawatts of capacity by 2030.

Wind generation also grows rapidly in the CEPS case, along with growth from other renewable technologies. In the CEPS case, generation from wind, which is 14 billion kilowatthours in 2004, grows to 58 billion kilowatthours in 2015 and 210 billion kilowatthours in 2030. In the reference case, wind generation grows more slowly, reaching 65 billion kilowatthours by the end of the forecast. Wind capacity also quickly grows under the CEPS proposal, reaching 63 gigawatts in 2030, over three times the level projected in the reference case. Geothermal capacity and generation increase in the CEPS case, with nearly 8 gigawatts of capacity generating 60 billion kilowatthours of electricity in 2030. This compares to 7 gigawatts of capacity producing 53 billion kilowatthours of electricity in 2030 in the reference case.

Figure 3. Nuclear Generation in Alternative Cases

(billion kilowatthours)

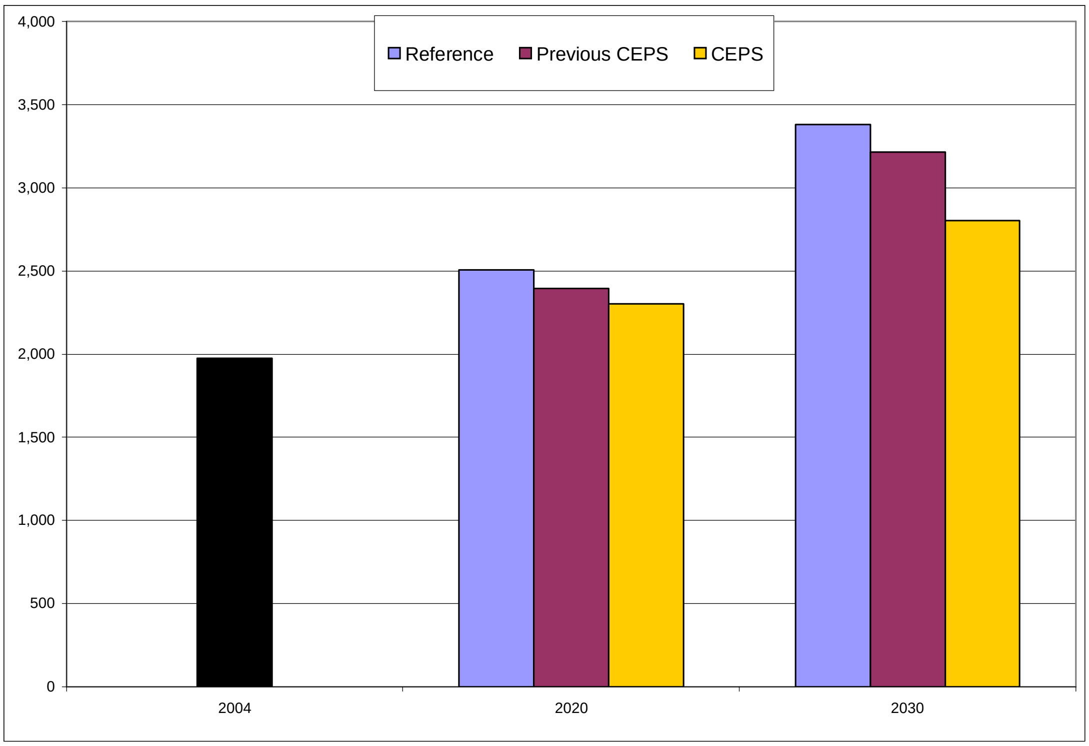


Source: National Energy Modeling System runs: AEO2006.D111905A, AEO06_COLE.D050906A, and AEO06_NWCOLES.D111606A

The CEPS is projected to lead to increased nuclear generation despite a reduction in the credit share earned in the new proposal. Unlike the previous proposal, where nuclear technologies received one full credit per unit of generation, new nuclear power stations receive one-half credit for the same amount of electricity produced under the new CEPS. Yet, because of higher required shares and resulting higher credit prices, nuclear generation increases by a larger amount. However, it no longer accounts for the majority of qualifying sources, as it did in the earlier analysis. In the CEPS case, nuclear generation grows to 1,109 billion kilowatthours in 2030 (Figure 3). This is a 41 percent increase over 2004 levels, and 27 percent greater than the generation projected in the reference case. Moreover, generation in 2030 is 8 percent higher than the 2030 projections under the earlier CEPS proposal. In the reference case, nuclear capacity is projected to increase by 9 gigawatts between 2004 and 2030. This increase includes 3 gigawatts of capacity up-rates at existing plants and 6 gigawatts of new plant capacity. In the CEPS case, 36 gigawatts of new nuclear capacity are added by 2030, 10 gigawatts greater than under the previous proposal.

Figure 4. Coal Generation in Alternative Cases

(billion kilowatthours)



Source: National Energy Modeling System runs: AEO2006.D111905A, AEO06_COLE.D050906A, and AEO06_NWCOLES.D111606A

While coal generation still increases in the CEPS case, annual generation in 2030 is projected to be 17 percent lower than in the reference case. Coal generation grows from 1,977 billion kilowatthours of electricity in 2004, to 2,803 billion kilowatthours by 2030 in the CEPS case compared to 3,381 billion kilowatthours in the reference case (Figure 4). Annual coal generation in 2030 is 13 percent less than what was projected in the previous CEPS analysis.

In the CEPS case, coal expansion occurs much more slowly, resulting in 63 fewer gigwatts of capacity in 2030 than in the reference case projections. In the reference case forecast, coal capacity is expected to rise from 310 gigawatts in 2004 to 481 gigawatts in 2030. This growth is higher than that of all other sources, so it follows that under the

CEPS proposal the growth in eligible clean energy technologies comes largely at the expense of coal. Coal capacity grows to 418 gigawatts in 2030 in the CEPS case. While this represents 33.0 percent growth over 2004 levels, it is 13 percent less than in the reference case, and 10 percent less than the previous proposal's projections for the same year. IGCC plants with carbon sequestration, which is eligible for clean energy credits, are not economical under the proposal.

Electricity generation from petroleum and natural gas in the CEPS case shows a slight decline from reference case levels, since these fuels do not qualify for clean energy credits. While natural gas generation grows in the CEPS case, it generates 10 percent less electricity in 2030 when compared to the reference case. Natural gas combined cycle capacity is 12 gigawatts lower in the CEPS case than in the reference. While the CEPS results in slower growth in natural gas generation, it still shows an overall growth of 21 percent compared to 2004 levels.

Cost and Price Impacts

Overall, the cost and price impacts of the CEPS are small. Credit prices generally rise as the required clean generation share increases. During the first phase of the CEPS, from 2015 through 2019, credit prices range from 0.4 to 1.0 cent per kilowatthour. During the second phase of the program, from 2020 to 2024, credit prices rise, but stay below 2.0 cents per kilowatthour. Shortly after 2025, during the third phase of the program when the share required increases to 20 percent, credit prices temporarily rise to the 2.5 cent per kilowatthour price cap, but they fall over time as fossil fuel prices increase and new nuclear and renewable facilities are built. The credit price drops to 1.5 cents per kilowatthour by 2030.

The CEPS leads to higher costs for power producers. From 2006 to 2030, the cumulative incremental cost to the electric power sector of the CEPS case, in net present value terms using a seven-percent discount rate, is $7.8 billion (less than 0.5 percent of reference case industry costs).[5] These costs include such costs as material and labor for plant construction and operation, fuel, and taxes. Costs for the purchase of compliance credits are internal transfer payments within the industry (that is, one power company paying a second power company to compensate them for the second company's clean energy credits). This analysis considers credits purchased from the government as costs to the electric power sector. The primary changes to industry costs include nearly $22 billion in higher capital and fixed operations and maintenance expenditures for nuclear, wind, and biomass generating facilities from 2006 through 2030. However, $14 billion in reduced cumulative fuel and variable operating and maintenance costs caused by lower fossil fuel use and prices partially offsets these increase costs. Suppliers purchase approximately $223 million in compliance credits from the government.

Because EIA projects impacts on power industry costs to be small with respect to the reference case, consumer electricity prices and bills experience similarly small increases.

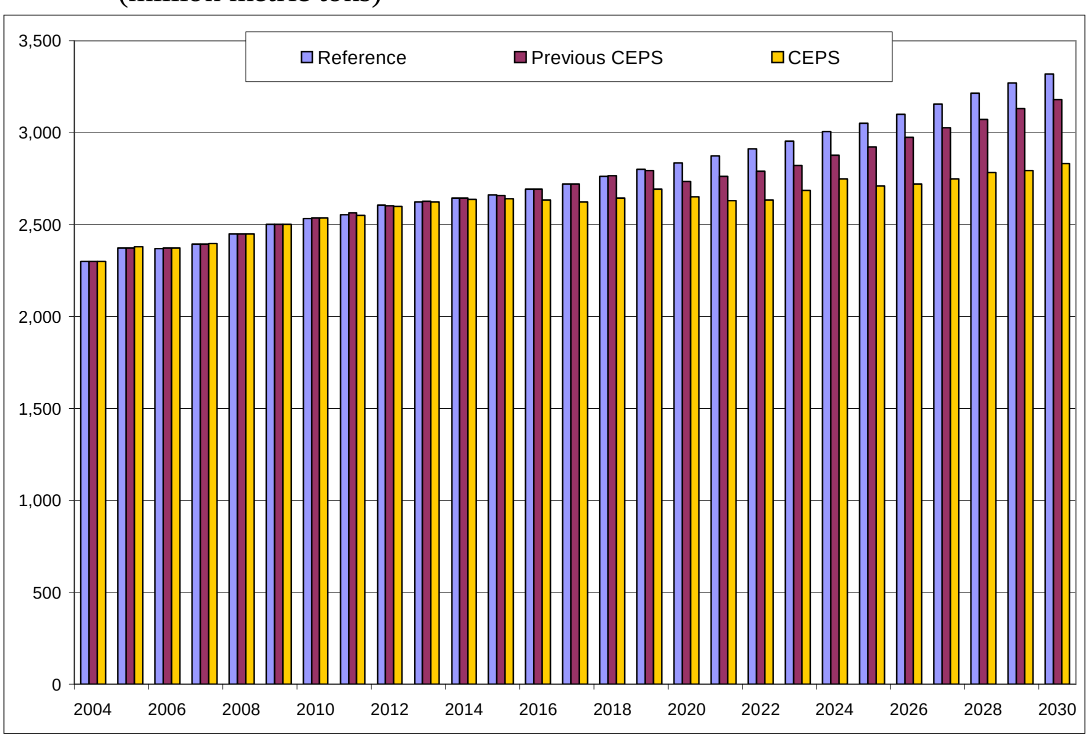
[5] All dollars in this report are 2004 dollars, cumulative calculations are discounted at 7 percent to 2006 and span from 2006 through 2030.

Average end-use electricity prices increase with the proposal requirements, but the impact is small and it varies over time. The largest increases are in 2020 through 2022 and in 2029, when annual electricity prices are slightly more than 1 percent (nearly 0.1 cent) above reference case levels. However, by 2030 end-use electricity prices are only 0.02 cents (0.3 percent) higher. Compared with the reference case, cumulative residential expenditures on electricity from 2006 through 2030 are $4.7 billion (2.8 percent) higher. Table 1 provides summary results for the analysis.

Emissions

The reduced use of coal and natural gas in the CEPS case lowers CO_2 emissions, particularly in the later years of the projections (Figure 5). Within the electric power sector, CO_2 emissions in 2030 are 488 million metric tons (15 percent) lower in the CEPS case than in the reference case. Over the entire projection period, cumulative emissions are 4,162 million metric tons lower (6 percent) than the reference levels. The current proposal achieves deeper cuts than the previous one, which only decreased 2030 annual emissions by 136 million metric tons. Despite this change, electricity sector CO_2 emissions in 2030 in the CEPS case are still 23 percent higher than the 2004 level. Emissions of sulfur dioxide, nitrogen oxides, and mercury are largely unchanged by the CEPS proposal. These emissions are subject to national or regional cap-and-trade regulations under the recently enacted Clean Air Interstate Rule and Clean Air Mercury Rule.

Figure 5. Power Sector Carbon Dioxide Emissions
(million metric tons)



Source: National Energy Modeling System runs: AEO2006.D111905A, AEO06_COLE.D050906A, and AEO06_NWCOLES.D111606A

Table 1. Key CEPS Analysis Results, 2020, 2025, and 2030

	2004	2020 Reference	2020 CEPS	2025 Reference	2025 CEPS	2030 Reference	2030 CEPS
Generation (billion kilowatthours)							
Coal	1,977	2,505	2,302	2,896	2,547	3,381	2,803
Petroleum	120	107	109	108	103	115	108
Natural Gas	702	1,103	1,090	1,070	968	993	889
Nuclear Power	789	871	892	871	967	871	1,109
Conventional Hydropower	269	303	302	303	302	303	302
Geothermal	14	34	37	47	55	53	60
Municipal Solid Waste/Landfill Gas	22	29	34	30	36	30	37
Dedicated Biomass	36	51	53	63	119	77	285
Biomass Co-Firing	1	36	177	29	188	26	126
Solar[A]	1	3	3	4	4	6	6
Wind	14	60	97	63	201	65	210
Total	3,955	5,108	5,104	5,492	5,498	5,926	5,944
Clean Energy Portfolio Standard Compliance							
Electricity Sales (billion kilowatthours)	3,567	4,629	4,621	4,956	4,945	5,341	5,326
Percent Clean Energy Required[B]	0.0	0.0	9.4	0.0	13.8	0.0	16.6
Generating Capacity (gigawatts)							
Coal Steam	310	345	336	390	365	457	394
Other Fossil Steam	124	80	81	79	78	75	74
Combined Cycle	159	214	208	226	215	231	218
Combustion Turbine/Diesel	130	149	150	159	160	174	174
Nuclear Power	100	109	112	109	122	109	139
Other	0	1	1	2	3	6	7
Conventional Hydropower	78	78	78	79	78	78	78
Geothermal	2	5	5	6	7	7	8
Municipal Solid Waste/Landfill Gas	3	4	5	4	5	4	5
Wood and Other Biomass	6	8	10	10	19	12	42
Solar	1	1	1	2	2	3	3
Wind	7	19	30	20	60	20	63
Total	936	1,027	1,032	1,098	1,126	1,186	1,215
Price (2004 cents per kilowatthour)							
Credit Price	0.00	0.00	1.25	0.00	1.98	0.00	1.52
Retail Electricity Price	7.6	7.2	7.3	7.4	7.4	7.5	7.5
Electric Power Sector Emissions (million metric tons)							
Carbon Dioxide	2,299	2,835	2,649	3,052	2,711	3,318	2,830
Fuel Prices							
Natural Gas Wellhead Price (2004 dollars per thousand cubic feet)	5.49	4.90	4.91	5.43	5.26	5.92	5.78
Coal Minemouth Price (2004 dollars per ton)	20.07	20.20	19.71	20.63	19.53	21.73	20.17

[A]Includes solar thermal power, utility-owned photovoltaics, and distributed photovoltaics.
[B] Incremental legislative target expressed as share of total same-year sales, accounting for exempt small retail suppliers and biological sequestration.

Source: National Energy Modeling System runs: AEO2006.D111905A and AEO06_NWCOLES.D111606A

3. Uncertainty

All long-term projections engender considerable uncertainty. It is particularly difficult to foresee how existing technologies might evolve or what new technologies might emerge as market conditions change. EIA projects that the requirements of this program can be met using existing technologies or technologies already projected to be commercially available in the reference case. However, as new clean energy technologies are developed or existing technologies are improved, these new technologies may prove more economically attractive than those technologies projected in this analysis to meet the CEPS targets. Introduction of lower-cost clean energy technologies could change the projected mix of generation resources and reduce the cost of compliance. Similarly, the cost and performance of some commercial or near-commercial clean energy technologies may not improve at the projected rates, thus allowing other technologies to gain market share and potentially raise the costs of compliance.

Several of the clean energy technologies projected to gain market share also face uncertainties with respect to resource availability and concerns over ability to site plants and dispose of generation by-products. Although the United States has witnessed extensive wind development over the past 5 years, some projects have been hampered or stopped by community objections, environmental concerns (such as for local bird or bat populations), or other siting issues. Of the extensive wind resource remaining undeveloped in the United States, it is largely unknown how much will be associated with such concerns or what the costs of mitigating these concerns might be. Similarly, nuclear plant siting may face the possibility of additional legal expenses, or local opposition, which could raise costs or limit opportunities; however, the magnitudes of these limitations are currently unknown. Additionally, nuclear power faces waste disposal issues. Several States limit the on-site storage of spent nuclear fuels and Federal efforts to commission a permanent storage site are not progressing as originally scheduled. Furthermore, approved Federal long-term storage sites only contain sufficient capacity for current facilities. These problems may be mitigated with a combination of additional spent-fuel storage capability and spent-fuel reprocessing, but the cost of either of these options is highly uncertain.

As noted in the methodology section, NEMS was not able to fully model some aspects of the policy. Provisions to award double credits for projects built on Indian lands, exempt slower-growing utilities from holding credits, and exempt retail energy suppliers with fewer than 500,000 megawatthours of annual sales will affect the actual amount of clean energy generation required under this proposal. These impacts are believed to be small, but are largely unknown.

Appendix A. Analysis Request Letter

NORM COLEMAN
MINNESOTA

United States Senate

WASHINGTON, DC 20510-2307

hmp://coleman.senate.gov

COMMITTEE ON
GOVERNMENTAL AFFAIRS
CHAIRMAN
PERMANENT SUBCOMMITTEE ON INVESTIGATIONS

COMMITTEE ON
FOREIGN RELATIONS
CHAIRMAN
SUBCOMMITTEE ON
WESTERN HEMISPHERE, PEACE CORPS AND NARCOTICS AFFAIRS

COMMITTEE ON
AGRICULTURE, NUTRITION, AND FORESTRY

COMMITTEE ON
SMALL BUSINESS AND ENTREPRENEURSHIP

September 12, 2006

The Honorable Guy F. Caruso
Administrator, Energy Information Administration
Department of Energy
Room 2H-027/FORS
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Caruso:

On April 24th, 2006, I submitted a request to the Energy Information Administration (EIA) for analysis of a clean energy portfolio standard (CEPS) proposal. In June, EIA released its analysis, providing valuable insight into how a clean energy portfolio standard could perform in the United States, and I have utilized that information to inform a revised, more robust CEPS.

The goal of this revised CEPS (attached) remains the formulation of legislation that will diversify electric generation fuels; reduce Clean Air Act criteria pollutants and carbon dioxide emissions; promote new electric sector technology; and encourage energy conservation through demand side management programs. This revised CEPS proposal, submitted last April, showed great promise on these fronts. EIA found electricity sector carbon dioxide emissions could be reduced at negligible cost to ratepayers and the electricity power sector. Meanwhile, the analysis showed the proposal would lessen America's reliance on natural gas through implementation of advanced energy technologies.

Building on the first analysis, the revised proposal will require each retail electric supplier (supplying more than 500,000 MWh/year) to, beginning in 2015, submit to the Secretary of Energy clean energy credits equal to a required annual percentage of its retail electric sales. This required percentage would be 10 percent in 2015-2020; 15 percent in 2020-2025; and 20 percent in 2025 and thereafter. In order to prevent slow-growing utilities from being forced to shut down existing generation to comply, a retail electric supplier's obligation would be capped at 100 percent of its load growth.

Thank you for your timely consideration of this request. If you or your staff has any questions regarding the draft legislation, please feel free to contact Tony Eberhard on my staff at (202) 224-7424.

Sincerely,

Norm Coleman
United States Senate

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Appendix B. Proposed Clean Energy Portfolio Standard

Clean Energy Portfolio Standard

SEC. —. CLEAN ENERGY PORTFOLIO.

Title VI of the Public Utility Regulatory Policies Act of 1978 is amended by adding at the end the following:

"SEC. 609. CLEAN ENERGY PORTFOLIO STANDARD.

"(a) Findings.— Congress finds that

"(1) The development of the country's clean energy resources is a high priority. A Federal clean energy portfolio standard will help improve the the nation's air quality by increasing the use of technologies to generate electricity without the production of sulfur dioxide, nitrous oxide, mercury and other emissions.

"(2) Nearly one-half of all States have implemented or are in the process of implementing programs, including Renewable Portfolio Standard ("RPS") programs, intended to diversify the mix of fuels used in the generation of electricity by requiring that a percentage of electricity sold, generated or otherwise supplied to end users be generated from designated renewable energy resources, or otherwise have programs in effect that encourage the generation of renewable or inherently clean sources of electricity.

“(3) These programs have been developed on a state-by-state basis in recognition of specific state and regional needs, interests, and resource availability.

“(4) On a national basis, the diversification of the electricity generation base will help to insure our national energy and economic security, while producing environmental improvements and advancing the introduction of new energy technologies.

“(5) Reduction of consumer demand for electricity through deployment of energy efficient technologies in the residential, business and commercial sector; implementation of demand response, smart metering and other programs that give end users tools to reduce energy consumption; and greater use of on site generating technologies, including solar, photovoltaic, combined heat and power, and fuel cells, also will contribute to national energy and economic security, environmental improvement and market opportunities for advanced technologies.

“(6) A clean energy portfolio standard can help diversify fuel sources used for electricity generation, encourage conservation, promote renewable generation resources, and significantly reduce future CO2 emissions.

“(7) The proliferation of various state programs addressing carbon emissions from the electric generation sector threatens efficiencies, generation fuel diversification and consumer electricity prices.

“(8) To ensure the most effective use of existing resources and facilities,and to ensure that a signficant portion of the increased future demand for electricity is served by clean energy resources, a Federal clean energy porfolio standard should be applied to the a retail electric supplier’s total electric sales to consumers.

"**(b) Minimum Renewable Generation Requirement.—** For each calendar year beginning in calendar year 2015,each retail electric supplier shall submit to the Secretary, not later than April 1 of the following calendar year, clean energy credits in an amount equal to the required annual percentage specified in subsection (c) of the retail electric supplier’s total retail electric sales, except that a retail electric supplier shall not be required to submit clean energy credits in an amount greater than its incremental electric sales to electric consumers in excess of the retail electric supplier’s base amount.

"**(c) Required Annual Percentage.—** The required annual percentage submitted in a calendar year shall be not less than the amount specified in the following table:

Calendar year:	**Minimum annual percentage**
2015-2019	10%
2020-2024	15%
2025 and thereafter	20%

"**(d) Clean Energy Credits.—** (1) A retail electric supplier may satisfy the requirements of subsection (b) through the submission of clean energy credits--

"(A) issued to the retail electric supplier under subsections (e) and (g);

"(B) obtained by purchase or exchange under subsection (f);

"(C) borrowed under subsection (h); or

"(D) purchased from the Secretary under subsection (i).

"(2) No more than 10% of a retail electric supplier's obligation under subsection (b) may be satisfied through use of credits issued under subsection (e)(3)(B) (credits associated with sequestration or retrofit technologies).

"(3) A clean energy credit may be counted toward compliance with subsection (b) only once.

"(e) Issuance of Credits.— (1) The Secretary shall establish by rule, not later than 1 year after the date of enactment of this section, a program to issue, monitor the sale or exchange of, and track clean energy credits.

"(2) Under the program established under this section, an entity that generates electric energy through the use of a clean energy resource may apply to the Secretary for the issuance of clean energy credits. If the electricity is generated outside the United States, the applicant must demonstrate to the Secretary that the electricity is sold for ultimate consumption in the United States. The application shall indicate--

"(A) the type of clean energy resource used to produce the electricity,

"(B) the location where the electric energy was produced, and

"(C) any other information the Secretary determines to be appropriate.

"(3)(A) Except as provided in the subparagraphs that follow, the Secretary shall issue annually to each entity that generates electric energy one clean energy credit for each kilowatt hour of electric energy the entity generated in the prior calendar year through the use of clean energy.

"(B) The Secretary shall establish by rule, within one year after the date of enactment, a program for verifying the reduction of CO2 emissions into the atmosphere through permanent geological sequestration, bio-sequestration or through other verifiably permanent reductions in CO2 emissions from the retrofit of existing power plants with technology that permanently reduces CO2 emissions as related to net power output of the existing power plant or from the permanent reduction in CO2 emissions from industrial or other sources. The Secretary shall issue 1,000 credits for each ton of CO2 that has been verifiably and permanently sequestered, reduced or that verifiably has been sequestered through bio-sequestration. Credits issued under this subparagraph shall have the same value as credits issued under any other subparagraph of this subsection and may be used for purposes of complying with the minimum generation requirements under subsections (b) and (c) of this section, except as provided in subsection (d)(2). Projects eligible under this section shall include bio sequestration or other offset projects located outside the United States or verifiable carbon dioxide reductions obtained through international carbon dioxide trading markets.

"(C) The Secretary shall issue two clean energy credits for each kilowatt hour of electric energy generated and supplied to the grid in the prior calendar year through the use of clean energy at a facility located on Indian land. For purposes of this paragraph, clean energy generated by biomass cofired with other fuels is eligible for two credits only if the biomass was grown on such land.

"(D) In the case of a retail electric supplier that is subject to a State renewable standard program that requires the generation or purchase of electricity from renewable energy; provides for alternative compliance payments in satisfaction of applicable State requirements under the program; provides for compliance through the acquisition of certificates or credits; provides for other financial compliance mechanisms; or imposes a penalty in the event of a failure to meet applicable requirements, the Secretary shall issue clean energy credits in an amount that corresponds to the kilowatt-hour obligation represented by the State alternative compliance payment, other financial compliance payment or penalty payment as though that payment had been made to the Secretary under subsection (i).

Such clean energy credits may be applied against the retail electric supplier's own required annual percentage under subsection (b) or may be transferred for use only by an associate company of the retail electric supplier. For purposes of this subsection, “associate company” shall have the meaning in Section 1262 of the Public Utility Holding Company Act of 2005.

“(E) In the case of a retail electric supplier that meets the criteria under subsections (n) (5) and (6), the Secretary shall issue clean energy credits in an amount that corresponds to the amount of expenditures on eligible demand side management products or services as though those expenditures had been payments made to the Secretary under subsection (i). Such clean energy credits may be applied against the retail electric supplier's own required annual percentage or may be transferred for use only by an associate company of the retail electric supplier.

"(F) In the case of a new nuclear power facility qualifying as an inherently low emissions facility, the Secretary shall issue ½ credit for each kilowatt hour of production.

"(G) To be eligible for a clean energy credit, the unit of electric energy generated through the use of a clean energy resource must be either sold or used by the generator. If both a clean energy resource and a non-clean energy resource are used to generate the electric energy, the Secretary shall issue clean energy credits based on the proportion of the clean energy resources used. The Secretary shall identify clean energy credits by type and year of generation.

"(H) When a generator sells electric energy generated through the use of a clean energy resource to a retail electric supplier under a contract subject to section 210 of this Act or pursuant to a State net metering program, the retail electric supplier shall be treated as the generator of the electric energy for the purposes of this section for the duration of the contract.

"(I) The Secretary shall issue clean energy credits for electricity generated by an integrated gasification combined cycle generation facility or other generation facility that provides for carbon capture and sequestration in proportion to the fraction of carbon dioxide captured and sequestered. The Secretary shall calculate the amount of clean energy credits issued to such facility by multiplying the kilowatt hours generated by the facility and supplied to the grid during the prior year by the ratio of the amount of carbon dioxide captured from the facility and sequestered to the sum of the amount of carbon dioxide captured from the facility and sequestered plus the amount of carbon dioxide emitted from the facility during the same year. Clean energy credits issued under this subsection are not subject to the limits set forth in subsection (d)(2).

"(f) Clean Energy Credit Trading.— A clean energy credit may be sold, transferred or exchanged by the entity to whom issued or by any other entity who acquires the renewable energy credit, except for those clean energy credits issued pursuant to subsections (e)(3)(D) and (E). A clean energy credit for any year that is not used to satisfy the minimum renewable generation requirement of subsection (b) for that year may be carried forward for use within any subsequent year.

"(g) Early Action.-- A retail electric supplier generating electric energy through the use of a clean energy resource (except for an inherently low emissions facility), at any time after 2009 and before 2015, is eligible to receive credits from the Secretary, and the Secretary is directed to issue such credits, on the same basis as if the generation occurred in 2015 or thereafter. Such credits shall have the same value and may be used for any purpose authorized under this section.

"(h) Clean Energy Credit Borrowing.— At any time before the end of calendar year 2015 and any subsequent calendar year, a retail electric supplier that has reason to believe it will not have sufficient clean energy credits to comply with subsection (b) may --

"(1) submit a plan to the Secretary demonstrating that the retail electric supplier will earn sufficient credits within the next 3 calendar years (or longer if the retail electric supplier intends to obtain credits for new nuclear power) which, when taken into account, will enable the retail electric supplier's to meet the requirements of subsection (b) for calendar year 2015 and the subsequent calendar years involved; and

"(2) upon the approval of the plan by the Secretary, apply clean energy credits that the plan demonstrates will be earned within the next 3 calendar years (or longer if the retail electric supplier intends to obtain credits for new nuclear power) to meet the requirements of subsection (b) for each calendar year involved.

"(i) Credit Cost Cap.— The Secretary shall offer clean energy credits for sale at 2.5 cents per kilowatt-hour beginning in 2015 and shall offer credits for sale in subsequent years at the same price after adjusting for inflation.

"(j) Enforcement.— The Secretary may assess a civil penalty on a retail electric supplier that does not comply with subsection (b), unless the retail electric supplier was unable to comply with subsection (b) for reasons outside of the supplier's reasonable control (including weather-related damage, mechanical failure, lack of transmission capacity or availability, strikes, lockouts, or actions of a governmental authority). A retail electric supplier who does not submit the required number of clean energy credits under subsection (b) shall be subject to a civil penalty of not more 200 percent of the average market value of credits for the compliance period for each clean energy credit not submitted.

"(k) Information Collection.— The Secretary may collect the information necessary to verify and audit--

"(1) the annual electric energy generation and clean energy generation of any entity applying for clean energy credits under this section,

"(2) the validity of clean energy credits submitted by a retail electric supplier to the Secretary, and

"(3) the quantity of electricity sales of all retail electric suppliers.

"(l) Environmental Savings Clause.— Qualified hydropower production shall be subject to all applicable environmental laws and licensing and regulatory requirements.

"(m) Existing Programs.— (1) State Savings Clause.--This section does not preclude a State from imposing additional clean energy requirements in that State, including specifying eligible technologies under such State requirements.

“(2) Coordination. --In the rule establishing this program, the Secretary shall incorporate common elements of existing clean energy programs, including state programs, to ensure administrative efficiency, market liquidity and effective enforcement.   The Secretary shall work with the States to minimize administrative burdens and costs and to avoid duplicating compliance charges to retail electric suppliers.

"(n) Definitions.— For purposes of this section:

"(1) Biomass.--The term `biomass' means any organic material that is available on a renewable or recurring basis, including dedicated energy crops, trees grown for energy production, wood waste and wood residues, plants (including aquatic plants, grasses, and agricultural crops), residues, fibers, animal wastes and other organic waste materials, and fats and oils, except that with respect to material removed from National Forest System lands the term includes only organic material from --

"(A) thinnings from trees that are less than 12 inches in diameter;

"(B) slash;

"(C) brush; and

"(D) mill residues.

"(2) Bio-sequestration.- The term 'bio-sequestration' means the capture and storage of carbon in biological organisms.

"(3) Clean energy.--The term `clean energy' means electric energy generated by a clean energy resource.

"(4) Clean energy resource.--The term `clean energy resource' means solar (including solar water heating), wind, ocean, or geothermal energy, fuel cells (including zero emission regenerative fuel cell technology), biomass, solid waste (as defined in the Solid Waste disposal Act, 42 U.S.C. sec. 6901 et seq.), landfill gas, qualified hydropower production, as defined in section 45 (c)(8) of the Internal Revenue Code or an inherently low emissions facility.

"(5) Demand side management.- The term 'demand side management' means management of customer consumption of electricity or the demand for electricity through the implementation of energy efficiency technologies, management practices or other measures relating to residential, commercial, industrial, institutional or government customers that reduce electricity consumption by those customers or industrial by-product technologies consisting of the use of a by-product from an industrial process, including the reuse of energy from exhaust gasses or other manufacturing by-products that are used in the direct production of electricity at the facility of a customer. Such term shall also include –

"(A) distributed generation technologies, including on-site renewable energy systems and fuel cells;

"(B) energy efficiency technologies, including generation technologies to improve efficiency and grid technologies to reduce line losses and otherwise improve transmission efficiency; and

"(C) demand management techniques or processes.

"(6) Expenditures on eligible demand side management products or services.- The term 'expenditures on eligible demand side management products or services' means expenditures incurred, including administration and overhead costs, for demand side management measures offered by a retail electric supplier pursuant to energy conservation, efficiency and/or demand side management plans and programs established under state law or regulation and approved by the appropriate state regulatory authorities.

"(7) Indian land.--The term `Indian land' means--

"(A) any land within the limits of any Indian reservation, pueblo, or rancheria,

"(B) any land not within the limits of any Indian reservation, pueblo, or rancheria title to which was on the date of enactment of this paragraph either held by the United States for the benefit of any Indian tribe or individual or held by any Indian tribe or individual subject to restriction by the United States against alienation,

"(C) any dependent Indian community, and

"(D) any land conveyed to any Alaska Native corporation under the Alaska Native Claims Settlement Act.

"(8) Indian tribe.--The term `Indian tribe' means any Indian tribe, band, nation, or other organized group or community, including any Alaskan Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.), which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

“(9) Inherently low emissions facility. The term ‘inherently low emissions facility’ means an integrated gasification combined cycle generation facility or other generation technology that provides for carbon capture and sequestration, or a new nuclear power facility.

“(10) New nuclear power. The term ‘new nuclear power’ means electric energy that is generated from a nuclear facility placed in service after January 1, 2015.

"(11) Retail electric supplier.--The term `retail electric supplier' means a person or entity that sold not less than 500,000 megawatt hours of electric energy to electric consumers for purposes other than resale in any calendar year before January 1, 2015, and a person or entity that first sold electric energy to electric consumers for purposes other than resale after January 1, 2015.

"(12) Retail electric supplier's base amount.--The term `retail electric supplier's base amount' means the average annual amount of electric energy sold by the retail electric supplier to electric consumers for purposes other than resale, expressed in terms of kilowatt hours, during calendar years 2008 to 2011 or as otherwise determined by the Secretary. The Secretary shall issue rules within two years of enactment of this Act to establish the calculation of the base amount for retail electric suppliers that initiate sales after January 1, 2010, and how adjustments will be made for material changes in marketing patterns or other unusual circumstances in or since the base period.

"(13) Retail electric supplier's incremental electric sales. The term 'retail electric supplier's incremental electric sales' means the difference between a retail electric supplier's sales to electric consumers in a given year and the retail electric supplier's base amount.

"(14) Retail electric supplier's total retail sales. The term "retail electric supplier's total retail sales" means the total sales made to consumers in the previous calendar year by a retail supplier but excluding sales associated with electricity generated by a hydro-electric facility (but excluding qualified hydropower production as defined by section 45 (c)(8) of the Internal Revenue Code).

"(o) Recovery of Costs.— Any costs that will be incurred by a retail electric supplier in order to comply with the requirements of this section shall be deemed necessary and reasonable costs and shall be fully and contemporaneously recoverable in all jurisdictions. Costs necessary to comply with this section include, but are not limited to, the costs of purchase of clean energy credits and any associated energy, the costs of generation of clean energy credits, and the costs of firming, shaping, balancing, backup and delivery services prudently incurred to maintain a reliable and well-functioning electric system that incorporates energy from clean energy resources. A retail electric supplier whose sales of electric energy are subject to any form of rate regulation, including any utility whose rates are regulated by the Commission and any State regulated electric utility, shall not be denied the opportunity to recover the full amount of the prudently incurred incremental cost of energy obtained to comply with the requirements of subsection (b) for sales to electric customers which are subject to any form of rate regulation, notwithstanding any other law, regulation, rule, administrative order or any agreement between the electric utility and either the Commission or a State regulatory authority. For the purpose of this subsection, the term `incremental cost of energy' means--

"(1) the cost to the electric utility for the purchase of energy associated with the acquisiton of clean energy credits or for the generation of energy to satisfy the minimum clean energy generation requirement of subsection (b), including any costs incurred by the electric utility to receive such energy on its system and deliver such energy to its retail loads either over existing transmission facilities or newly constructed transmission facilities. Receipt and delivery costs include transmission and distribution costs or charges, any losses and associated ancillary service charges assessed by any applicable transmission provider or provided for pursuant to an electric utility's own Commission-accepted open access transmission tariff, and any firming, shaping, backup or delivery services necessary to balance clean energy; and

"(2) the cost to the electric utility for acquiring renewable energy credits to satisfy the minimum clean energy- generation requirement of subsection (b), including the costs for alternative compliance payments, credit or certificate purchases and other financial compliance payments made to states.

"(p) Program Review.— The Secretary shall conduct a comprehensive evaluation of all aspects of the Clean Energy Standard program within 10 years of enactment of this section and every 5 years thereafter. The study shall include an evaluation of --

"(1) The effectiveness of the program in increasing the market penetration and lower the cost of the eligible renewable technologies,

"(2) The opportunities for any additional technologies emerging since enactment of this section,

"(3) The impact on the regional diversity and reliability of supply sources, including the power quality benefits of distributed generation,

"(4) The regional resource development relative to renewable potential and reasons for any under investment in renewable resources,

"(5) The net cost/benefit of the clean energy standard to the national and state economies, including retail power costs, economic development benefits of investment, avoided costs related to environmental and congestion mitigation investments that would otherwise have been required, impact on natural gas demand and price, effectiveness of green marketing programs at reducing the cost of renewable resources, and

"(6) The flexibility granted to any State under subsection (r).

The Secretary shall transmit the results of the program review and any recommendations for modifications and improvements to the program to Congress not later than January 1, 2019.

"(q) Program Improvements.— Using the results of the review under subsection (p), the Secretary shall by rule, within 6 months of the completion of the review, make such modifications to the program as may be necessary to improve the efficiency of the program and maximize the use of clean energy under the program. In making such rule, the Secretary shall be authorized to expand the definition of clean energy resource in subsection (m)(4) or inherently low emissions facility in subsection (m)(10) to include new technologies the Secretary determines have characteristics in common with other energy resources listed in those subsections.

"(r) State Flexibility.— Within one year of enactment of this Section, any State that has reason to believe that the cost of complying with the requirements of this section shall cause undue economic hardship to the ultimate purchasers of electricity in that State, including manufacturing and industrial users of electricity, may petition the Secretary to grant a waiver from the requirements of this section for retail electric suppliers selling electricity to end use customers in that State. The Secretary shall grant such a waiver if he finds that the requirements of this section are likely to cause undue economic hardship to ultimate purchasers of electricity in that State. In making a determination on a State petition under this paragraph, the Secretary shall take into account (a) the adequacy of commercially available clean energy resources within the State, (b) the potential clean energy resources available within the region and (c) the cost of developing those resources at current and reasonably expected levels of technology, including the cost and availability of existing and needed transmission facilities to transmit electric energy from such clean energy resources to customers within the State, and (d) the economic and related impacts of such costs on ultimate purchasers within the State.

SR/OIAF/2007-01

Energy Market and Economic Impacts of a Proposal to Reduce Greenhouse Gas Intensity with a Cap and Trade System

January 2007

Energy Information Administration
Office of Integrated Analysis and Forecasting
U.S. Department of Energy
Washington, DC 20585

Preface and Contacts

The Energy Information Administration (EIA) is the independent statistical and analytical agency within the Department of Energy. EIA provides timely, high-quality energy information and prepares objective, transparent analyses for use of Congress, the Administration and the public. EIA does not, however, take positions on policy issues. Because of EIA's statutory independence with respect to the content of its energy information program, the analysis presented herein is strictly its own and should not be construed as representing the views of the U.S. Department of Energy or the Administration.

The model projections in this report are not statements of what will happen but of what might happen, given the assumptions and methodologies used. The reference case projections are business-as-usual trend forecasts, given known technology, technological and demographic trends, and current laws and regulations. Thus, they provide a policy-neutral starting point that can be used to analyze policy initiatives. EIA does not propose, advocate, or speculate on future legislative and regulatory changes. All laws are assumed to remain as currently enacted; however, the impacts of scheduled regulatory changes, when defined, are reflected.

The Office of Integrated Analysis and Forecasting prepared this report. General questions concerning the report can be directed to John J. Conti (john.conti@eia.doe.gov, 202/586-2222), Director of the Office of Integrated Analysis and Forecasting, and J. Alan Beamon (joseph.beamon@eia.doe.gov, 202/586-2025), Director of its Coal and Electric Power Division. Specific questions about the report can be directed to the following analysts:

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Executive Summary

Background

This report responds to a request from Senators Bingaman, Landrieu, Murkowski, Specter, Salazar, and Lugar for an analysis of a proposal that would regulate emissions of greenhouse gases (GHGs) through a national allowance cap-and-trade system. Under this proposal, suppliers of fossil fuel and other covered sources of GHGs would be required to submit government-issued allowances based on the emissions of their respective products. The gases covered in this analysis of the proposal include energy-related carbon dioxide, methane from coal mining, nitrous oxide from nitric acid and adipic acid production, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.[1]

The program would establish annual emissions caps based on targeted reductions in greenhouse gas intensity, defined as emissions per dollar of Gross Domestic Product (GDP). The targeted reduction in GHG intensity would be 2.6 percent annually between 2012 and 2021, then increase to 3.0 percent per year beginning in 2022. To limit its potential cost, the program includes a "safety-valve" provision that allows regulated entities to pay a pre-established emissions fee in lieu of submitting an allowance. The safety-valve price is initially set at $7 (in nominal dollars) per metric ton of carbon dioxide equivalent ($MMTCO_2e$) in 2012 and increases each year by 5 percent over the projected rate of inflation, as measured by the projected increase in the implicit GDP price deflator. In 2004 dollars, the safety valve rises from $5.89 in 2012 to $14.18 in 2030.

The proposal calls for initially allocating 90 percent of the allowances for free to various affected groups, but the proportion of allowances to be auctioned grows from 10 percent in 2012 to 38 percent in 2030. The revenue from the auctions and any safety-valve payments are accumulated into a "Climate Change Trust Fund," capped at $50 billion, to provide incentives and pay for research, development, and deployment of technologies to reduce greenhouse gas emissions. The U.S. Treasury would retain any revenue collected in excess of the $50-billion limit.

As specified in the request for the analysis, EIA considered both a Phased Auction case, which allocates allowances as specified in the proposal, and a Full Auction case, in which all allowances are assumed to be auctioned beginning in 2012. Because they share the same emissions targets and safety valve prices, the energy sector impacts in the Phased and Full Auction cases are very similar. The only areas where the impacts in the two cases differ are for electricity prices and the economic impacts associated with collection and use of revenue from the sale of allowances. Several additional sensitivity cases examine the impacts of higher and lower safety valves and limiting the use of emission reduction credits, or offsets, from non-covered entities. The proposal and its variants were modeled using the National Energy Modeling System and compared to the reference case projections from the *Annual Energy Outlook 2006 (AEO2006)*.[2]

[1] Specific provisions in the bill define the covered entities and the respective gases subject to regulation more precisely; however, the emissions accounting in NEMS precludes a more detailed treatment.

[2] Energy Information Administration, *Annual Energy Outlook 2006*, DOE/EIA-0383(2006)(Washington, DC, February 2006), web site www.eia.doe.gov/oiaf/aeo/index.html

The analysis presented in this report builds on previous EIA analyses addressing GHG limitation, including earlier EIA reports requested by Senator Bingaman[3], Senator Salazar[4], and Senators Inhofe, McCain, and Lieberman.[5] All of the analysis cases incorporate the economic and technology assumptions used in the AEO2006 reference case. While increased expenditures for research and development (R&D) resulting from the creation of the Climate Change Trust Fund are expected to lead to some technology improvements, a statistically reliable relationship between the level of R&D spending for specific technologies and the impacts of those expenditures has not been developed. Furthermore, the impact of Federal R&D is also difficult to assess, because the levels of private sector R&D expenditures usually are unknown and often far exceed R&D spending by the Federal Government.

However, the recent reports for Senators Bingaman and Salazar include additional sensitivity analyses on the assumptions made regarding the availability of GHG emissions reductions outside the energy sector and the pace of advances in technology used to produce and consume energy. The report for Senators Inhofe, McCain, and Lieberman also examines the economic implications of possible alternative approaches to recycling revenues collected by government under a cap-and-trade program in which significant amounts of government revenue is collected from allowance auctions. Alternative assumptions in these areas can have a major impact on the results obtained, and the insights from those prior sensitivity cases would also be applicable to the proposal analyzed this report. Readers interested in how the results reported below might be affected by different assumptions in these areas are encouraged to review the earlier reports.

The modeled impacts of the proposal are summarized below. Reported results apply for the $7 Phased Auction case, unless otherwise stated. Energy and allowance prices are reported in 2004 dollars for compatibility with *AEO2006*. Macroeconomic time series such as GDP and consumption expenditures are reported in 2000 chain-weighted dollars to maintain consistency with standard reports of U.S. economic statistics. Projections of the aggregate value of allowances and auction revenues and fiscal impacts on the budget surplus are reported in nominal dollars, as are deposits relating to the Climate Change Trust Fund.

Results

Emissions and Allowance Prices

- The proposal leads to lower GHG emissions than in the reference case, but the intensity reduction targets are not fully achieved after 2025. Some regulated entities would opt to make safety-valve payments beginning in 2026, the year in which the market value of allowances is projected to reach the safety-valve level (Table ES1). With the higher safety-valve prices in the $9 Phased Auction sensitivity case, the intensity targets are attained through 2029.

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[3] Energy Information Administration, *Impacts of Modeled Recommendations of the National Commission on Energy Policy*, SR/OIAF/2005-02 (Washington, DC, April, 2005) web site http://www.eia.doe.gov/oiaf/servicerpt/bingaman/index.html

[4] Energy Information Administration, *Energy Market Impacts of Alternative Greenhouse Intensity Reduction Goals*, SR/OIAF/2006-01 (Washington, DC, March, 2006) web site http://www.eia.doe.gov/oiaf/servicerpt/agg/pdf/sroiaf(2006)01.pdf

[5] Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003*, SR/OIAF/2003-02 (Washington, DC, June 2003) web site http://www.eia.doe.gov/oiaf/servicerpt/ml/pdf/sroiaf(2003)02.pdf

- Relative to the reference case, covered GHG emissions less offsets[6] are 562 $MMTCO_2e$ (7.4 percent) lower in 2020 and 1,259 $MMTCO_2e$ (14.4 percent) lower in 2030 in the Phased Auction case. Covered GHG emissions grow by 24 percent between 2004 and 2030, about half the increase in the reference case.

- In the early years of the program, when allowance prices are relatively low, reductions in GHG emissions outside the energy sector are the predominant source of emissions reductions. In 2020, reductions of GHGs other than energy-related CO_2, estimated based on information provided by the Environmental Protection Agency, account for nearly 66 percent of the total reductions. By 2030, however, the higher allowance prices lead to a significant shift in energy decisions, particularly in the electricity sector, and the reduction in energy-related CO_2 emissions account for almost 58 percent of total GHG emissions reductions.

- An allowance allocation incentive for carbon sequestration, available only in the Phased Auction case, is projected to result in an additional emissions impact of 296 $MMTCO_2e$ in 2020 and 311 $MMTCO_2e$ in 2030, or about 4 percent of covered emissions.

- In 2004 dollars, the allowance prices rise from just over \$3.70 per metric tons CO_2 equivalent in 2012 to the safety valve price of \$14.18 metric tons CO_2 equivalent in 2030.

Energy Markets

- The cost of GHG allowances is passed through to consumers, raising the price of fossil fuels charged and providing an incentive to lower energy use and shift away from fossil fuels, particularly in the electric power sector.

- When allowance costs are included, the average delivered price of coal to power plants in 2020 increases from \$1.39 per million Btu in the reference case to \$2.06, an increase of 48 percent. By 2030 the change grows from \$1.51 per million Btu in the reference case to \$2.73 per million Btu, an increase of 81 percent.

- Electricity prices are somewhat lower in the Phased Auction case than in the Full Auction case because the Phased Auction provides a portion of the allowances to the electric power sector for free, a benefit that is passed on to ratepayers where the recipients are subject to cost-of-service regulation. Electricity prices in 2020 are 3.6 and 5.6 percent higher than in the reference case in the Phased and Full Auction cases, respectively. In 2030, electricity prices are 11 and 13 percent above the reference case level. Electricity price impacts are likely to vary across states and regions due to differences in State regulatory regimes and in the fuel mix used for generation in each area.

- Relative to the reference case, annual per household energy expenditures in 2020 are 2.6 percent (\$41) higher in the Phased Auction case and 3.6 percent (\$58) higher in the Full Auction case. By 2030, projected annual per household energy expenditures range from 7.0

[6] Offset credits are certified reductions in greenhouse gases from uncovered (or exempted) sources. Under the emission offset provision, covered entities can submit "offset credits" in place of allowances. Therefore, the relevant compliance target measure is covered emissions less offsets.

percent to 8.1 percent ($118 to $136) higher in the two cases. The difference primarily reflects the lower electricity prices in the Phased Auction case.

- Coal use is projected to continue to grow, but at a much slower rate than in the reference case. Total energy from coal increases by 23 percent between 2004 and 2030, less than half the 53-percent increase projected in the reference case over the same time period.

- The proposal significantly boosts nuclear capacity additions and generation. The projected 47-gigawatt increase in nuclear capacity between 2004 and 2030 allows nuclear to continue to provide about 20 percent of the Nation's electricity in 2030. In the reference case, nuclear capacity increases by only 9 gigawatts between 2005 and 2030.

- The proposal also adds significantly to renewable generation. In the reference case, renewable generation is projected to increase from 358 billion kilowatthours in 2004 to 559 billion kilowatthours in 2030. In the Phased Auction case, renewable generation increases to 572 billion kilowatthours by 2020 and 823 billion kilowatthours by 2030. Most of the increase in renewable generation is expected to be from non-hydroelectric renewable generators, mainly biomass and wind.

- Retail gasoline prices in 2030 are $0.11 per gallon higher in 2030 compared to the *AEO2006* reference case, leading to modest changes in vehicle purchase and travel decisions. The transportation sector provides only a small amount of emissions reduction.

Economy

- While the Phased Auction and Full Auction cases have similar energy market impacts, the macroeconomic impacts of the two cases differ because of differences in the revenue flows associated with emission allowances.

- In the Phased Auction case, the $50-billion cap (nominal dollars) on the maximum cumulative deposits to the Climate Change Trust Fund is reached in 2017, and all subsequent revenues from allowance sales or safety valve payments go to the U.S. Treasury. This leads to a $59-billion reduction in the Federal deficit by 2030. However, in the Full Auction case, the revenues flowing to the government are much larger, resulting in a $200-billion reduction in the Federal deficit in 2030.

- In the Phased Auction case, wholesale energy prices rise steadily and, by 2030, are approximately 12 percent above the reference case levels (after inflation). This translates into 8-percent higher energy prices at the consumer level by 2030 and a 1-percent increase in the All-Urban Consumer Price Index (CPI) above the reference case level.

- In the Phased Auction case, discounted total GDP (in 2000 dollars) over the 2009-2030 time period is $232 billion (0.10 percent) lower than in the reference case, while discounted real consumer spending is $236 billion (0.14 percent) lower. In 2030, in the Phased Auction case, real GDP is projected to be $59 billion (0.26 percent) lower than in the reference case, while aggregate consumption expenditures, which relate more directly to impacts on consumers, are $55 billion (0.36 percent) lower. The reductions in GDP and consumption reflect the rise in energy prices and the resulting decline in personal disposable income.

- While higher energy costs and lower consumption expenditures tend to discourage investment, many provisions of the bill help to support investment activity. The value of allowances allocated to States is substantial, and some portion of the allowance revenue would likely result in increased investment. In addition, the portion of the allowances allocated to the private sector generates funds which would help spur private investment in energy saving technologies.

Table ES1: Summary Energy Market Results for the Reference and $7 Phased Auction Cases

Projection	2004	2020		2030	
		AEO2006 Reference	Phased Auction	AEO2006 Reference	Phased Auction
Emissions of Greenhouse Gases (million metric tons CO_2 equivalent)					
Energy-Related Carbon Dioxide	5,900	7,119	6,926	8,114	7,387
Other Covered Emissions	259	452	195	627	235
Total Covered emissions	6,159	7,571	7,121	8,742	7,622
Total Greenhouse Gases	7,122	8,649	8,087	9,930	8,671
Emissions Reduction from Reference Case (million metric tons CO_2 equivalent)					
Energy-Related Carbon Dioxide	-	-	193	-	727
Other Covered Emissions	-	-	258	-	392
Nonenergy Offset Credits	-	-	111	-	140
Carbon Sequestration	-	-	296	-	311
Total Emission Reductions	-	-	562	-	1,259
Total (including sequestration)	-	-	858	-	1,570
Allowance Price (2004 Dollars per metric ton CO_2 equivalent)	-	-	7.15	-	14.18
Delivered Energy Prices (2004 dollars per unit indicated) (includes allowance costs)					
Motor Gasoline (per gallon)	1.90	2.08	2.14	2.19	2.30
Jet Fuel (per gallon)	1.22	1.42	1.50	1.56	1.69
Distillate (per gallon)	1.74	1.93	2.04	2.06	2.25
Natural Gas (per thousand cubic feet)	7.74	7.14	7.55	8.22	9.10
Residential	10.72	10.48	10.87	11.67	12.59
Electric Power	6.07	5.53	5.99	6.41	7.39
Coal, Electric Power (per million Btu)	1.39	1.39	2.06	1.51	2.73
Electricity (cents per kilowatthour)	7.57	7.25	7.51	7.51	8.31
Fossil Energy Consumption (quadrillion Btu)					
Petroleum	40.1	48.1	47.2	53.6	52.0
Natural Gas	23.1	27.7	27.4	27.7	27.9
Coal	22.5	27.6	26.4	34.5	27.7
Electricity Generation (billion kilowatthours)					
Petroleum	120	107	49	115	49
Natural Gas	702	1,103	1,184	993	1,190
Coal	1,977	2,505	2,370	3,381	2,530
Nuclear	789	871	871	871	1,168
Renewable	358	515	572	559	823
Total	3,955	5,108	5,055	5,926	5,768

Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006B.

- GDP and consumption impacts in the Full Auction case are substantially larger than those in the Phased Auction case. Relative to the reference case, discounted total GDP (in 2000 dollars) over the 2009-2030 time period in the Full Auction case is $462 billion (0.19 percent lower), while discounted real consumer spending is $483 billion (0.29 percent) lower. In 2030, projected real GDP in the Full Auction case is $94 billion (0.41 percent) lower than in the reference case, while aggregate consumption is $106 billion (0.69 percent) lower, almost twice the estimated consumption loss in the Phased Auction case. These results reflect the substantially higher level of auction revenues under the Full Auction case, which, by assumption, are not re-circulated into the economy beyond the $50 billion in expenditures from the Climate Change Trust Fund. Because these estimated impacts could change significantly under alternative revenue recycling assumptions, these results do not imply a general conclusion that a Phased Auction will necessarily result in lesser impacts on GDP and consumption than a Full Auction.

1. Background and Scope of the Analysis

This service report was prepared by the Energy Information Administration (EIA), in response to a September 27, 2006, request from Senators Bingaman, Landrieu, Murkowski, Specter, Salazar, and Lugar (Appendix A). The Senators requested that EIA assess the impacts of a proposal that would regulate emissions of greenhouse gases (GHGs) through an allowance cap-and-trade system. The program would set the cap to achieve a reduction in emissions relative to economic output, or greenhouse gas intensity.[7]

The analysis presented in this report builds on previous EIA analyses addressing GHG limitation, including earlier EIA reports requested by Senator Bingaman[8], Senator Salazar[9], and Senators Inhofe, McCain, and Lieberman.[10] All of the analysis cases incorporate the economic and technology assumptions used in the AEO2006 reference case. While increased expenditures for research and development (R&D) resulting from the creation of the Climate Change Trust Fund are expected to lead to some technology improvements, a statistically reliable relationship between the level of R&D spending for specific technologies and the impacts of those expenditures has not been developed. Furthermore, the impact of Federal R&D is also difficult to assess, because the levels of private sector R&D expenditures usually are unknown and often far exceed R&D spending by the Federal Government.

However, the recent reports for Senators Bingaman and Salazar include additional sensitivity analyses on the assumptions made regarding the availability of GHG emissions reductions outside the energy sector and the pace of advances in technology used to produce and consume energy. The report for Senators Inhofe, McCain, and Lieberman also examines the economic implications of possible alternative approaches to recycling revenues collected by government under a cap-and-trade program in which significant amounts of government revenue is collected from allowance auctions. Alternative assumptions in these areas can have a major impact on the results obtained, and the insights from those prior sensitivity cases would also be applicable to the proposals analyzed this report. Readers interested in how the results reported below might be affected by different assumptions in these areas are encouraged to review the earlier reports.

In this latest request, EIA was asked to analyze the impacts of a draft Congressional bill (Appendix B) that was provided with the analysis request. A summary of the program and the reasoning behind it (Appendix C) was also provided. The draft bill calls for an emissions cap-and-trade program similar to that recommended by NCEP, but with differences in timing, flexibility, allowance allocation, and other provisions. The bill also establishes a program to provide incentives and fund research, development, and deployment (RD&D) of technologies to reduce greenhouse gas emissions.

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[7] Greenhouse gas intensity is defined as the emissions of greenhouse gases from covered sources per real dollar of GDP (in 2000 dollars). Greenhouse gases are measured in metric tons of carbon dioxide (CO_2) equivalent.
[8] Energy Information Administration, *Impacts of Modeled Recommendations of the National Commission on EnergyPolicy*, SR/OIAF/2005-02 (Washington, DC, April, 2005) web site http://www.eia.doe.gov/oiaf/servicerpt/bingaman/index.html
[9] Energy Information Administration, *Energy Market Impacts of Alternative Greenhouse Intensity Reduction Goals*, SR/OIAF/2006-01 (Washington, DC, March, 2006) web site http://www.eia.doe.gov/oiaf/servicerpt/agg/pdf/sroiaf(2006)01.pdf
[10] Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003*, SR/OIAF/2003-02 (Washington, DC, June 2003) web site http://www.eia.doe.gov/oiaf/servicerpt/ml/pdf/sroiaf(2003)02.pdf

The gases covered in this analysis of the proposal include energy-related carbon dioxide (CO_2), methane from coal mining, nitrous oxide from nitric acid and adipic acid production, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.[11] Under the draft bill, the emissions of these gases would be regulated through an "upstream" market-based emissions allowance program, meaning fuel suppliers and producers of greenhouse gases would be regulated. This contrasts with proposals where the entities responsible for the actual release of the emissions, such as electric power producers, manufacturers, or building owners are held responsible for emissions compliance and reporting. An upstream approach could simplify the administration of a greenhouse gas cap and trade program by limiting the number of regulated entities.

The bill establishes caps on annual emissions by creating a fixed number of tradable emission permits, or allowances, which provide the right to release a given amount of greenhouse gases in units of carbon dioxide equivalence, based on the global warming potential of each gas. To comply, regulated entities would have to submit the allowances to cover the emissions that result from their products. The number of allowances issued for each year would be determined based on a goal to reduce GHG intensity in two phases. In the first phase, from 2012 to 2021, the GHG intensity reduction goal is 2.6 percent per year, allowing some growth in the absolute level of emissions, because the gross domestic product is projected to grow faster, about 3 percent annually, over the same period. Beginning in 2022, the GHG intensity reduction goal is raised to 3.0 percent per year. With an emissions cap based on projected GHG intensity, the cap is flexible, allowing a higher level of future emissions if economic growth is faster than anticipated or a lower subsequent cap if economic expansion is slower than anticipated.

To limit the potential cost of the program, a "safety-valve" provision allows regulated entities to pay a pre-established emissions fee in lieu of submitting an allowance. As a result, actual aggregate emissions could exceed the cap if compliance costs reach the safety-valve level, as some entities would pay the fee to meet their obligations. The alternative emissions fee, or safety-valve price, is initially set at $7 per metric ton of carbon dioxide equivalent for 2012 and increases each year by 5 percent over the projected rate of inflation, as measured by the projected increase in the implicit price deflator for gross domestic product (GDP). In 2004 dollars, the safety valve is set to $5.89 in 2012 and rises to $14.18 in 2030.

Several provisions offer additional flexibility and extend the effective scope of the program. Under the emission offset provision, covered entities can submit "offset credits" that reflect certified reductions in greenhouse gases from uncovered (or exempted) sources in place of allowances. To provide further flexibility, emission allowances can be saved, or banked, for use in subsequent years if they are left unused in the year for which they were issued. This provides an incentive to over-comply, or reduce emissions further than that required, thus saving the allowances for future years in which marginal compliance costs might be higher. Another provision provides incentives to reward entities that reduce emissions before the program starts.

[11] Specific provisions in the bill define the covered entities and the respective gases subject to regulation more precisely; however, the emissions accounting in NEMS precludes a more detailed treatment.

A portion of the emission allowances allocated each year is auctioned by the Federal government, with the percentage set at 10 percent in the first 5 years, then increasing by 2 percentage points each year beginning in 2017. Table 1 shows the percentage of allowances distributed by year to individual sectors for 2012 through 2030. The methodology for allocating allowances to individual entities in each of the sectors varies, but, in general, a "grandfathered" approach where the allocation is based on historical output is used. For example, the allocation to individual coal mines is based on the each coal mine's share of the total carbon of coal produced over the 3-year period beginning January 1, 2004. Most of the allowances not auctioned each year are allocated to fossil fuel suppliers and producers of non-CO_2 GHGs, electric power generators and other fuel users and GHG emitters in the industrial sector, and State governments. Some allowances (up to 1 percent) would be provided as incentives to reward entities that have voluntarily reduced emissions in advance of the 2012 start date, while others (up to 5 percent) would be provided as incentive for activities that sequester carbon, such as certain agricultural practices, increases in forestation, and carbon capture and storage. Increases in carbon sequestration do not substitute for allowance requirements, so any net emissions impact from this provision is incremental. Insofar as the timing of auctions is concerned, half the emission allowances are auctioned 4 years in advance of the year for which they are issued, and half are auctioned in the year of issue.[12]

Analysis Cases

In the original analysis request, EIA was asked to analyze two variants of the proposal: one in which the allowances are mostly allocated freely as indicated in the draft bill, with some allowances auctioned, and another in which no allowances are allocated freely (all are auctioned). These two cases, referred to as the Phased Auction[13] case and the Full Auction case, will be the primary focus of the analysis. Both cases incorporate the $7 per metric ton of carbon dioxide equivalent safety-valve price for 2012, which then increases each year by 5 percent over the projected rate of inflation. The Phased Auction case incorporates the allowance allocation plan outlined above, while the Full Auction case provides no free allocation of allowances to fossil fuel suppliers and producers of non-CO_2 GHGs, electric power generators and other fuel users and GHG emitters in the industrial sector , or State governments. Nor are allowances used as an incentive for carbon sequestration or early action. Instead, the Full Auction case assumes all of the auction revenue collected goes to the U.S. Treasury. The RD&D spending under the bill's Climate Trust Fund provision, capped at a cumulative $50 billion dollars, is treated similarly in the two cases. The difference, however, is that under the Full Auction case, the auction revenue collected is substantially more than under the Phased Auction case.

[12] An exception is that the early auction for 2012 allowances is held in 2009, 3 years in advance. Also, allowances purchased in advance may not be used until the year for which they were issued.
[13] The term "phased" is meant to describe the gradually increasing share of allowances that are auctioned over time.

Table 1. Allowance Distribution
(Percent)

Year	Auction	Allocation to Fossil Fuel Suppliers and Producers of Non-CO_2 GHGs				Allocation to Energy Users and Other GHG emitters		Set-Aside Programs		Allocation to States
		Coal	Petroleum	Natural Gas	Non-CO_2 GHGs	Electric Generators	Industrial Sectors	Agricultural Sequestration	Early Reduction Credits	
2012	10.00	7.00	4.00	2.00	2.00	30.00	10.00	5.00	1.00	29.00
2013	10.00	7.00	4.00	2.00	2.00	30.00	10.00	5.00	1.00	29.00
2014	10.00	7.00	4.00	2.00	2.00	30.00	10.00	5.00	1.00	29.00
2015	10.00	7.00	4.00	2.00	2.00	30.00	10.00	5.00	1.00	29.00
2016	10.00	7.00	4.00	2.00	2.00	30.00	10.00	5.00	1.00	29.00
2017	12.00	6.75	3.85	1.93	1.93	28.91	9.64	5.00	1.00	29.00
2018	14.00	6.49	3.71	1.85	1.85	27.82	9.27	5.00	1.00	29.00
2019	16.00	6.24	3.56	1.78	1.78	26.73	8.91	5.00	1.00	29.00
2020	18.00	5.98	3.42	1.71	1.71	25.64	8.55	5.00	1.00	29.00
2021	20.00	5.73	3.27	1.64	1.64	24.55	8.18	5.00	0.00	30.00
2022	22.00	5.47	3.13	1.56	1.56	23.45	7.82	5.00	0.00	30.00
2023	24.00	5.22	2.98	1.49	1.49	22.36	7.45	5.00	0.00	30.00
2024	26.00	4.96	2.84	1.42	1.42	21.27	7.09	5.00	0.00	30.00
2025	28.00	4.71	2.69	1.35	1.35	20.18	6.73	5.00	0.00	30.00
2026	30.00	4.45	2.55	1.27	1.27	19.09	6.36	5.00	0.00	30.00
2027	32.00	4.20	2.40	1.20	1.20	18.00	6.00	5.00	0.00	30.00
2028	34.00	3.95	2.25	1.13	1.13	16.91	5.64	5.00	0.00	30.00
2029	36.00	3.69	2.11	1.05	1.05	15.82	5.27	5.00	0.00	30.00
2030	38.00	3.44	1.96	0.98	0.98	14.73	4.91	5.00	0.00	30.00

Source: Senate staff.

In a follow-up letter (Appendix D), EIA was asked to address several additional issues. EIA was asked to examine the impact of higher and lower starting prices for the program's safety valve price. To address this request, two sensitivity cases with the safety valve prices starting at $5 and $9, referred to as the $5 Phased Auction and $9 Phased Auction cases, were prepared.

EIA was also asked to estimate the impacts of not allowing or limiting GHG offsets. To analyze this issue a case not allowing offsets, the No Offsets case, was prepared. One category of offset credits is for non-energy use of fossil fuels (primarily for chemical feedstocks). The potential carbon dioxide emissions of these fuels would be included in this upstream regulatory approach, so the need to adjust for non-energy use of the fuel arises. With the National Energy Modeling System (NEMS), however, the potential carbon dioxide emissions from these fuels are omitted in the emission accounting and are therefore not treated as an offset in this analysis, but are instead omitted from the regulated emissions directly. Therefore, the No Offsets case does not change the treatment of non-energy use of fossil fuels. The classes of emissions that *are* treated as offsets and for which emissions abatement cost estimates were available from the Environmental Protection Agency (EPA) are methane emissions from natural gas production and distribution and methane emissions from small landfills. Estimated emissions reductions from these two sources are excluded in the No Offsets case.

EIA was further asked to address "the impact on program costs and the distribution of those costs associated with using a different point of regulation, specifically an alternative in which the point of regulation for coal was downstream (i.e., at electric power plants and industrial sources." EIA can not quantify the effects of a different point of regulation using NEMS, but the potential implications of different points of regulation will be discussed. The results of the $5 Phased Auction, $9 Phased Auction and No Offset sensitivity cases are only discussed in key areas to highlight important impacts including the impacts on allowance prices, program compliance, and coal use. In previous reports, EIA has prepared numerous greenhouse gas cap-and-trade sensitivity analyses, examining the impacts of alternative emission caps, alternative combinations of emission caps and safety-valve prices, alternative assumptions about potential emission reductions in non-energy related greenhouse gases, and alternative assumptions about the cost of performance of new appliances, motor vehicles, and energy production equipment.[14]

Methodology

The analysis of energy sector and energy-related economic impacts of the various GHG emission reduction proposals in this report is based on NEMS results. NEMS projects emissions of energy-related CO_2 emissions resulting from the combustion of fossil fuels, representing about 84 percent of total GHG emissions today. For this analysis, the *AEO2006* reference case emissions for energy-related CO_2 were augmented with baseline emissions projections for other covered GHGs to create a baseline for total covered GHG emissions. Projections of non-CO_2 GHG emissions, including the covered non-CO_2

[14] These reports are all available at http://www.eia.doe.gov/oiaf/service_rpts.htm..

gases, are derived from an unpublished, EPA "no-measures" case, a recent update to the "business-as-usual" case cited in the White House Greenhouse Gas Policy Book Addendum[15] released with the Climate Change Initiative. The projections from the Policy Book were based on several EPA-sponsored studies conducted in preparation of the U.S. Department of State's *Climate Action Report 2002*.[16] However, the no-measures case used in this analysis was a preliminary, unpublished projection developed by EPA in preparation for a forthcoming update of that report.[17]

Simulations of the emissions cap-and-trade policy in NEMS were used to estimate the price of GHG allowances over time and the resulting changes in the energy system. First, starting from the projected level of energy-related CO_2 emissions in 2011 from the *AEO2006* reference case and the EPA projection for emissions of other GHGs in 2011, the GHG intensity rate reduction targets for each of the analysis cases were translated into annual emissions targets for the 2012 to 2030 period.

NEMS endogenously calculates changes in energy-related CO_2 emissions in the analysis cases. The cost of using each fossil fuel includes the costs associated with the GHG allowances needed to cover the emissions produced when they are used. These adjustments influence energy demand and energy-related CO_2 emissions. The GHG allowance price also determines the reductions in the emissions of other GHGs based on the abatement cost relationships supplied by EPA. With emission allowance banking, NEMS solves for the time path of permit prices such that cumulative emissions match the cumulative target, provided the permit price remains below the safety-valve permit price. Once the safety-valve permit price is attained and the previously-banked permits are exhausted, actual GHG emissions can exceed the calculated annual emissions target, as covered entities can pay the safety-valve fee in place of providing the government-issued emissions allowances.

The NEMS Macroeconomic Activity Module (MAM), which is based on the Global Insight U.S. model, interacts with the energy supply, demand, and conversion modules of NEMS to solve for an energy-economy equilibrium. In an iterative process within NEMS, MAM reacts to changes in energy prices, energy consumption, and allowance revenue, solving for the effect on macroeconomic and industry level variables such as real GDP, the unemployment rate, inflation, and real industrial output. These economic impacts, in turn, feed back into the energy sectors of NEMS. The cycle is repeated until an integrated solution is obtained. The economic impacts of the legislation stem partly from its impact on energy prices and its effects on production, imports, and exports of energy goods and services. In addition, the auction and distribution of the GHG

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[15] See "Addendum" in the "Global Change Policy Book" at http://www.whitehouse.gov/news/releases/2002/02/climatechange.html. The business-as-usual (BAU) projections cited in the addendum are somewhat higher than a "Policies and Measures" case EPA developed for the *U.S. Climate Action Report 2002*.
[16] U.S. Department of State, *U.S. Climate Action Report 2002* (Washington, DC, May 2002), Chapter 5, "Projected Greenhouse Gas Emissions," pp. 70-80, web site: http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsUSClimateActionReport.html .
[17] Personal communication from Casey Delhotal, of the Environmental Protection Agency, to Dan Skelly of the Energy Information Administration, on July 7, 2005. EIA adjusted the EPA's preliminary no-measures case projections to extrapolate from the most recent 2002-to-2004 data on these gases as published by EIA, as well as to estimate the intervening years of the projections, since the projections were only provided for every 5 years beginning in 2005 and ending in 2020. In addition, EIA extrapolated the projection to 2030 for this analysis based on the average annual growth rates of individual emissions sources from 2015 to 2020.

allowances generate revenue streams to the government and private sectors. The MAM represents the revenue streams accruing to these sectors based on the allowance allocations specified in the draft bill, as well as the bill's $50 billion in cumulative RD&D[18] expenditures funded from auction revenues. Together, these energy-related price, quantity, and revenue allocation effects impact on the aggregate level of prices, output, and employment within the economy.

While NEMS is able to represent the broad energy and economic impacts of the emissions allowance program, there is little in the model to distinguish the merits of the point of regulation (downstream or upstream) and only a limited ability to represent alternate allowance allocation schemes. Depending on the distribution of allowances, some industries, firms, or localities may be partly or fully compensated for the compliance costs and economic disruption. While such free allowance allocation can offset some of the direct cost of compliance to recipients, their incentives to take action based on allowance opportunity costs are similar whether they are given the allowances or whether they buy them at auction. NEMS is not designed to evaluate the distributional impacts of whether industries are better or worse off under a given allocation scheme, but it does reflect the marginal allowance opportunity costs that give rise to emission compliance activities. In addition, NEMS simulates the broad impacts of the emissions policy on the economy as a whole, without regard to how individual industries or communities will fare under such a program.

This analysis assumes that the transaction and administrative costs of implementing and operating a GHG cap and trade program will be small when compared to the costs of the allowances themselves. The "upstream" regulatory approach in the proposal analyzed, which requires large suppliers of fossil fuel and other sources of greenhouse gases to submit government-issued allowances based on the emissions potential of their products, is designed to reduce the control program costs. Because so many sources produce GHG emissions, a "downstream" approach that focuses on monitoring each source of actual emissions and collecting the required allowances from them could be much more costly. For example, there are more than 100 million residential and commercial buildings and over 200 million personal autos that produce GHG emissions. A program that required monitoring all of these sources would likely be more expensive than the one in the proposed bill. If the program costs were to turn out to be significant when compared to the cost of allowances, the efficiency and success of the program would be impacted.

NEMS, like all models, is a simplified representation of reality. Projections are dependent on the data, methodologies, model structure, and assumptions used to develop them. Since many of the events that shape energy markets are random and cannot be anticipated (including severe weather, technological breakthroughs, and geopolitical developments), energy markets are subject to uncertainty. Moreover, future developments in technologies, demographics, and resources cannot be foreseen with certainty. Nevertheless, well-formulated models are useful in analyzing complex

[18] The potential energy efficiency improvements and other carbon mitigation effects of the proposed RD&D provisions and incentives of the bill are not evaluated in this report.

policies, because they ensure consistency in accounting and represent key interrelationships, albeit imperfectly, to provide insights.

EIA's projections are not statements of what will happen, but what might happen, given technological and demographic trends and current policies and regulations. EIA's *AEO2006* reference case is based on current laws and regulations as of October 31, 2005. Thus, it provides a policy-neutral starting point that can be used to analyze energy policy initiatives. EIA does not propose, advocate, or speculate on future legislative or regulatory changes within its reference case. Laws and regulations are generally assumed to remain as currently enacted or in force (including sunset or expiration provisions); however, the impacts of scheduled regulatory changes, when clearly defined, are reflected.

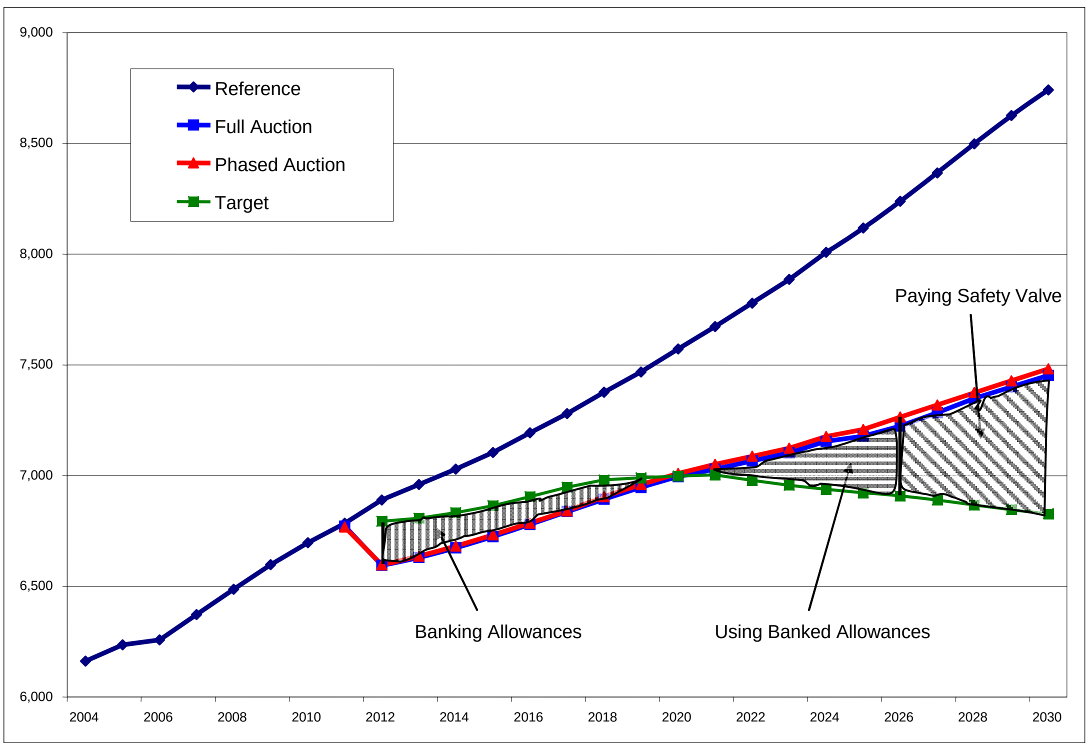
This report, like other EIA analyses of energy and environmental policy proposals, focuses on the impacts of those proposals on energy choices made by consumers in all sectors and the implications of those decisions for the economy. This focus is consistent with EIA's statutory mission and expertise. The study does not account for any possible health or environmental benefits that might be associated with curtailing GHG emissions.

2. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals

Greenhouse Gas Emissions and Permit Prices

Relative to the *AEO2006* reference case, projected GHG emissions are reduced starting in 2012 as a result of the allowance program and the GHG intensity targets (Figure 1). With banking of allowances permitted, an incentive exists to over-comply in the first few years of the program, when the emissions targets are relatively easy to meet and allowance prices are low, and to draw down the bank balance later as the targets become more stringent and prices rise. As a result, projected emissions in both the Phased Auction and Full Auction cases are below the intensity-based target for emissions from 2012 to 2020 and above the target thereafter.[19] Once the market price for allowances reaches the safety valve level in 2026, the gap between covered emissions and the target continues to widen.

Figure 1: Covered Greenhouse Gas Emissions, Net of Offset Credits
(million metric tons carbon dioxide equivalent)



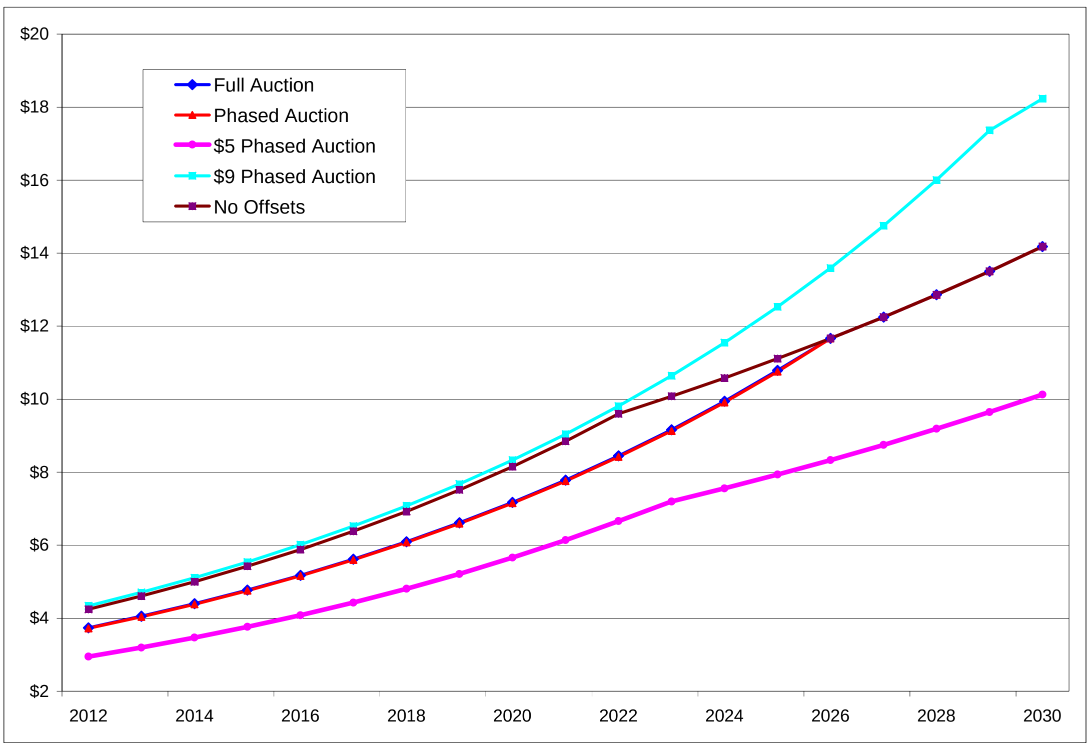
Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, and BL_FULL7.D112006C.

[19] The figure plots total covered GHG gas emissions, less offsets credits, compared to the target. Not shown are the increases in carbon sequestration in the Phased Auction case that are projected as a result of the proposed bill's allowance allocation incentives. Total GHG emissions are somewhat higher than covered emissions because some sources are exempted.

The market price for emissions allowances is assumed to reflect financial incentives to bank emissions allowances over time, limited by the established safety-valve price, which grows over time at a rate of 5 percent per year (after inflation). To represent the proposed bill, a path of allowance prices is calculated based on an assumed rate of return on banked allowances of 8.5 percent per year up until the safety valve price is reached.[20] Under these assumptions, the allowances prices derived in the Phased Auction and Full Auction cases are essentially the same (Figure 2). However, the economic impacts of these cases, and some of the energy market impacts, differ due to the distributional impacts from allowance allocation. Table 2 summarizes the emissions and energy market impacts of the Phased and Full Auction cases relative to the *AEO2006* reference case.

Figure 2: Projected Allowance Prices

(2004 dollars per metric ton carbon dioxide equivalent)



Source: National Energy Modeling System runs BL_FULL.D112006C, BL_PHASED7.D112006B, BL_PHASED5.D111306A, BL_PHASED9.D112006B, and BL_PHASED7NO.D112006B.

[20] The 8.5-percent rate (real dollars) approximates the cost of capital in the electric power industry, where investments to reduce GHG emissions are likely to be tied to expectations of allowance price growth. Under this reasoning, allowance prices are assumed to increase at a real rate of 8.5 percent per year until the safety-valve level is reached or the bank balance of allowances is exhausted. Once the safety-valve price is attained, holding bank allowances would be uneconomical due to the assumed 5 percent escalation rate of the safety-valve price.

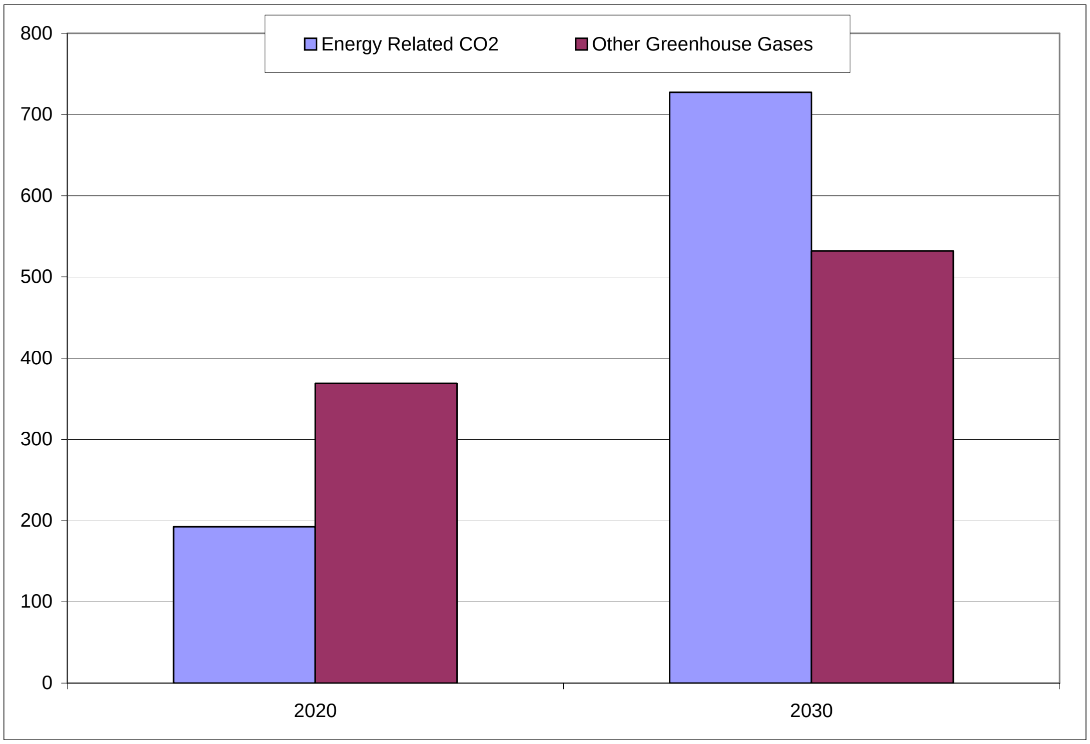
Table 2: Summary Energy Market Results for the Reference, Phased Auction, and Full Auction Cases

Projection	2004	2020			2030		
		AEO2006 Reference	Phased Auction	Full Auction	AEO2006 Reference	Phased Auction	Full Auction
Emissions of Greenhouse Gases (million metric tons CO_2 equivalent)							
Energy-Related Carbon Dioxide	5,900	7,119	6,926	6,913	8,114	7,387	7,358
Other Covered Emissions	259	452	195	195	627	235	235
Total Covered Emissions	6,159	7,571	7,121	7,107	8,742	7,622	7,593
Total Greenhouse Gases	7,122	8,649	8,087	8,073	9,930	8,671	8,641
Emissions Reduction from Reference Case (million metric tons CO_2 equivalent)							
Energy-Related Carbon Dioxide	-	-	193	206	-	727	757
Other Covered Emissions	-	-	258	258	-	392	392
Nonenergy Offset Credits	-	-	111	111	-	140	140
Carbon Sequestration	-	-	296	-	-	311	-
Total Emissions Reduction	-	-	562	576	-	1,259	1,289
Total (including sequestration)	-	-	858	576	-	1,570	1,289
Allowance Price (2004 Dollars per metric ton CO_2 equivalent)	-	-	7.15	7.17	-	14.18	14.18
Delivered Energy Prices (2004 dollars per unit indicated) (includes allowance costs)							
Motor Gasoline (per gallon)	1.90	2.08	2.14	2.13	2.19	2.30	2.30
Jet Fuel (per gallon)	1.22	1.42	1.50	1.51	1.56	1.69	1.69
Distillate (per gallon)	1.74	1.93	2.04	2.03	2.06	2.25	2.23
Natural Gas (per thousand cubic feet)	7.74	7.14	7.55	7.55	8.22	9.10	9.09
Residential	10.72	10.48	10.87	10.87	11.67	12.59	12.57
Electric Power	6.07	5.53	5.99	5.96	6.41	7.39	7.39
Coal, Electric Power (per million Btu)	1.36	1.39	2.06	2.06	1.51	2.73	2.73
Electricity (cents per kilowatthour)	7.57	7.25	7.51	7.65	7.51	8.31	8.48
Fossil Energy Consumption (quadrillion Btu)							
Petroleum	40.1	48.1	47.2	47.2	53.6	52.0	52.1
Natural Gas	23.1	27.7	27.4	27.3	27.7	27.9	27.9
Coal	22.5	27.6	26.4	26.4	34.5	27.7	27.4
Electricity Generation (billion kilowatthours)							
Petroleum	120	107	49	48	115	49	48
Natural Gas	702	1,103	1,184	1,166	993	1,190	1,180
Coal	1,977	2,505	2,370	2,362	3,381	2,530	2,500
Nuclear	789	871	871	875	871	1,168	1,156
Renewable	358	515	572	579	559	823	857
Total	3,955	5,108	5,055	5,039	5,926	5,768	5,749

Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, and BL_FULL7.D112006C.

Lower energy related CO_2 emissions and other GHG emissions both contribute to the total reduction in GHG emissions, but their respective shares of total reductions change over time. Abatement cost curves for other GHG based on EPA research suggest that there are a significant amount of emissions reductions that can be made at relatively low costs. As a result, in the early years of the program, when allowance prices are relatively low, other GHG emissions reductions dominate the overall emissions reductions. For example, in 2020 in the Phased Auction case, reductions in other GHG emissions account for nearly 66 percent of the total GHG emissions reductions (Figure 3). By 2030, however, higher allowance prices lead to a significant shift in the fuels used in the energy sector, particularly in the electricity sector, and the reduction in energy related CO_2 emissions account for almost 58 percent of the total GHG emissions reductions.

Figure 3: Greenhouse Gas Emissions Reductions in the Phased Auction Case
(difference from reference case in million metric tons CO_2 equivalent)



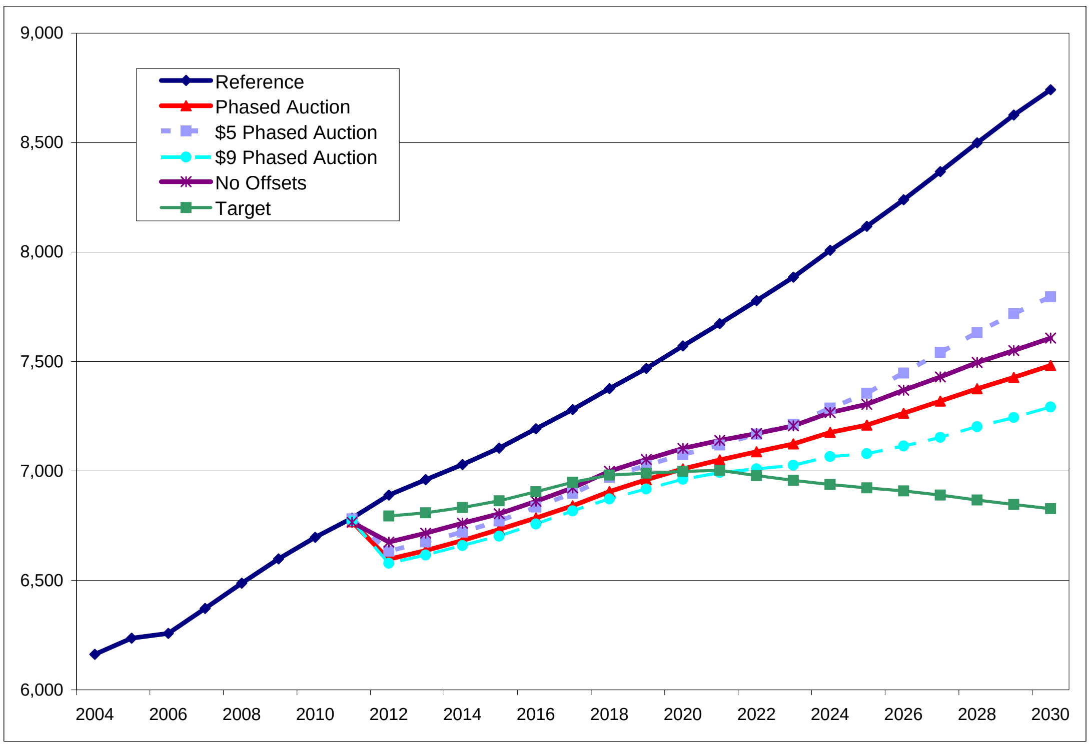
Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006B .

There is also an increase in carbon sequestration in the Phased Auction case. The draft bill calls for allocating up to 5 percent of the allowances each year to create a pilot program to stimulate increased agricultural carbon sequestration. Because it is a pilot program, the increase in sequestration stimulated does not count towards meeting the GHG intensity reduction target. However, based on the supply curves for carbon sequestration opportunities used in EIA's recent GHG analyses, the allowance allocation incentives would stimulate an increase in carbon sequestration of over 300 million metric tons CO_2 equivalent (Table 2). In the Full Auction case, the allowance allocation incentives for carbon sequestration were assumed unavailable, since no allowances would be available to use as incentives, and the draft bill proposed no other mechanism whereby auction revenues might be used directly to promote carbon sequestration.

Because the safety-valve price is binding in these cases, establishing higher or lower safety-valve prices will influence the emission compliance results, including incentives to bank allowances and the extent to which the emissions targets are achieved. Figure 4 compares covered emissions in the Phased Auction case to those in the $5 and $9 Phased Auction cases. In the $5 Phased Auction case, which assumes a lower starting value for the safety valve, the allowance price reaches the safety-valve level in 2022, four years earlier than in the original Phased Auction case, which assumes a $7-per-metric-ton starting price for the safety valve (nominal dollar price). Covered emissions in the $5 Phased Auction case remain higher than the original Phased Auction case throughout the projection. In the $9 Phased Auction case, the safety valve is not triggered until 2029. As a result, on a cumulative basis, the emissions intensity targets are projected to be achieved through 2029 in the $9 Phased Auction case, compared to 2025 in the original Phased Auction case.

Figure 4: Covered Greenhouse Gas Emissions, Net of Offset Credits in Sensitivity Cases

(million metric tons carbon dioxide equivalent)



Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, BL_PHASED5.D111306A, BL_PHASED9.D112006B, and BL_PHASED7NO.D112006B.

In the No Offsets case, the provision to allow compliance with emissions reduction credits from uncovered sources is removed. Without these relatively low-cost emission reduction opportunities, the marginal compliance cost is driven up, reflected in a higher market price for allowances. The projected allowance price in the No Offsets case reaches the safety-valve level in 2022, 4 years earlier than in the Phased Auction case (Figure 2). As a result, the overall reductions in GHG emissions are somewhat less in the No Offsets case (Figure 4).

In previous assessments of similar cap-and-trade proposals for GHGs, EIA has included sensitivity results to highlight some key areas of uncertainty, including the importance of the assumed abatement costs for non-CO2 gases and the effect of alternative assumptions about energy technology cost, performance, and availability. Rather than repeating those sensitivity cases, we will simply point out that these assumptions have had a bearing on the magnitude and cost of compliance. With less optimistic assumptions about abatement opportunities for other GHGs, the projected cost of compliance is driven up, the safety-valve price is likely to be attained several years earlier, and cumulative emissions reductions will be correspondingly less.

With regard to technology assumptions, the technological improvements reflected in the *AEO2006* reference case may under- or overpredict future technology trends. For example, the results of the integrated advanced technology case indicated projected CO_2 emissions would be 9 percent lower than in the reference case in 2030. Under such assumptions, compliance costs under the proposed bill would be less, and the intensity targets would be achieved over a longer time frame before the safety-valve price is triggered, if at all.

As shown in Figures 1 and 2, the emissions and allowance price paths in the Phased and Full Auction cases are very similar. As a result, with the exception of electricity price and macroeconomic effects, the market impacts in the two cases are essentially the same. The analysis in the remainder of this chapter will focus on the Phased Auction case, only discussing other cases where they are important.

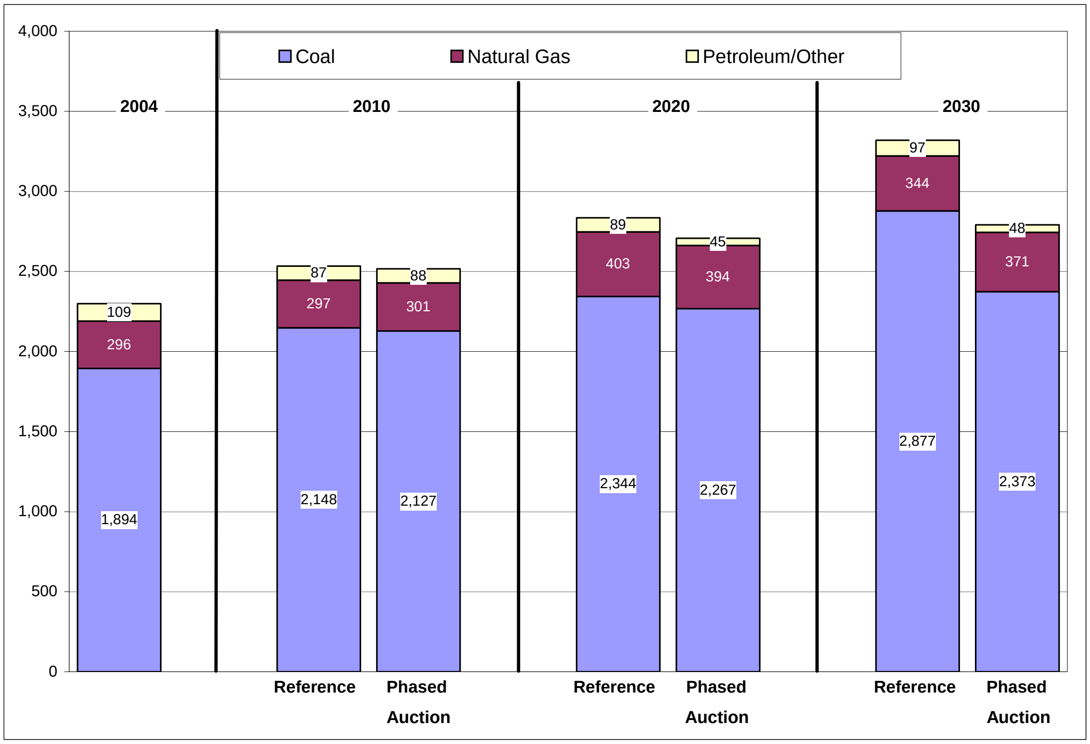
Electricity Sector Emissions, Generation and Prices

Implementing the proposed GHG intensity reduction program could have significant impacts on power sector CO_2 emissions, generation by fuel, generating technology selection, electricity sales, and electricity prices. The power sector shifts away from its long-term reliance on coal-fired generation, towards increasing reliance on nuclear, non-hydroelectric renewable, and natural gas generation. These changes lead to lower emissions. However, increased capital expenditures for these technologies, together with higher fossil-fuel prices, result in higher electricity prices. Because a portion of the allowances are allocated to regulated utilities for free in the Phased Auction case and because regulators are expected to pass these savings on to consumers, the impact on electricity prices is slightly smaller than in the Full Auction case.

CO_2 Emissions

In the reference case, total power sector CO_2 emissions are projected to increase 44.4 percent between 2004 and 2030 as the industry increases its use of fossil fuels, particularly coal (Figure 5). However, in the Phased Auction case, CO_2 emissions are forecast to increase by less than half that amount, about 21 percent between 2004 and 2030, because of a greater reliance on nuclear and renewable and a less carbon-intensive fossil fuel mix. Power sector CO_2 emissions are expected to be 4.5 percent below the reference case level in 2020 and 15.9 percent below the reference case level in 2030 in the Phased Auction case.

Figure 5: Power Sector CO_2 Emissions
(million metric tons CO_2)

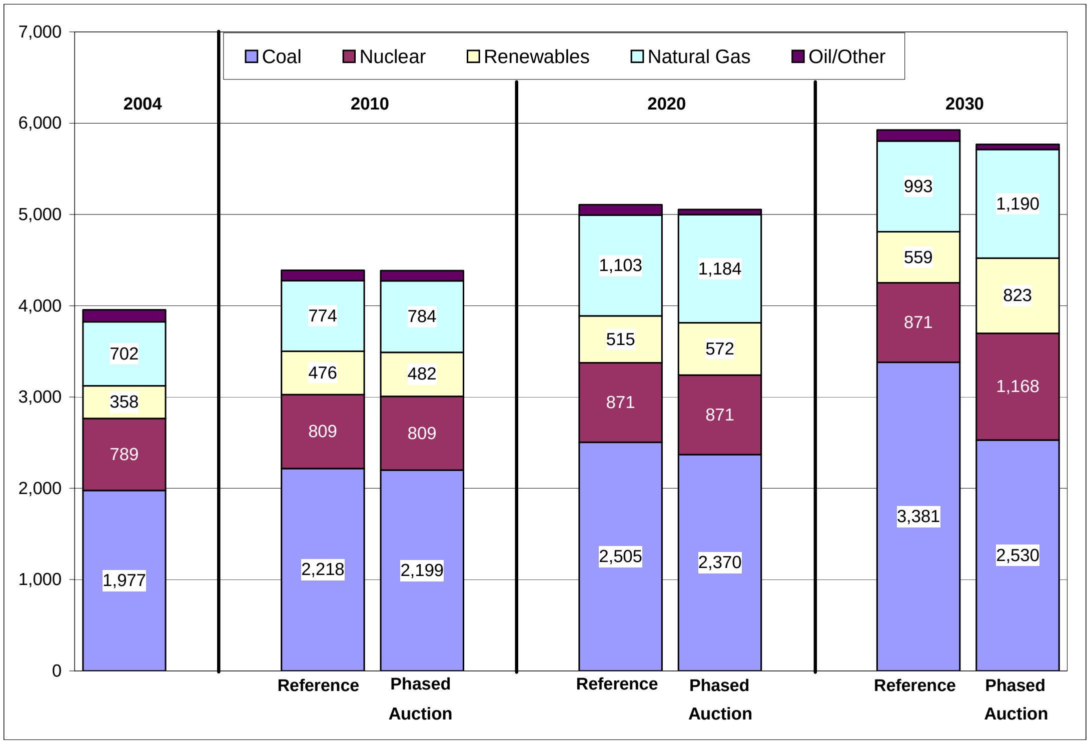


Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

Generation by Fuel

To reduce its CO_2 emissions, the power industry, including generators in the industrial and commercial sectors, is expected to shift away from its historical reliance on coal generation (Figure 6). Total coal generation in 2020 is projected to be 135 billion kilowatthours (5.4 percent) below the reference case level in the Phased Auction case. By 2030, coal generation relative to the reference case is 851 billion kilowatthours (25 percent) less in the Phased Auction case. In the reference case, coal accounts for 57 percent of total generation in 2030, but its share falls to 44 percent in the Phased Auction case. While coal generation in 2030 in the Phased Auction case is well below the reference case projection it would still be substantially above the current level, increasing by 28 percent between 2004 and 2030.

Figure 6: Generation by Fuel
(billion kilowatthours)

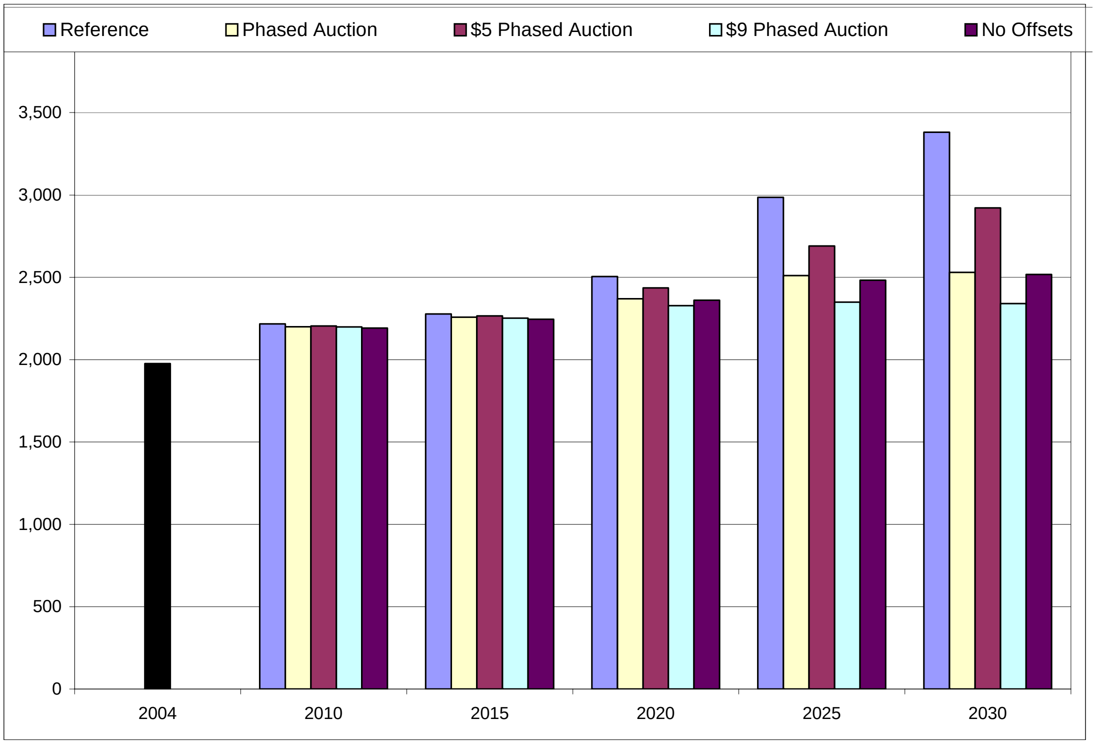


Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

The higher coal costs in the Phased Auction case greatly influence the relative economics of new plant alternatives. In the reference case, 174 gigawatts of new coal capacity is projected to be added between 2004 and 2030. In the Phased Auction case, the amount added over the same period is 51 gigawatts. The plant choice results are very sensitive to the allowance price, as indicated by the projections of coal generation across the cases (Figure 7). In the $5 Phased Auction case, projected coal generation in 2030 is 14 percent below the reference case level, compared to 25 percent below in the original Phased Auction case and 31 percent below in the $9 Phased Auction case. Projected coal generation in 2030 grows from its current level in all of the cases analyzed.

While successful development of carbon capture and storage technologies might allow coal-fired plants to remain competitive under a GHG allowance program, the allowance prices in this analysis are not sufficiently high to compensate for the increased capital and operating costs. As a result, power plants using carbon capture and storage are not projected to be commercially viable within the 2030 time frame in the analysis cases.

Figure 7: Coal Generation in Sensitivity Cases
(billion kilowatthours)



Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, BL_PHASED5.D111306A, BL_PHASED9.D112006B, and BL_PHASED7NO.D112006B.

In contrast to the situation for coal generation, nuclear generation is projected to increase significantly in the Phased Auction case. In the reference case, nuclear generation is projected to increase from 789 billion kilowatthours in 2004 to 871 billion kilowatthours in 2030, as existing plants are upgraded by 3 gigawatts and 6 gigawatts of new capacity, stimulated by incentives in the Energy Policy Act of 2005 (EPACT2005), are added. The 47 gigawatts of nuclear capacity added in the Phased Auction case increases nuclear generation to 1,168 billion kilowatthours. As a result of the additions, the share of generation accounted for by nuclear plants in 2030 increases from 15 percent in the reference case to 20 percent in the Phased Auction case.

Renewable generation is also expected to see significant growth in the Phased Auction case. In the reference case, renewable generation is projected to increase from 358 billion kilowatthours in 2004 to 559 billion kilowatthours in 2030. Part of this growth is stimulated by tax incentives for certain renewable technologies in EPACT2005. In the Phased Auction case, renewable generation is projected to grow to 572 billion kilowatthours by 2020 and to 823 billion kilowatthours by 2030. Most of the increase in renewable generation is expected to be from non-hydroelectric renewable generators, mainly biomass and wind. In the reference case, biomass generation is forecast to rise from 37 to 103 billion kilowatthours between 2004 and 2030. In the Phased Auction case, biomass generation is expected to increase three-fold relative to the reference case to 306 billion kilowatthours. Wind generation, projected to increase from 14 billion kilowatthours in 2004 to 65 billion kilowatthours in the reference case by 2030, is expected to increase to almost twice that amount in the Phased Auction case, where it grows to 108 billion kilowatthours. As a result, the non-hydroelectric renewable share of generation, 2.2 percent in 2004, increases significantly in the Phased Auction case. By 2030, the share grows to 9 percent in the Phased Auction case, more than twice the 4 percent share in the reference case.

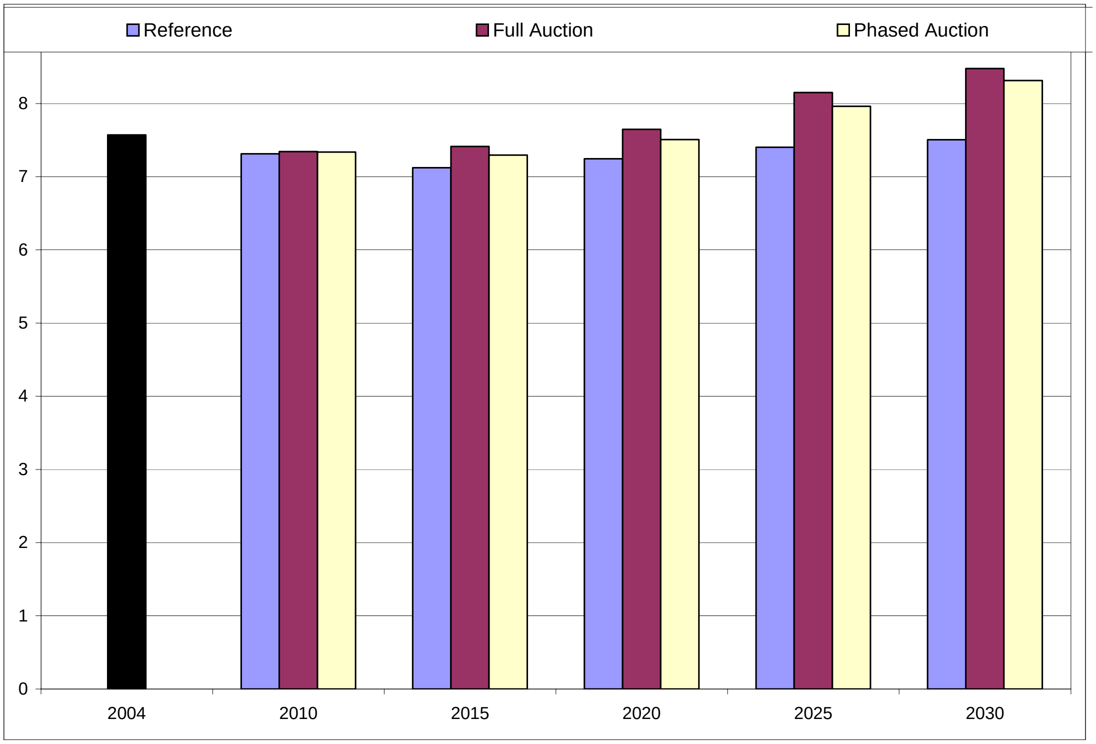
Oil and natural gas generation are also impacted by efforts to reduce power sector GHG emissions, but to lesser degrees than coal, nuclear, and renewables. Oil generation, already a very small part of electricity market, falls even further in the Phased Auction case. Relative to the reference case, natural gas generation in 2030 is 20 percent higher in the Phased Auction case, as new combined-cycle plants become more attractive, relative to coal plants, for new baseload capacity.

Electricity Prices

The shift away from coal to increased use of nuclear and renewable fuels, together with the costs of fuel suppliers holding emissions permits, affects electricity prices (Figure 8). The impacts are slightly different in the Phased and Full Auction cases because of the different approaches used to distribute allowances. In the reference case, real electricity prices fall from 7.6 cents per kilowatthour to 7.2 cents per kilowatthour in 2020, and then increase slowly to 7.5 cents per kilowatthour in 2030 as fuel prices rise. In the Phased and Full Auction cases, 2020 electricity prices are, respectively, 4 and 6 percent higher than in the reference case. As the GHG permit price continues to rise between 2020 and 2030 in the Phased and Full Auction cases, the cost of using fossil fuels also continues to grow, contributing to electricity prices that are respectively, 11 and 13 percent above the reference case level in 2030. Electricity prices are slightly lower in the Phased Auction case because a portion of the allowances are given out to power producers for free, lowering the revenue requirements of those producers who are subject to rate regulation. Consumers' total electricity bills in 2020 in the Phased and Full Auction cases are $10 and $15 billion (2.9 and 4.4 percent), respectively, higher than in the reference case. By 2030, the increase in consumer bills above the reference case level in the Phased and Full Auction cases grows to $34 billion and $41 billion (8.6 and 10.2 percent).

The different regulatory regimes in the various regions of the country do affect the electricity prices in the Phased Auction case. While electricity prices are higher in all regions in both the Phased and Full Auction cases, the price impacts are smaller in the Phased Auction case in regions where prices are set under cost-of-service regulation. For example, in the South Atlantic and Florida regions, 2030 electricity prices are 0.2 cents lower in the Phased Auction case than they are in the Full Auction case. In contrast, in regions where electricity prices are set competitively, the changes relative to the reference case are the same in both the Phased and Full Auction cases.

Figure 8: Electricity Prices
(2004 cents per kilowatthour)



Source: National Energy Modeling System runs AEO2006.D111905A, BL_FULL7.D112006c, and BL_PHASED7.D112006b.

End-Use Energy Consumption

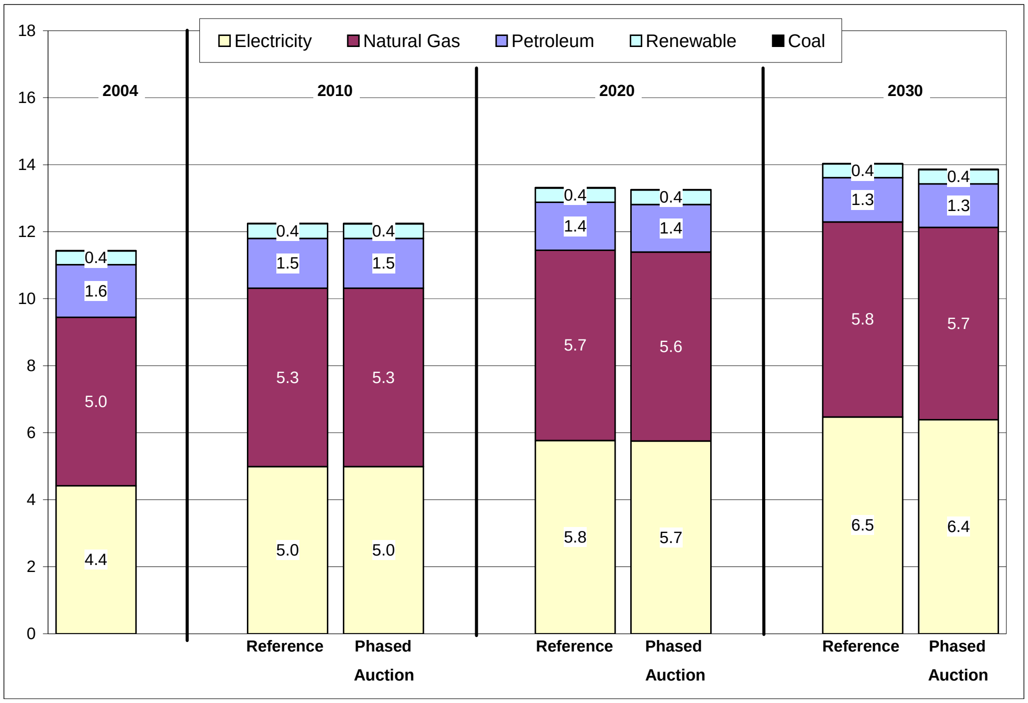
In response to higher delivered fossil fuel and electricity prices in the Phased and Full Auction cases, consumers and businesses in all sectors of the economy are projected to reduce their energy consumption and, where possible, shift their consumption away from fossil fuels. These changes reduce overall energy consumption, but raise consumers' energy bills.

Residential and Commercial

Higher fuel prices under the proposed GHG cap and trade program provide an incentive for residential and commercial consumers to use less energy than otherwise. Relative to the reference case, total delivered residential energy consumption in the Phased Auction case is 0.4 percent lower in 2020, and 1.2 percent lower in 2030 (Figure 9). Similarly, for the commercial sector, total delivered energy consumption in the Phased Auction case is 0.8 percent lower in 2020 and 2.2 percent lower in 2030 (Figure 10).

Figure 9: Delivered Residential Energy Consumption

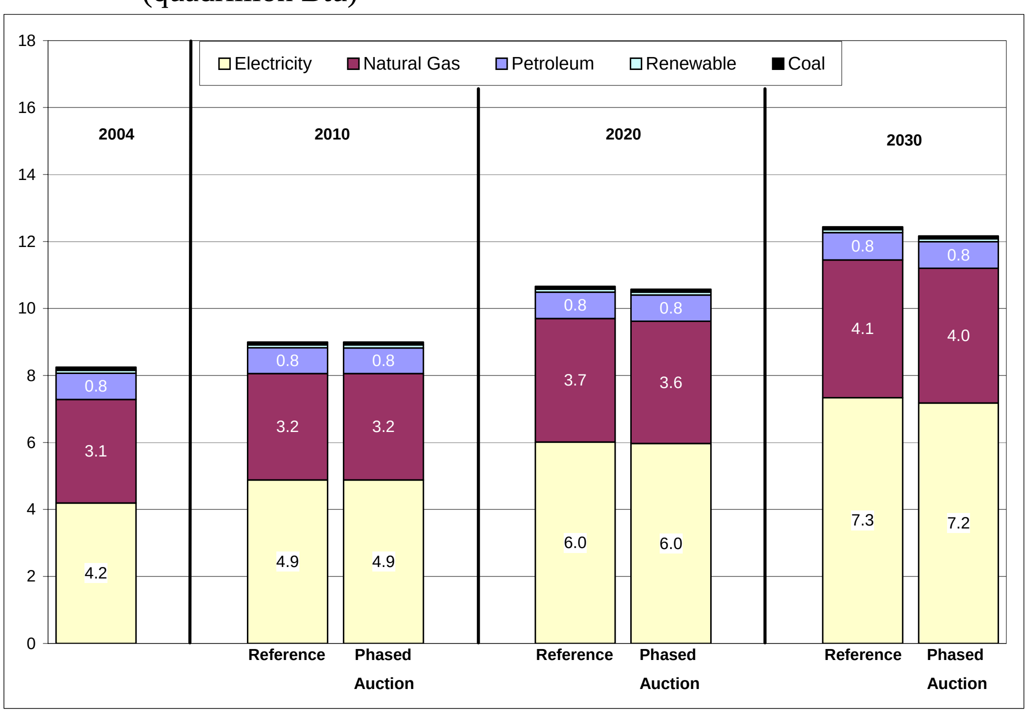
(quadrillion btu)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

Figure 10: Delivered Commercial Energy Consumption

(quadrillion Btu)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

These changes result from consumer responses to higher costs for all fossil fuels and electricity in the Phased Auction case. These costs include the purchase price of the fuels together with the costs of permits needed to cover the GHG emissions associated with their use. For example, relative to the reference case, the average delivered price of natural gas is $0.40 per million Btu (6 percent) higher in 2020 in the Phased Auction case. By 2030, this difference grows to $0.86 per million Btu (11 percent). For distillate fuel oil and electricity, the projected percentage changes in average prices are similar to those for natural gas.

Even with lower energy consumption, households are projected to see higher energy bills because household energy consumption is relatively unresponsive to energy prices. Compared to the reference case, annual per-household energy expenditures in 2020 are 3 percent ($41) higher in the Phased Auction case. By 2030, the difference increases, with annual per household energy expenditures 7 percent ($118) higher in the Phased Auction case.

Where possible, homeowners will increase their use of non-fossil energy. For example, relative to the reference case, the number of homes with solar photovoltaic (PV) systems increases 22 percent in the Phased Auction case by 2030. However, even with a large percentage change, the stock of homes with PV systems remains small. The 22-percent increase results in about 0.1 percent of the homes having PV systems by 2030.

As in the residential sector, the impact of higher energy prices outweighs the impact of reductions in commercial energy consumption, resulting in a $6-billion (3 percent) increase in commercial energy expenditures in the Phased Auction case in 2020, relative to the reference case. The increase in expenditures is greater by 2030, reaching $18 billion (8 percent) higher than commercial sector energy expenditures in the reference case in the Phased Auction case.

Also, as in the residential sector, commercial consumers are expected to increase their use of renewable energy in response to a GHG cap and trade program. In the Phased Auction case, total commercial sector PV capacity is 5 percent higher in 2020 than in the reference case. By 2030, commercial sector PV capacity in the Phased Auction case is 35 percent higher than in the reference case.

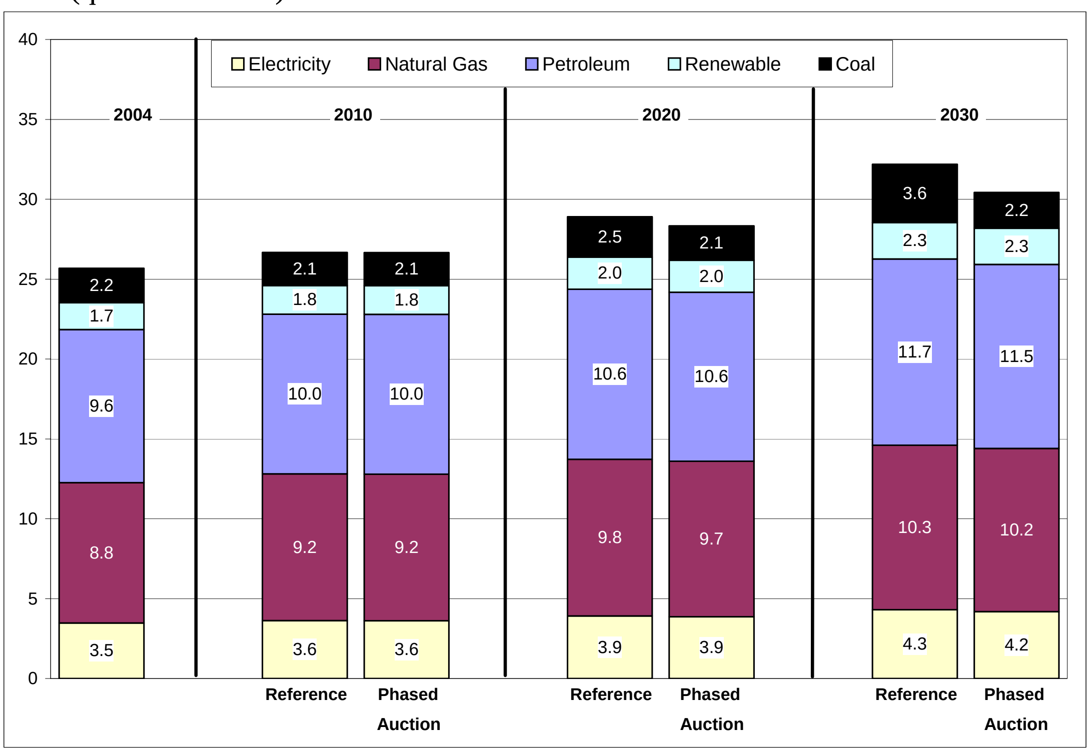
The GHG cap and trade program also stimulates commercial users to increase their investments in natural gas-fired combined heat and power plants (CHP). These facilities can be very efficient, and higher fossil fuel prices make investments in them more attractive. Overall, commercial natural gas-fired CHP capacity is 0.6 percent higher in 2020 in the Phased Auction case, when compared to the reference case. By 2030, the increase relative to the reference case increases to 9 percent.

Industrial

Industrial consumers also reduce their energy consumption in response to higher energy prices, particularly their consumption of coal, which includes coal used to produce oil and electricity in coal-to-liquids (CTL) plants. Relative to the reference case, delivered industrial energy consumption in the Phased cases is 2 percent lower in 2020 and 6 percent lower in 2030 in the Phased Auction case (Figure 11). The largest percentage reductions occur in coal used in CTL production and purchased electricity. In the *AEO2006* reference case, industrial coal use is projected to grow rapidly in the latter half of the projection as CTL plants are introduced. Under the proposed GHG program policy cases, the cost of coal reduces the economic potential for these plants. Relative to the reference case, total industrial coal use is 15 percent lower in 2020 and 39 percent lower in 2030 in the Phased Auction case. In 2030, the use of coal in CTL plants is lower by nearly 85 percent in the Phased Auction case, and the domestic petroleum supply from CTL plants is about 650 thousand barrels a day lower, compared to the reference case.

Figure 11: Industrial Energy Consumption

(quadrillion Btu)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

Compared to the reference case, purchased electricity consumption in the industrial sector is 1 percent lower in 2020 and 3 percent lower in 2030 in the Phased Auction case.

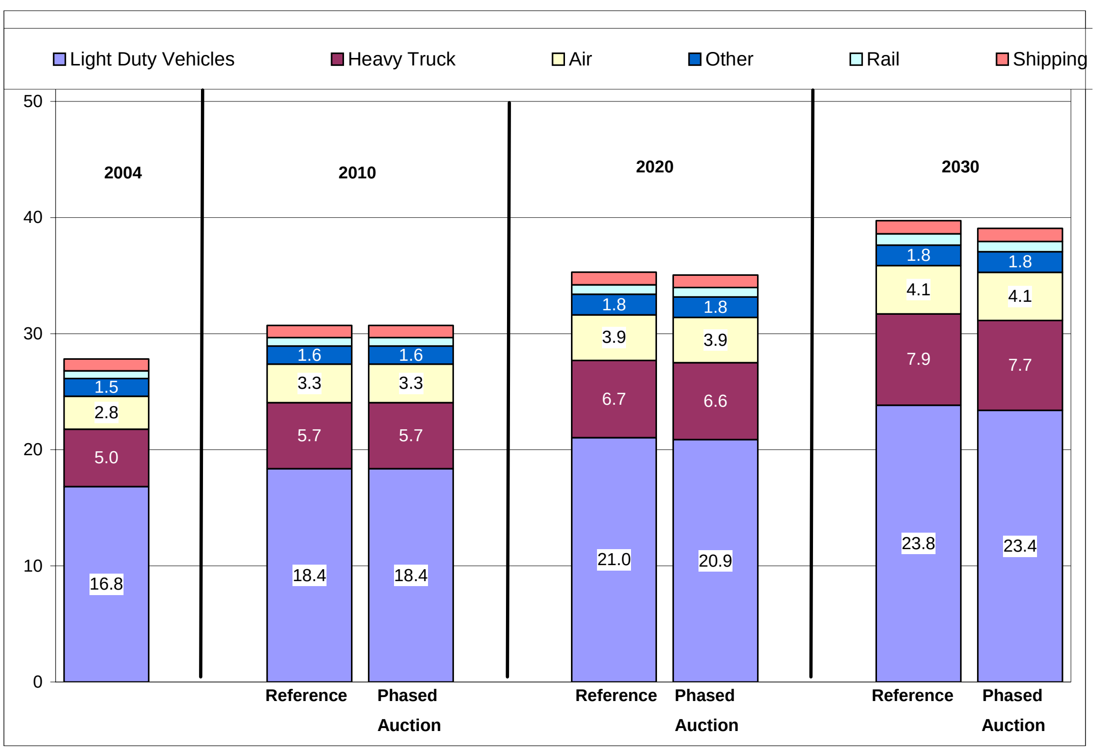
While energy consumption falls in the industrial sector in the Phased Auction case, total industrial energy expenditures rise. Relative to the reference case, industrial energy expenditures increase by $8 billion (5 percent) in 2020 and $21 billion (10 percent) in 2030, in the Phased Auction case. Industrial output, measured in year 2000 dollars, is also reduced relative to the reference case by $91 billion (1 percent) in 2030 in the Phased Auction case.

Transportation

Responding to higher gasoline, diesel, and jet fuel prices, transportation consumers also reduce their energy consumption under the GHG proposal (Figure 12). Relative to the reference case, the higher prices projected in the Phased Auction case lead to 1 percent lower transportation sector energy consumption in 2020 and 2 percent lower transportation sector energy consumption in 2030.

Lower transportation energy consumption results from a combination of reduced travel and increased purchases of more efficient vehicles. In 2020, the reduction in light-duty vehicle miles traveled from the reference case level is 19 billion miles (1 percent) in the Phased Auction case. By 2030, this difference grows to 46 billion miles (1 percent). Freight truck travel is also slightly lower in the Phased Auction case because of lower industrial output.

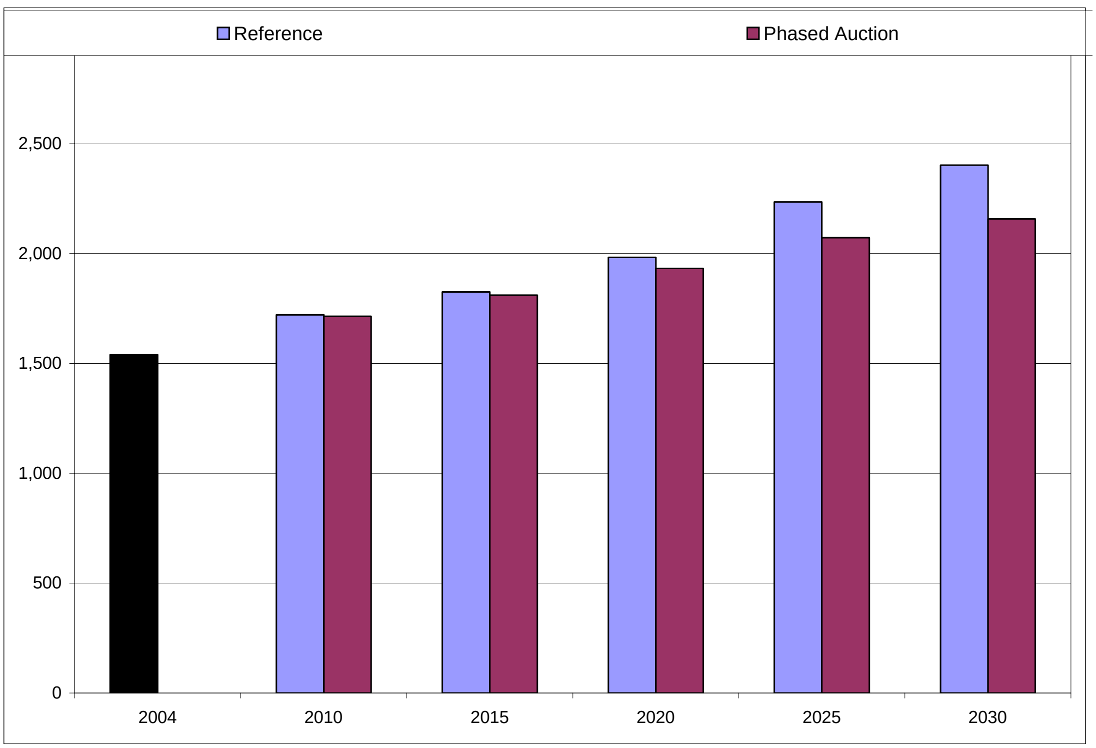
Figure 12: Transportation Sector Energy Consumption by Mode
(quadrillion Btu)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

Though energy use by railroads accounts for only a small part of overall transportation energy use, projected growth in railroad shipments is expected to be significantly impacted by large reductions in the projected growth of coal use (Figure 13). Relative to the reference case, 2020 rail ton-miles traveled are 50 billion ton-miles (3 percent) lower in the Phased Auction case. With a growing reduction over time in coal use relative to the reference case, by 2030 rail ton-miles are 245 billion ton-miles (10 percent) lower than in the reference case.

Figure 13: Railroad Freight Shipments
(billion ton miles traveled)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

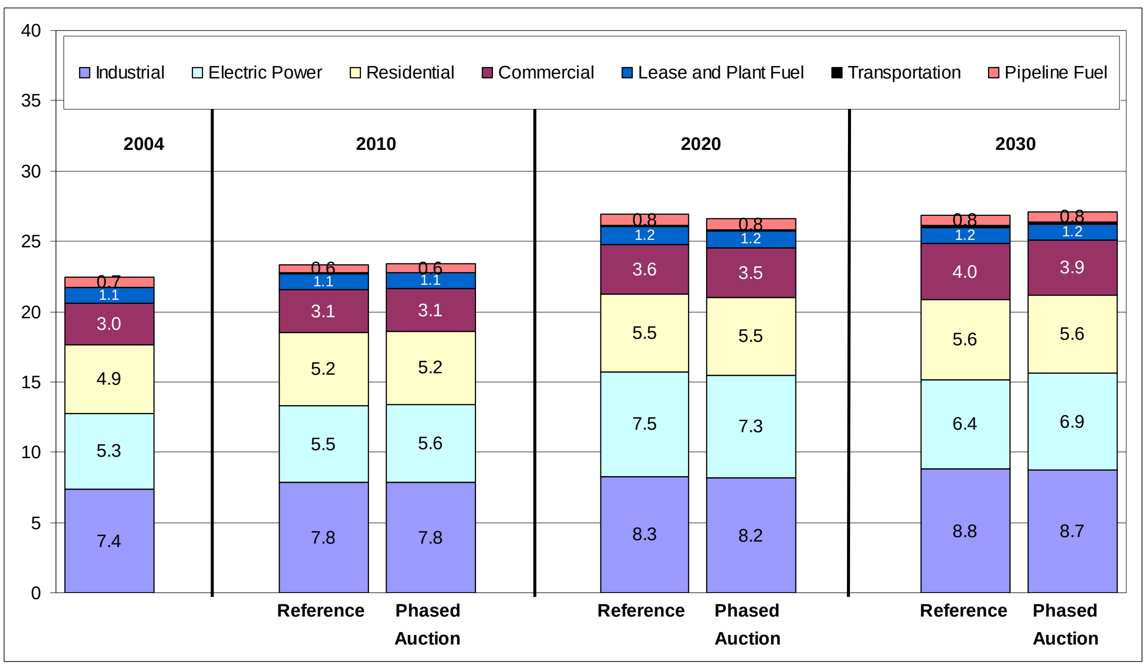
Improved fuel economy also contributes to the lower transportation sector energy consumption. The higher fuel prices in the Phased Auction case stimulate consumers to shift away from light trucks and purchase more hybrid and diesel vehicles. However, the increase in gasoline prices in 2030, $0.11 per gallon (2004 dollars), is not large enough to stimulate a significant shift in the mix of vehicles purchased. The changes that do occur are gradual, but by 2030, the percent of new light vehicle sales that are cars increases from 45 percent in the reference case to 46 percent in the Phased Auction case. Sales of hybrid vehicles in 2030 grow from 12 percent of new light vehicle sales in the reference case to 11.5 percent of new light vehicle sales in the Phased Auction case. Because of the shift in vehicle purchases in the Phased Auction case, new light-duty vehicle fuel economy is 0.4 miles per gallon (1 percent) higher in 2030 than in the reference case.

Fuel Supply

Natural Gas

In general, relative to the reference case, total natural gas consumption changes very little in the Phased and Full Auction cases (Figure 14). The change in consumption occurs mainly in the electric power sector, but most other sectors show small changes. Electric power sector natural consumption is projected to be 0.2 quadrillion Btu (2 percent) below the reference case level in the Phased Auction case in 2020 due to reduced total generation requirements. However, by 2030, the pattern reverses itself and electric power sector natural gas consumption is expected to be 0.5 quadrillion Btu (8 percent) higher in the Phased Auction case than in the reference case.

Figure 14: Natural Gas Consumption by Sector
(trillion cubic feet)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

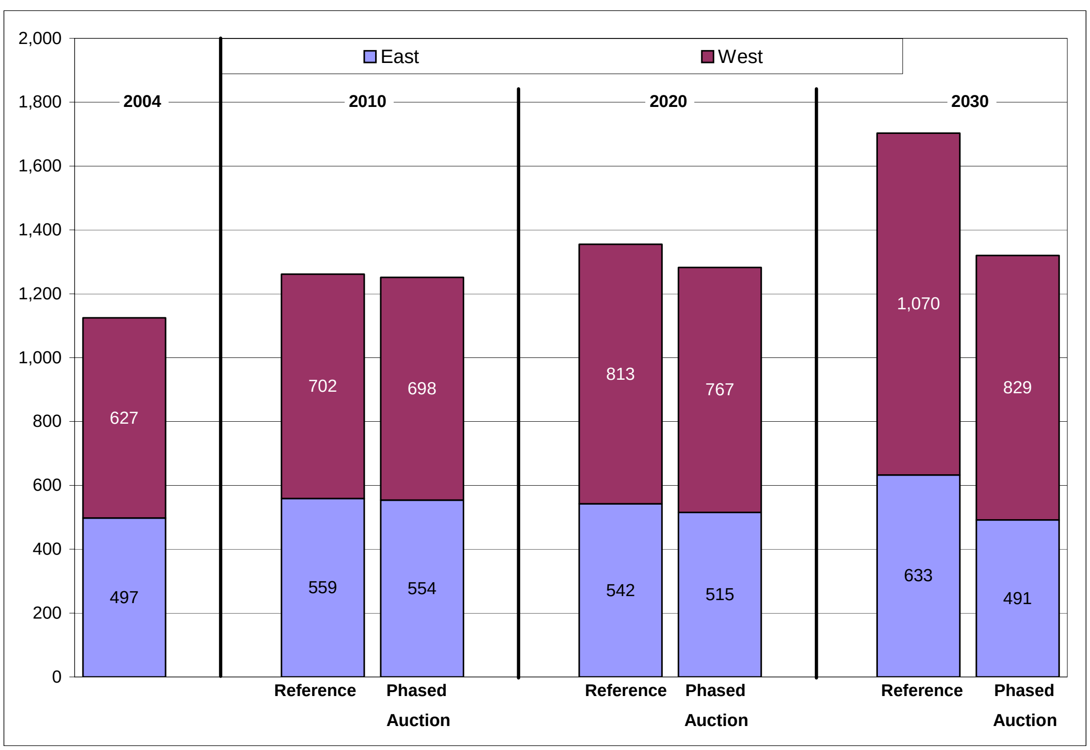
Coal

Because of large reductions in coal use in the electric power sector and in the production of liquid fuels, coal production is much lower in the Phased Auction case (Figure 15). Relative to the reference case, total coal production is 73 million tons (5 percent) lower in 2020 and 383 million tons (22 percent) lower in 2030 in the Phased Auction case. However, even with these changes, coal production in 2030 in the Phased Auction case is projected to be 17 percent (196 million tons) greater than 2004 production. Both eastern and western coal production are lower in the Phased Auction case, but the impact is larger in the west because that is where coal production is projected to grow most rapidly in the reference case.

Petroleum

Relative to the reference case, the consumption of petroleum products is lower in the Phased Auction case, as consumers respond to the higher delivered petroleum product prices that result from cost of allowances under the cap-and-trade program. Petroleum consumption in 2020 is projected to be 0.4 million barrels per day (2 percent) lower in the Phased Auction case than in the reference case. By 2030 the difference grows to 0.7 million barrels per day (3 percent) lower in the Phased Auction case than in the reference case. However, domestic crude oil production is relatively unaffected because the world crude oil prices are unchanged. The reduction in petroleum supply in the Phased Auction case comes from reductions in imports and reductions in domestic CTL production. In the Phased Auction case in 2020, CTL production is 0.2 million barrels per day (74 percent) lower than in the reference case. By 2030, the change is 0.6 million barrels per day (85 percent) lower than in the reference case. The cost of allowances increases the cost of using coal, making CTL production much less competitive with imported and domestic oil.

Figure 15: Coal Production
(million short tons)



Source: National Energy Modeling System runs AEO2006.D111905A and BL_PHASED7.D112006b.

Economic Impacts

Implementing a GHG emissions cap-and-trade program based on a targeted rate of reduction in emissions intensity in which some emissions permits will be auctioned and others will be sold if the safety valve is triggered will impact the economy through two mechanisms. First, efforts to reduce GHG emissions and the requirement to hold permits for all remaining GHG emissions will raise energy prices, particularly those for fossil fuels. Second, the auctioning of permits and the sale of additional permits if the safety valve is triggered will increase revenues to the government. In turn, higher energy prices and increased government revenues will impact aggregate economic growth.

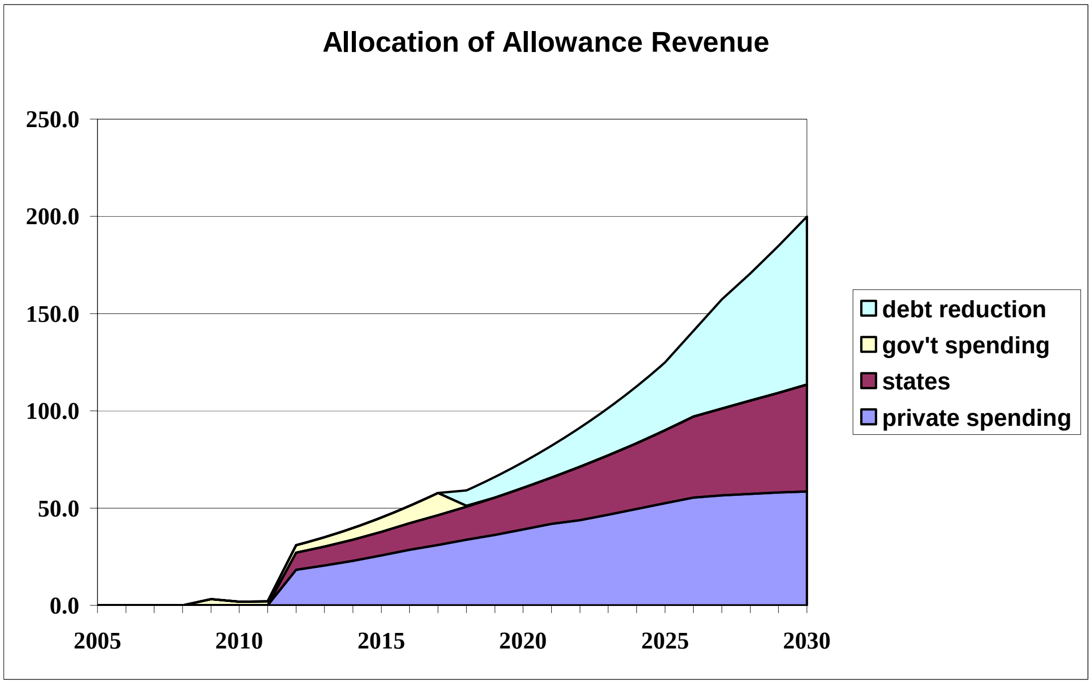
Government Revenues

Projected government revenue from the allowance program is a function of the market price of the allowances, the number of initial allowances auctioned, and the additional revenue from safety valve fees. The value of allowances allocated for free can be considered a revenue transfer in the sense that recipients will accrue revenue from the resale of these allowances. For simplicity in the following discussion, free allowance allocation from the Federal government to recipients is treated as a revenue transfer.

The auctioning of allowances and their free distribution under the proposal will result in revenue flows to different sectors of the economy. Industry will presumably apply some of the value of allowances allocated to them to implement energy-saving processes and technologies. States will use the funds for a variety of programs, such as addressing economic impacts and promoting technology or energy efficiency. As specified in the proposal, the revenue generated by the Federal government (auction proceeds plus safety-valve fees) is initially used to fund early technology deployment, subject to a $50-billion cap on the maximum cumulative deposits to the trust fund. This limit is projected to be reached in 2017 in the Phased Auction case, after which all remaining revenue flows to the U.S. Treasury and is assumed to be used to retire some part of the Federal debt. Figure 16 shows the flows of these funds among the various sectors for the Phased Auction case. The projected change in the Federal deficit relative to the reference case differs from the amount of allowance revenue allocated to debt reduction due to the impact of the proposed program on the overall economy.

The Full Auction case considers the effects of a policy of letting *all* of the allowance receipts flow to the Federal government as an alternative to the allocation scheme in the proposal. The Federal expenditure profile for revenue deposited in the Climate Change Trust Fund is assumed to be the same as in the Phased Auction case. The difference in the two cases is the impact on funds flowing to the Federal government and the subsequent rate at which the Federal debt level is lowered (Figure 17). In essence, the Full Auction case draws more money away from the spending stream of the economy and thus lowers aggregate demand to a much larger degree than the Phased Auction case. Some discussion of possible alternative approaches to revenue recycling and their implications is provided in an earlier EIA report requested by Senators Inhofe, McCain, and Lieberman[21]

Figure 16: Allocation of Allowance Revenue in the Phased Auction Case
(billion nominal dollars)



Source: National Energy Modeling System run, BL_PHASED7.D112006b.

Prices

The energy market impacts of the proposed program influence the aggregate economy through the effect on prices and energy expenditures. Figure 18 shows the percentage changes in the consumer price index (CPI) for energy and the All-Urban CPI, a measure of aggregate consumer prices in the economy. The CPI for energy, a summary measure of energy prices facing households at the retail level incorporating the energy price impacts associated with rising petroleum, natural gas, and electricity prices, increases by approximately 8 percent above the reference case level by 2030. Ultimately the consumer sees higher prices directly through final prices paid for energy goods and service, plus higher prices for other goods and services that come about due to changes in the price of other goods and services resulting from energy price changes, as well as changes in interest rates and other prices driven by the flow of revenues to the government and other sectors under the proposal.

In the Phased Auction case, the All-Urban CPI rises steadily and by 2030 is approximately one percent above the reference case. In the Full Auction case, both

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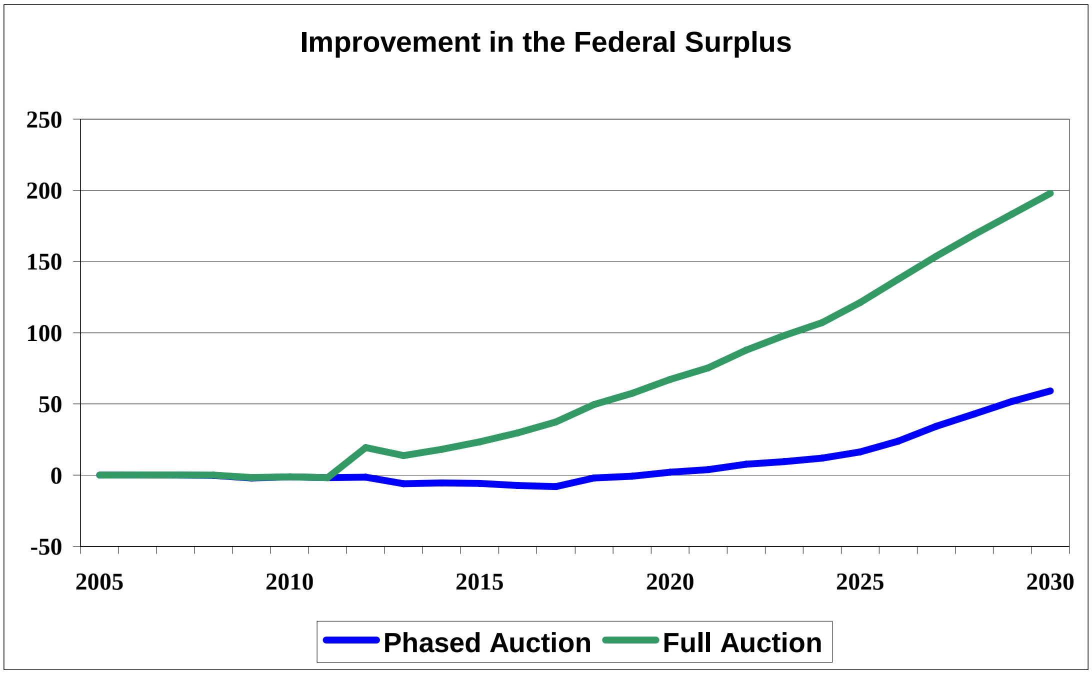
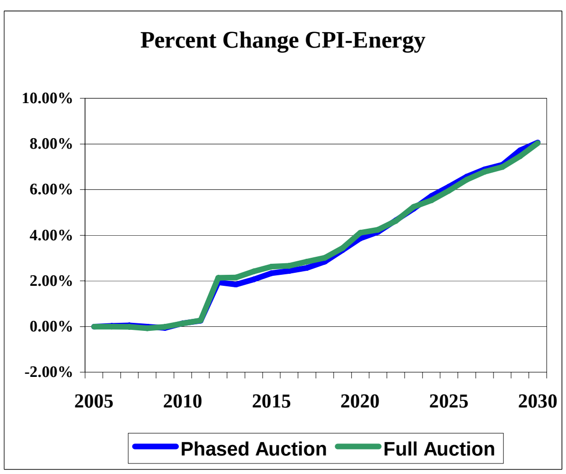
[21] Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003,* SR/OIAF/2003-02 (Washington, DC, June 2003) web site http://www.eia.doe.gov/oiaf/servicerpt/ml/pdf/sroiaf(2003)02.pdf.

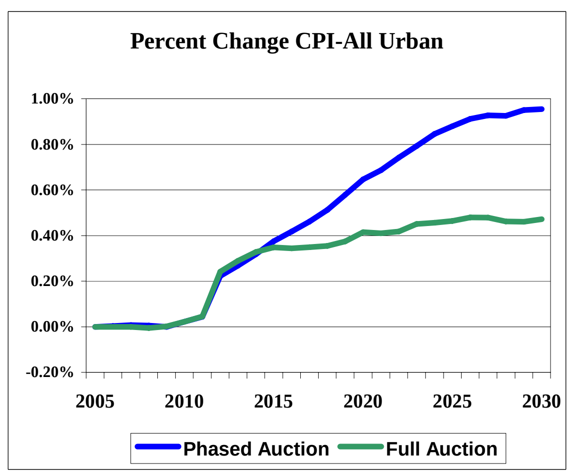
Figure 17: Projected Improvement in the Federal Surplus
(billion nominal dollars)



Source: National Energy Modeling System runs BL_FULL7.D112006c, and BL_PHASED7.D112006b.

Figure 18: Impacts on the CPI for Energy and the All Urban CPI
(percent change from reference case)





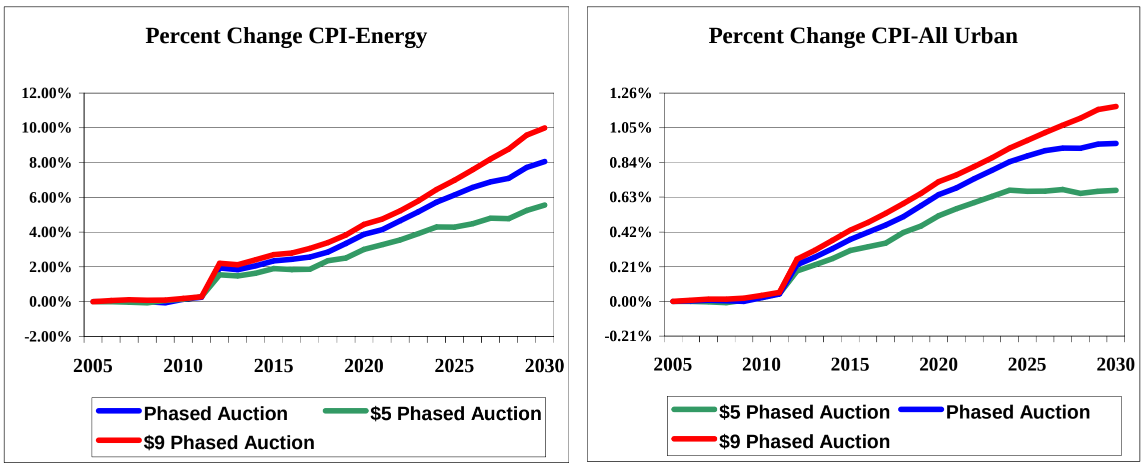
Source: National Energy Modeling System runs BL_FULL7.D112006c, and BL_PHASED7.D112006b.

interest rates and aggregate demand are lower. Interest rates are lower for two main reasons. First, there is less inflationary pressure due to lower aggregate demand and the slightly higher unemployment. Second, with a lower government deficit there is less demand for credit. With less inflationary pressure, the Full Auction variant of the proposal has a lesser effect on the All-Urban CPI than the Phased Auction version. This result implies that energy prices are higher relative to the prices of other goods in the Full Auction case than in the Phased Auction case.

The alternative values of the safety valve price considered in the sensitivity cases will have relatively symmetric impacts on aggregate prices. Figure 19 shows that the All-Urban CPI will rise to approximately 1.2 percent above the reference case by 2030 in the Phased $9 case compared to a 1.0-increase in the Phased Auction case.

Figure 19: Impacts on the CPI for Energy and the All Urban CPI with Alternative Safety Valves

(percent change from reference case)



Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, BL_PHASED5.D111306A, and BL_PHASED9.D112006B.

Real GDP and Consumption Impacts[22]

The higher delivered energy prices and the collection of additional government revenues lower real output for the economy in both the Phased and Full Auction cases. They reduce energy consumption, but also indirectly reduce real consumer spending for other goods and services due to lower purchasing power. The lower aggregate demand for goods and services in the both the Phased and Full Auction cases results in lower real GDP relative to the reference case (Figure 20). Relative to the reference case, total discounted GDP over the 2009 to 2030 time period is $232 billion (0.10 percent) lower in the Phased Auction case and $462 billion (0.19 percent) lower in the Full Auction case. Projected GDP impacts generally increase over time, as the cap-and-trade program requires larger changes in the energy system. Relative to the reference case, real GDP in 2030 is $59 billion (0.26 percent) lower in the Phased Auction case and $94 billion (0.41 percent) lower in the Full Auction case. Because the additional impact on economic activity under a Full Auction could be significantly, or even fully, mitigated under alternative revenue recycling assumptions, the results for the Full Auction case presented

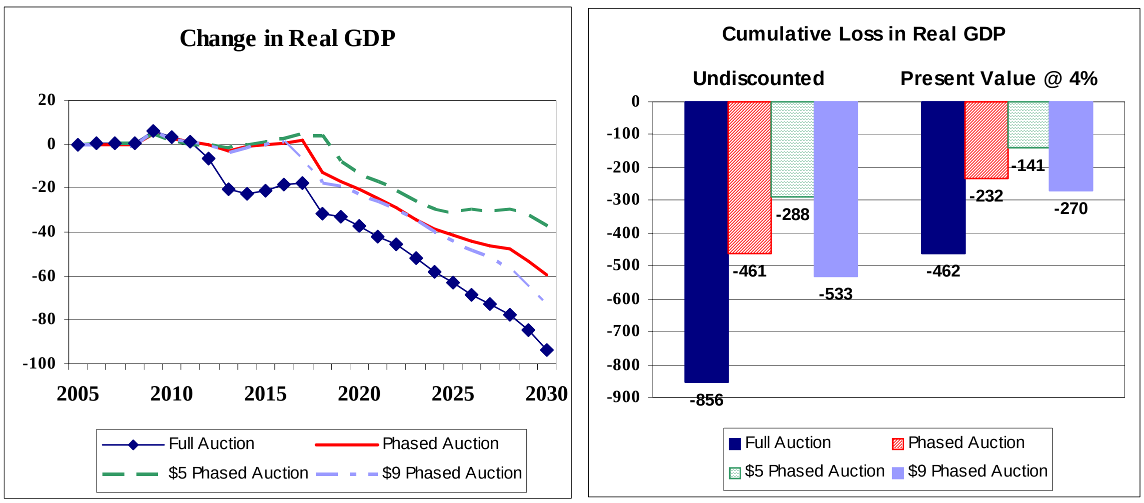
[22] All dollar values reported in this section and beyond are expressed in real 2000 dollars unless otherwise stated

here should not be construed as suggesting a general conclusion that a Phased Auction will necessarily result in lesser impacts on GDP than a comparable Full Auction.

The alternative values of the safety valve price considered in the sensitivity cases have relatively symmetric impacts on projected GDP losses. The estimated loss in GDP in 2030 is 0.32 percent in the Phased $9 case, compared to 0.26 percent for the Phased Auction case and 0.16 percent for the Phased $5 case. In terms of cumulative GDP losses, the difference between the Phased Auction and Phased $9 cases is much smaller, 0.10 percent compared to 0.11 percent, reflecting the fact that the safety valve does not become binding until after 2025 in the Phased Auction case, so that economic impacts up to that date follow the same path in either case. Under the Phased $5 case, the safety valve comes into play at an earlier date, so there is a longer period of time over which projected economic impacts differ from those in the Phased Auction case.

Figure 20: GDP Impacts

(billion 2000 dollars)



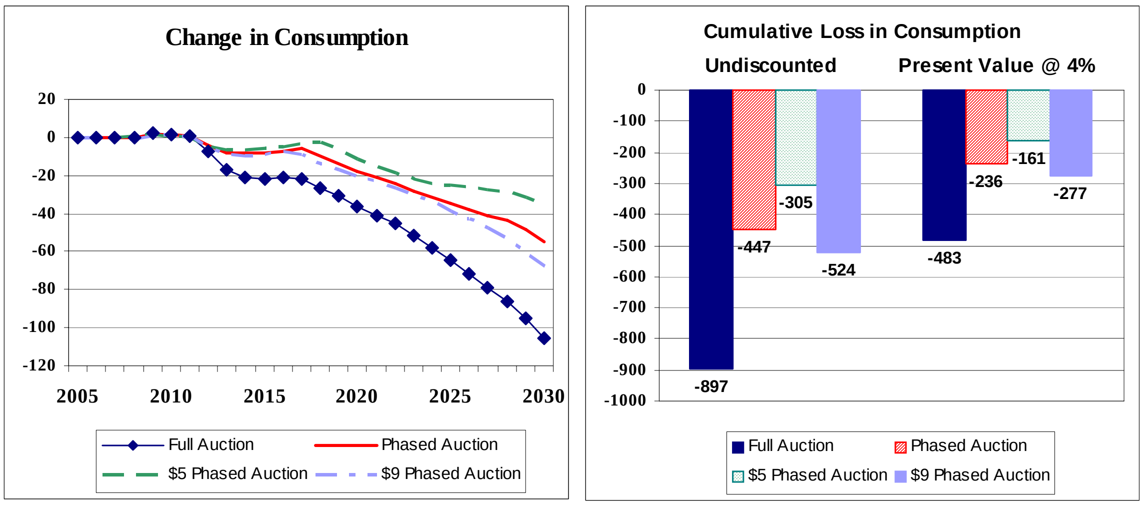
Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, BL_PHASED5.D111306A, and BL_PHASED9.D112006B.

While real GDP is a measure of what the economy produces, ultimately consumers are interested in their purchases of goods and services. GDP and consumption impacts of a proposed policy can differ if the policy leads to changes the shares of the GDP components, which include consumption, investment, government expenditures, and net exports, as well as the level of GDP. Figure 21 shows two measures of consumption impacts: the change in consumption relative to the reference case and the cumulative discounted loss in consumption over the 2009 to 2030 period. Cumulative discounted consumption losses relative to the reference case are $236 billion (0.14 percent) in the Phased Auction case and $483 billion (0.29 percent) in the Full Auction case. Consumption impacts, like GDP impacts, generally grow over time. In 2030, projected real consumption in the Phased Auction and Full Auction case is, respectively, $55 billion (0.36 percent) and $106 billion (0.69 percent) below the reference case level. Starting from the Phased Auction case in which the safety valve is binding before the end of the modeled time horizon, a lower initial value for the safety valve lowers estimated consumption losses, while a higher safety valve raises them (Figure 21). In terms of cumulative discounted consumption losses over the 2010 to 2030 period, the impact of the $5 Phased Auction and $9 Phased Auction sensitivity cases on consumption losses is somewhat asymmetric relative to the $236 billion estimated cumulative discounted consumption loss in the Phased Auction case. The $5 Phased Auction case lowers the estimated cumulative discounted consumption loss to $161 billion (0.10 percent), while the $9 Phased Auction case raises it to $277 billion (0.17 percent).

Table 3 provides more detail on the two main Auction cases.

Figure 21: Consumption Impacts

(billion 2000 dollars)



Source: National Energy Modeling System runs AEO2006.D111905A, BL_PHASED7.D112006B, BL_PHASED5.D111306A, and BL_PHASED9.D112006B.

Table 3: Economic Impacts of Phased and Full Auction Cases

Projection	2004	2020			2030		
		AEO2006 Reference	Phased Auction	Full Auction	AEO2006 Reference	Phased Auction	Full Auction
Allocation of Allowance Revenue (billion nominal dollars)							
Private Spending	-	-	39.0	0.0	-	58.6	0.0
States	-	-	21.4	0.0	-	54.9	0.0
Government Spending	-	-	0.0	0.0	-	0.0	0.0
Debt Reduction	-	-	13.3	73.7	-	86.4	199.9
Total Revenue	-	-	73.7	73.7	-	199.9	199.9
Aggregate Prices in the Economy							
WPI – Fuel & Power (1982 =1.0)	1.27	1.77	1.88	1.88	2.49	2.79	2.79
CPI – Energy (1982/84 = 1.0)	1.51	2.19	2.27	2.28	2.96	3.20	3.20
CPI – All Urban (1982/84 = 1.0)	1.89	2.86	2.88	2.87	3.78	3.82	3.80
Inflation Rate, Unemployment Rate and the Federal Funds Rate (percent)							
Inflation	2.68	3.06	3.13	3.10	2.67	2.68	2.68
Unemployment Rate	5.53	4.37	4.44	4.46	4.90	5.01	5.02
Federal Funds Rate	1.35	5.24	5.24	5.16	5.04	4.96	4.86
Components of GDP (billion 2000 dollars)							
GDP	10,756	17,541	17,520	17,503	23,112	23,053	23,018
Disposable Income	8,004	13,057	13,037	12,991	17,562	17,468	17,367
Consumption	7,589	11,916	11,898	11,880	15,352	15,298	15,247
Investment	1,810	3,293	3,291	3,288	4,985	4,990	4,973
Government	1,952	2,464	2,474	2,464	2,838	2,861	2,839
Exports	1,118	3,776	3,759	3,765	6,833	6,785	6,813
Imports	1,719	3,659	3,660	3,647	6,156	6,165	6,121

Source: National Energy Modeling System runs AEO2006.D111905A, BL_FULL7.D112006c, and BL_PHASED7.D112006b.

Uncertainty

All long-term projections engender considerable uncertainty. It is particularly difficult to foresee how existing technologies might evolve or what new technologies might emerge as market conditions change, particularly when those changes are fairly dramatic. This analysis suggests that, to comply with the GHG emissions growth limits necessary to meet the intensity reduction targets, all energy providers, particularly electricity producers, will increasingly rely on technologies that play a relatively small role today or have not been built in the United States in many years. Sensitivity analyses included in previous EIA studies of cap-and-trade systems for GHG show that estimates of both energy and economic impacts of such programs can change significantly under alternative assumptions regarding the cost and availability of new technologies.

Non-hydroelectric renewable generators currently provide 2.2 percent of the electricity generated. In the reference case, their share is expected to grow to 4.3 percent in 2030. In the Phased and Full Auction cases their share grows to 9 and 10 percent of generation by 2030. While this level of growth is certainly possible, particularly since the GHG emission targets are tightened gradually, it comes with some uncertainty. It is possible that such growth might lead to significant reductions in the costs of these technologies. On the other hand, it is also possible that costly hurdles such as siting resistance, higher than expected transmission interconnection costs, or fuel supply limits could arise that limit their development.

Similarly, this analysis suggests that the power sector would significantly increase its reliance on nuclear power in order to reduce GHG emissions. This is despite the facts that the last nuclear order in the United States was placed in 1978 and the last nuclear plant to enter service began operating in 1996. However, several factors, including rising fossil fuel prices, concern about GHG emissions, tax incentives in the EPACT 2005 and new nuclear plant designs, have recently spurred renewed interest in new nuclear plants. In the reference case, nuclear capacity is projected to increase by 9 gigawatts, including 3 gigawatts of uprates at existing plants and 6 gigawatts of new nuclear plants, about 4 to 6 new plants. In the Phased and Full Auction cases, nuclear capacity is projected to grow by 48 gigawatts and 46 gigawatts, respectively. Such growth in nuclear power might lead to significant cost reductions, encouraging more expansion than projected. On the other hand, costly hurdles, such as unexpectedly high construction costs, public resistance to the siting of facilities, or waste disposal concerns, could arise to limit their development.

If the development of these technologies is limited for one reason or another, power providers will have two choices. First, they can turn to other low-GHG or non-GHG technologies, such as new fossil generators with carbon capture and sequestration equipment, that play a fairly small role in today's market. Second, they can comply by paying more safety-valve fees to maintain their reliance on current fossil-fired generation. To the extent this occurs, projected reductions in GHGs would be reduced. One way or another, significantly reducing energy-related GHG emissions would require a shift away from fossil energy sources that accounted for 86 percent of U.S. energy consumption in 2004. The costs of such a shift are inherently uncertain.

Particularly uncertain in this analysis is the role that increased research and development (R&D) expenditures might play in spurring the development and deployment of new more efficient, lower emitting technologies. The draft proposal calls for spending significant resources on R&D, but it is impossible to predict the impact of such expenditures.

A final source of uncertainty involves assumptions regarding the availability of reductions in covered GHG emissions outside the energy sector. To the extent that this analysis overstates the availability of such reductions, additional reductions in emissions within the energy sector or additional purchases of allowances at the applicable safety valve price would be required to comply with the proposed program.   Previous studies have explored the sensitivity of energy and economic impact estimates to alternative estimates of available emissions reductions outside the energy sector.

Appendix A. Analysis Request Letter

United States Senate

WASHINGTON, DC 20510

September 27, 2006

The Honorable Guy F. Caruso
Administrator
Energy Information Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Mr. Caruso:

Over the past 18 months the Energy Information Administration (EIA) has completed two reports analyzing variations of a greenhouse gas emission trading system as proposed by the National Commission on Energy Policy (NCEP). The first, completed in April 2005, examined NCEP's original proposal, while the second report, undertaken at the request of Senator Salazar and released in March 2006, built on EIA's previous work and analyzed a range of greenhouse gas intensity targets and safety valve levels for an emission trading system.

Both of these studies have proven extremely valuable to us and other members of the Senate as we continue to explore options for addressing global climate change. Over the past year, the Senate Committee on Energy and Natural Resources has held hearings and convened a day-long Climate Conference to examine the approaches analyzed by EIA in more detail. In order to continue this process, Senator Bingaman has drafted a proposal in consultation with other Congressional offices and interested stakeholders. We are requesting EIA analyze this proposal.

Two variants of this proposal should be included in the analysis. The first scenario should assume that no allowances are allocated freely so that we can have an understanding of the cost impacts experienced throughout the economy. The second scenario should assume that allowances are allocated as specified in the draft proposal.

The analysis should use the AEO 2006 reference case (the same reference case used for the March 2006 report) for its "business-as-usual" case. We also ask that you provide us with a short memo that compares the results of the original NCEP proposal as modeled in the March 2006 report ("cap_trade_1") with the results of this scenario.

The Honorable Guy F. Caruso, EIA
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Thank you for assistance with this report. In order to obtain an analysis that will fulfill our needs, we would like to request you meet with Jonathan Black in Senator Bingaman's office.

Sincerely,

Ken Salazar

Dick Lugar

Appendix B. Draft Bill Language

Title: To manage the carbon content of United States domestic energy supply.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "__________ Act of ____".

SEC. 2. ACTIONS TO ADDRESS GLOBAL CLIMATE.

Title XVI of the Energy Policy Act of 1992 (42 U.S.C. 13381 et seq.) is amended—

(1) by inserting after the title designation and heading the following:

"Subtitle A—General Provisions";

and

(2) by adding at the end the following:

"Subtitle B—Actions to Address Global Climate Change

"SEC. 1611. PURPOSE.

"The purpose of this subtitle is to reduce greenhouse gas emissions intensity in the United States, beginning in calendar year 2012, through an emissions trading system designed to achieve emissions reductions at the lowest practicable cost to the United States.

"SEC. 1612. DEFINITIONS.

"In this subtitle:

"(1) CARBON DIOXIDE EQUIVALENT.—The term 'carbon dioxide equivalent' means—

"(A) for each covered fuel, the quantity of carbon dioxide that would be emitted into the atmosphere as a result of complete combustion of a unit of the covered fuel, to be determined for the type of covered fuel by the Secretary; and

"(B) for each greenhouse gas (other than carbon dioxide) the quantity of carbon dioxide that would have an effect on global warming equal to the effect of a unit of the greenhouse gas, as determined by the Secretary, taking into consideration global warming potentials.

"(2) COVERED FUEL.—The term 'covered fuel' means—

"(A) coal;

"(B) petroleum products;

“(C) natural gas;

“(D) natural gas liquids; and

“(E) any other fuel derived from fossil hydrocarbons (including bitumen and kerogen).

“(3) COVERED GREENHOUSE GAS EMISSIONS.—

“(A) IN GENERAL.—The term ‘covered greenhouse gas emissions’ means—

“(i) the carbon dioxide emissions from combustion of covered fuel carried out in the United States; and

“(ii) nonfuel-related greenhouse gas emissions in the United States, determined in accordance with section 1615(b)(2).

“(B) UNITS.—Quantities of covered greenhouse gas emissions shall be measured and expressed in units of metric tons of carbon dioxide equivalent.

“(4) EMISSIONS INTENSITY.—The term ‘emissions intensity’ means, for any calendar year, the quotient obtained by dividing—

“(A) covered greenhouse gas emissions; by

“(B) the forecasted GDP for that calendar year.

“(5) FORECASTED GDP.—The term ‘forecasted GDP’ means the predicted amount of the gross domestic product of the United States, based on the most current projection used by the Energy Information Administration of the Department of Energy on the date on which the prediction is made.

“(6) FORECASTED GDP IMPLICIT PRICE DEFLATOR.—The term ‘forecasted GDP implicit price deflator’ means [TO BE SUPPLIED].

“(7) GREENHOUSE GAS.—The term ‘greenhouse gas’ means—

“(A) carbon dioxide;

“(B) methane;

“(C) nitrous oxide;

“(D) hydrofluorocarbons;

“(E) perfluorocarbons; and

“(F) sulfur hexafluoride.

“(8) INITIAL ALLOCATION PERIOD.—The term ‘initial allocation period’ means the period beginning January 1, 2012, and ending December 31, 2021.

[“(9) NATURAL GAS PROCESSING PLANT.—The term ‘natural gas processing plant’ means a facility designed to separate natural gas liquids from natural gas.]

“(10) NONFUEL REGULATED ENTITY.—The term ‘nonfuel regulated entity’ means—

“(A) the owner or operator of a facility that manufactures hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide;

"(B) an importer of hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide;

"(C) the owner or operator of a facility that emits nitrous oxide associated with the manufacture of adipic acid or nitric acid;

"(D) the owner or operator of an aluminum smelter;

"(E) the owner or operator of an underground coal mine that emitted more than 35,000,000 cubic feet of methane during 2004 or any subsequent calendar year; and

"(F) the owner or operator of facility that emits hydrofluorocarbon-23 as a byproduct of hydrochlorofluorocarbon-22 production.

"(11) OFFSET PROJECT.—The term 'offset project' means any project to—

"(A) reduce greenhouse gas emissions; or

"(B) sequester a greenhouse gas.

"(12) PETROLEUM PRODUCT.—The term 'petroleum product' means—

"(A) a refined petroleum product;

"(B) residual fuel oil;

"(C) petroleum coke; or

"(D) a liquefied petroleum gas.

"(13) REGULATED ENTITY.—The term 'regulated entity' means—

"(A) a regulated fuel distributor; or

"(B) a nonfuel regulated entity.

"(14) REGULATED FUEL DISTRIBUTOR.—The term 'regulated fuel distributor' means—

"(A) the owner or operator of—

"(i) a petroleum refinery;

"(ii) a coal mine that produces more than 10,000 short tons during 2004 or any subsequent calendar year; or

"(iii) a natural gas processing plant [size threshold];

"(B) an importer of—

"(i) petroleum products;

"(ii) coal;

"(iii) coke; or

"(iv) natural gas liquids; or

"(C) any other entity the Secretary determines under section

1615(b)(3)(A)(ii) to be subject to section 1615.

"(15) SAFETY VALVE PRICE.—The term 'safety valve price' means—

"(A) for 2012, $7 per metric ton of carbon dioxide equivalent; and

"(B) for each subsequent calendar year, an amount equal to the product obtained by multiplying—

"(i) the safety valve price established for the preceding calendar year increased by 5 percent, unless a different rate of increase is established for the calendar year under section 1622; and

"(ii) the ratio that—

"(I) the forecasted GDP implicit price deflator for the calendar year; bears to

"(II) the forecasted GDP implicit price deflator for the preceding calendar year.

"(16) SECRETARY.—The term 'Secretary' means the Secretary of Energy, unless the President designates another officer of the Executive Branch to carry out a function under this subtitle.

"(17) SUBSEQUENT ALLOCATION PERIOD.—The term 'subsequent allocation period' means—

"(A) the 5-year period beginning January 1, 2022, and ending December 31, 2026; and

"(B) each subsequent 5-year period.

"SEC. 1613. QUANTITY OF ANNUAL GREENHOUSE GAS ALLOWANCES.

"(a) Initial Allocation Period.—

"(1) IN GENERAL.—Not later than December 31, 2008, the Secretary shall—

"(A) make a projection with respect to emissions intensity for 2011, using—

"(i) the Energy Information Administration's most current projections of covered greenhouse gas emissions for 2011; and

"(ii) the forecasted GDP for 2011;

"(B) determine the emissions intensity target for 2012 by calculating a 2.6 percent reduction from the projected emissions intensity for 2011;

"(C) in accordance with paragraph (2), determine the emissions intensity target for each calendar year of the initial allocation period after 2012; and

"(D) in accordance with paragraph (3), determine the total number of allowances to be allocated for each calendar year during the initial allocation period.

“(2) EMISSIONS INTENSITY TARGETS AFTER 2012.—For each calendar year during the initial allocation period after 2012, the emissions intensity target shall be the emissions intensity target established for the preceding calendar year reduced by 2.6 percent.

“(3) TOTAL ALLOWANCES.—For each calendar year during the initial allocation period, the quantity of allowances to be issued shall be equal to the product obtained by multiplying—

“(A) the emissions intensity target established for the calendar year; and

“(B) the forecasted GDP for the calendar year.

“(b) Subsequent Allocation Periods.—

“(1) IN GENERAL.—Not later than the date that is 4 years before the beginning of each subsequent allocation period, the Secretary shall—

“(A) except as directed under section 1622, determine the emissions intensity target for each calendar year during that subsequent allocation period, in accordance with paragraph (2); and

“(B) issue the total number of allowances for each calendar year of the subsequent allocation period, in accordance with paragraph (3).

“(2) EMISSIONS INTENSITY TARGETS.—For each calendar year during a subsequent allocation period, the emissions intensity target shall be the emissions intensity target established for the preceding calendar year reduced by 3.0 percent.

“(3) TOTAL ALLOWANCES.—For each calendar year during a subsequent allocation period, the quantity of allowances to be issued shall be equal to the product obtained by multiplying—

“(A) the emissions intensity target established for the calendar year; and

“(B) the forecasted GDP for the calendar year.

“(c) Administrative Requirements.—

“(1) DENOMINATION.—Allowances issued by the Secretary under this section shall be denominated in units of metric tons of carbon dioxide equivalent.

“(2) PERIOD OF USE.—An allowance issued by the Secretary under this section may be used during—

“(A) the calendar year for which the allowance is issued; or

“(B) any subsequent calendar year.

“(3) SERIAL NUMBERS.—The Secretary shall—

“(A) assign a unique serial number to each allowance issued under this subtitle; and

“(B) retire the serial number of an allowance on the date on which the allowance is submitted under section 1615.

“SEC. 1614. ALLOCATION AND AUCTION OF GREENHOUSE GAS ALLOWANCES.

“(a) Allocation of Allowances.—

“(1) DEFINITION OF STATE.—In this subsection, the term ‘State’ means—

“(A) each of the several States of the United States;

“(B) the District of Columbia;

“(C) the Commonwealth of Puerto Rico;

“(D) Guam;

“(E) American Samoa;

“(F) the Commonwealth of the Northern Mariana Islands;

“(G) the Federated States of Micronesia;

“(H) the Republic of the Marshall Islands;

“(I) the Republic of Palau; and

“(J) the United States Virgin Islands.

“(2) ALLOCATIONS.—Not later than the date that is 2 years before the beginning of the initial allocation period, and each subsequent allocation period, the Secretary shall allocate for each calendar year during the allocation period a quantity of allowances in accordance with this subsection.

“(3) QUANTITY.—The total quantity of allowances available to be allocated to industry and States [OR: to industry and by the President] for each calendar year of an allocation period shall be the product obtained by multiplying—

“(A) the total quantity of allowances issued for the calendar year under subsection (a)(3) or (b)(3) of section 1613; and

“(B) the allocation percentage for the calendar year under subsection (c).

“(4) ALLOWANCE ALLOCATION RULEMAKING.—Not later than 18 months after the date of enactment of this subtitle, the Secretary shall establish, by rule, procedures for allocating allowances in accordance with the criteria established under this subsection, including requirements (including forms and schedules for submission) for the reporting of information necessary for the allocation of allowances under this section.

“(5) DISTRIBUTION OF ALLOWANCES TO INDUSTRY.—The allowances available for allocation to industry under paragraph (3) shall be distributed as follows:

“(A) COAL MINES.—

“(i) DEFINITION OF ELIGIBLE COAL MINE.—In this subparagraph, the term ‘eligible coal mine’ means a coal mine located in the United States that is a regulated fuel distributor.

"(ii) TOTAL ALLOCATION.—For each year, eligible coal mines shall be allocated \7/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(iii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to an eligible coal mine shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to eligible coal mines under clause (ii); and

"(II) the ratio that—

"(aa) the carbon content of coal produced at the eligible coal mine during the 3-year period beginning on January 1, 2004; bears to

"(bb) the carbon content of coal produced at all eligible coal mines in the United States during that period.

"(B) PETROLEUM REFINERS.—

"(i) TOTAL ALLOCATION.—For each year, the petroleum refining sector shall be allocated \4/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(ii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to a petroleum refinery located in the United States shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to the petroleum refining sector under clause (i); and

"(II) the ratio that—

"(aa) the carbon content of petroleum products produced at the refinery during the 3-year period beginning on January 1, 2004; bears to

"(bb) the carbon content of petroleum products produced at all refineries in the United States during that period.

"(C) NATURAL GAS PROCESSORS.—

"(i) DEFINITION OF ELIGIBLE NATURAL GAS PROCESSOR.—In this subparagraph, the term 'eligible natural gas processor' means a natural gas processor located in the United States that is a regulated fuel distributor.

"(ii) TOTAL ALLOCATION.—For each year, eligible natural gas processors shall be allocated \2/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(iii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to an eligible natural gas processor shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to eligible natural gas processors under clause (ii); and

"(II) the ratio that—

"(aa) the sum of, for the 3-year period beginning on January 1, 2004—

"(AA) the carbon content of natural gas liquids produced by the eligible natural gas processor; and

"(BB) the carbon content of the natural gas delivered into commerce by the eligible natural gas processor; bears to

"(bb) the sum of, for that period—

"(AA) the carbon content of natural gas liquids produced by all eligible natural gas processors; and

"(BB) the carbon content of the natural gas delivered into commerce by all eligible natural gas processors.

"(D) ELECTRICITY GENERATORS.—

"(i) DEFINITION OF ELIGIBLE ELECTRICITY GENERATOR.—In this subparagraph, the term 'eligible electricity generator' means an electricity generator located in the United States that is a fossil fuel-fired electricity generator.

"(ii) TOTAL ALLOCATION.—For each year, eligible electricity generators shall be allocated \30/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(iii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to an eligible electricity generator shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to eligible electricity generators under clause (ii); and

"(II) the ratio that—

"(aa) the carbon content of the fossil fuel input of the eligible electricity generator during the 3-year period beginning on January 1, 2004; bears to

"(bb) the total carbon content of fossil fuel input of eligible electricity generators in the United States during that period.

"(E) CARBON-INTENSIVE MANUFACTURING SECTORS.—

"(i) DEFINITION OF ELIGIBLE MANUFACTURER.—In this subparagraph, the term 'eligible manufacturer' means a carbon-intensive manufacturer located in the United States that [used more than _____ during ____; need to define/specify; need to exclude fossil fuel-fired electricity generation].

"(ii) TOTAL ALLOCATION.—For each year, eligible manufacturers shall be allocated \10/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(iii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to an eligible manufacturer shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to eligible manufacturers under clause (ii); and

"(II) the ratio that—

"(aa) the carbon content of fossil fuel combusted at the eligible manufacturer during the 3-year period beginning on January 1, 2004; bears to

"(bb) the total carbon content of fossil fuel combusted at all eligible manufacturers in the United States during that period.

"(F) NONFUEL REGULATED ENTITIES.—

"(i) TOTAL ALLOCATION.—For each year, nonfuel regulated entities shall be allocated \2/55\ of the total quantity of allowances available for allocation to industry under paragraph (3).

"(ii) INDIVIDUAL ALLOCATIONS.—For any year, the quantity of allowances allocated to a nonfuel regulated entity shall be the quantity equal to the product obtained by multiplying—

"(I) the total allocation to nonfuel regulated entities under clause (i); and

"(II) the ratio that—

"(aa) the carbon dioxide equivalent of the nonfuel-related greenhouse gas produced or emitted by the nonfuel regulated entity at facilities in the United States during the 3-year period beginning on January 1, 2004; bears to

"(bb) the carbon dioxide equivalent of the nonfuel-related greenhouse gases produced or emitted by all nonfuel regulated entities at facilities in the United States during that period.

"(6) ALLOWANCES TO STATES.—

"(A) DISTRIBUTION.—The allowances available for allocation to States under paragraph (3) shall be distributed as follows:

"(i) For each year, \1/2\ of the quantity of allowances available for allocation to States under paragraph (3) shall be allocated among the States based on the ratio that—

"(I) the greenhouse gas emissions of the State during the 3-year period beginning on January 1, 2004; bears to

"(II) the greenhouse gas emissions of all States for that period.

"(ii) For each year, \1/2\ of the quantity of allowances available for allocation to States under paragraph (3) shall be allocated among the States based on the ratio that—

"(I) the population of the State, as determined by the 2000 decennial census; bears to

"(II) the population of all States as determined by that census.

"(B) USE.—

"(i) IN GENERAL.—During any year, a State shall use not less than 90 percent of the allowances allocated to the State for that year—

"(I) to mitigate impacts on low-income energy consumers;

"(II) to promote energy efficiency;

"(III) to promote investment in nonemitting electricity generation technology;

"(IV) to encourage advances in energy technology that reduce or sequester greenhouse gas emissions;

"(V) to avoid distortions in competitive electricity markets;

"(VI) to mitigate obstacles to investment by new entrants in electricity generation markets;

"(VII) to address local or regional impacts of climate change policy, including providing assistance to displaced workers;

"(VIII) to mitigate impacts on energy-intensive industries in internationally-competitive markets; or

"(IX) to enhance energy security.

"(ii) DEADLINE.—A State shall allocate allowances for use in accordance with clause (i) by not later than 1 year before the beginning of each allowance allocation period.

["(6) [POSSIBLE SUBSTITUTE FOR (6)] distribution of allowances by president.—]]

["(A) IN GENERAL.—The President shall distribute the allowances available for allocation by the President under paragraph (3) in a manner designed to mitigate the undue impacts of the program under this subtitle.]

["(B) USE.—During any year, the President shall use not less than 90 percent of the allowances available for allocation by the President for that year—]

["(i) to mitigate impacts on low-income energy consumers;]

["(ii) to promote energy efficiency;]

["(iii) to promote investment in nonemitting electricity generation technology;]

["(iv) to support advances in energy technology that reduce or sequester greenhouse gas emissions;]

[“(v) to avoid distortions in competitive electricity markets;]

[“(vi) to mitigate obstacles to investment by new entrants in electricity generation markets;]

[“(vii) to address local or regional impacts of climate change policy, including providing assistance to displaced workers;]

[“(viii) to mitigate impacts on energy-intensive industries in internationally-competitive markets; and]

[“(ix) to enhance energy security.]

[“(C) DEADLINE.—The President shall allocate allowances for use in accordance with subparagraph (B) by not later than 1 year before the beginning of each allowance allocation period. [Corresponding changes needed elsewhere if this paragraph is selected.]]

“(7) COST OF ALLOWANCES.—The Secretary shall distribute allowances under this subsection at no cost to the recipient of the allowance.

“(b) Auction of Allowances.—

“(1) IN GENERAL.—The Secretary shall establish, by rule, a procedure for the auction of a quantity of allowances during each calendar year in accordance with paragraph (2).

“(2) BASE QUANTITY.—The base quantity of allowances to be auctioned during a calendar year shall be the product obtained by multiplying—

“(A) the total number of allowances for the calendar year under subsection (a)(3) or (b)(3) of section 1613; and

“(B) the auction percentage for the calendar year under subsection (c).

“(3) SCHEDULE.—The auction of allowances shall be held on the following schedule:

“(A) In 2009, the Secretary shall auction—

“(i) \1/2\ of the allowances available for auction for 2012; and

“(ii) \1/2\ of the allowances available for auction for 2013.

“(B) In 2010, the Secretary shall auction \1/2\ of the allowances available for auction for 2014.

“(C) In 2011, the Secretary shall auction \1/2\ of the allowances available for auction for 2015.

“(D) In 2012 and each subsequent calendar year, the Secretary shall auction—

“(i) \1/2\ of the allowances available for auction for that calendar year; and “(ii) \1/2\ of the allowances available for auction for the calendar year that is 4 years after that calendar year.

“(4) UNDISTRIBUTED ALLOWANCES.—In an auction held during any calendar year, the Secretary shall auction any allowance that was—

“(A) available for allocation by the Secretary under subsection (a) for the calendar year, but not distributed;

“(B) available during the preceding calendar year for an agricultural sequestration or early reduction activity under section 1620 or 1621, but not distributed during that calendar year; or

“(C) available for distribution by a State under subsection (a)(6), but not distributed by the date that is 1 year before the beginning of the applicable allocation period.

“(c) Available Percentages.—Except as directed under section 1622, the percentage of the total quantity of allowances for each calendar year to be available for allocation, agricultural sequestration and early reduction projects, and auction shall be determined in accordance with the following table:

Year	Percentage Allocated to Industry	Percentage Allocated to States	Percentage Available for Agricultural Sequestration	Percentage Available for Early Reduction Allowances	Percentage Auctioned
2012	55	29	5	1	10
2013	55	29	5	1	10
2014	55	29	5	1	10
2015	55	29	5	1	10
2016	55	29	5	1	10
2017	53	29	5	1	12
2018	51	29	5	1	14
2019	49	29	5	1	16
2020	47	29	5	1	18
2021	45	29	5	1	20
2022 & thereafter	2 less than allocated to industry in the prior year, but not less than 0	30	5	0	2 more than available for auction in the prior year, but not more than 65

“SEC. 1615. SUBMISSION OF ALLOWANCES.

“(a) Requirements.—

“(1) REGULATED FUEL DISTRIBUTORS.—For calendar year 2012 and each calendar year thereafter, each regulated fuel distributor shall submit to the Secretary a number of allowances equal to the carbon dioxide equivalent of the quantity of covered fuel, determined in accordance with subsection (b)(1), for the regulated fuel distributor.

"(2) NONFUEL REGULATED ENTITIES.—For 2012 and each calendar year thereafter, each nonfuel regulated entity shall submit to the Secretary a number of allowances equal to the carbon dioxide equivalent of the quantity of nonfuel-related greenhouse gas, determined in accordance with subsection (b)(2), for the nonfuel regulated entity.

"(b) Regulated Quantities.—

"(1) COVERED FUELS.—For purposes of subsection (a)(1), the quantity of covered fuel shall be equal to—

"(A) for a petroleum refinery located in the United States, the quantity of petroleum products refined, produced, or consumed at the refinery;

"(B) for a natural gas processing plant located in the United States, a quantity equal to the sum of—

"(i) the quantity of natural gas liquids produced or consumed at the plant; and

"(ii) the quantity of natural gas delivered into commerce from, or consumed at, the plant;

"(C) for a coal mine located in the United States, the quantity of coal produced or consumed at the mine; and

"(D) for an importer of coal, petroleum products, or natural gas liquids into the United States, the quantity of coal, petroleum products, or natural gas liquids imported into the United States.

"(2) NONFUEL-RELATED GREENHOUSE GASES.—For purposes of subsection (a)(2), the quantity of nonfuel-related greenhouse gas shall be equal to—

"(A) for a manufacturer or importer of hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide, the quantity of hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide produced or imported by the manufacturer or importer;

"(B) for an underground coal mine, the quantity of methane emitted by the coal mine;

"(C) for a facility that manufactures adipic acid or nitric acid, the quantity of nitrous oxide emitted by the facility;

"(D) for an aluminum smelter, the quantity of perfluorocarbons emitted by the smelter; and

"(E) for a facility that produces hydrochlorofluorocarbon-22, the quantity of hydrofluorocarbon-23 emitted by the facility.

"(3) ADJUSTMENTS.—

"(A) REGULATED FUEL DISTRIBUTORS.—

“(i) Modification.—The Secretary may modify, by rule, a quantity of covered fuels under paragraph (1) if the Secretary determines that the modification is necessary to ensure that—

“(I) allowances are submitted for all units of covered fuel; and

“(II) allowances are not submitted for the same quantity of covered fuel by more than 1 regulated fuel distributor.

“(ii) EXTENSION.—The Secretary may extend, by rule, the requirement to submit allowances under subsection (a)(1) to an entity that is not a regulated fuel distributor if the Secretary determines that the extension is necessary to ensure that allowances are submitted for all covered fuels.

“(B) NONFUEL REGULATED ENTITIES.—The Secretary may modify, by rule, a quantity of nonfuel-related greenhouse gases under paragraph (2) if the Secretary determines the modification is necessary to ensure that allowances are not submitted for the same volume of nonfuel-related greenhouse gas by more than 1 regulated entity.

“(c) Deadline for Submission.—Any entity required to submit an allowance to the Secretary under this section shall submit the allowance not later than March 31 of the calendar year following the calendar year for which the allowance is required to be submitted.

“(d) Regulations.—The Secretary shall promulgate such regulations as the Secretary determines to be necessary or appropriate to—

“(1) identify and register each regulated entity that is required to submit an allowance under this section; and

“(2) require the submission of reports and otherwise obtain any information the Secretary determines to be necessary to calculate or verify the compliance of a regulated entity with any requirement under this section.

“(e) Exemption Authority for Non-Fuel Regulated Entities.—

“(1) IN GENERAL.—Except as provided in paragraph (2), the Secretary may exempt from the requirements of this subtitle an entity that emits, manufactures, or imports nonfuel-related greenhouse gases for any period during which the Secretary determines, after providing an opportunity for public comment, that measuring or estimating the quantity of greenhouse gases emitted, manufactured, or imported by the entity is not feasible.

“(2) EXCLUSION.—The Secretary may not exempt a regulated fuel distributor from the requirements of this subtitle under paragraph (1).

“(f) Retirement of Allowances.—

“(1) IN GENERAL.—Any person or entity that is not subject to this subtitle may submit to the Secretary an allowance for retirement at any time.

“(2) ACTION BY SECRETARY.—On receipt of an allowance under paragraph (1), the Secretary—

“(A) shall accept the allowance; and

“(B) shall not allocate, auction, or otherwise reissue the allowance.

“(g) Submission of Credits.—A regulated entity may submit a credit distributed by the Secretary pursuant to section 1618, 1619, or 1622(e) in lieu of an allowance.

“(h) Clean Development Mechanism Certified Emission Reductions.—

“(1) IN GENERAL.—The Secretary shall establish, by regulation, procedures under which a regulated entity may submit a clean development mechanism certified emission reduction in lieu of an allowance under this section.

“(2) CLEAR TITLE AND PREVENTION OF DOUBLE-COUNTING.—Procedures established by the Secretary under this subsection shall include such provisions as the Secretary considers to be appropriate to ensure that—

“(A) a regulated entity that submits a clean development mechanism certified emission reduction in lieu of an allowance has clear title to that certified emission reduction; and

“(B) a clean development mechanism certified emission reduction submitted in lieu of an allowance has not been and cannot be used in the future for compliance purposes under any foreign greenhouse gas regulatory program.

“(i) Study on Process Emissions.—

“(1) IN GENERAL.—Not later than [_________], the Secretary shall—

“(A) carry out a study of the feasibility of requiring the submission of allowances for process emissions not otherwise covered by this subtitle; and

“(B) submit to Congress a report that describes the results of the study (including recommendations of the Secretary based on those results).

“SEC. 1616. SAFETY VALVE.

“The Secretary shall accept from a regulated entity a payment of the applicable safety valve price for a calendar year in lieu of submission of an allowance under section 1615 for that calendar year.

“SEC. 1617. ALLOWANCE TRADING SYSTEM.

“(a) In General.—The Secretary shall—

“(1) establish, by rule, a trading system under which allowances and credits may be sold, exchanged, purchased, or transferred by any person or entity, including a registry for issuing, recording, and tracking allowances and credits; and

“(2) specify all procedures and requirements required for orderly functioning of the trading system.

“(b) Transparency.—

“(1) IN GENERAL.—The trading system under subsection (a) shall include such provisions as the Secretary considers to be appropriate to—

“(A) facilitate price transparency and participation in the market for allowances and credits; and

“(B) protect buyers and sellers of allowances and credits, and the public, from the adverse effects of collusion and other anticompetitive behaviors.

“(2) AUTHORITY TO OBTAIN INFORMATION.—The Secretary may obtain any information the Secretary considers to be necessary to carry out this section from any person or entity that buys, sells, exchanges, or otherwise transfers an allowance or credit.

“(c) Banking.—Any allowance or credit may be submitted for compliance during any year following the year for which the allowance or credit was issued.

“SEC. 1618. CREDITS FOR FEEDSTOCKS AND EXPORTS.

“(a) In General.—The Secretary shall establish, by rule, a program under which the Secretary distributes credits to entities in accordance with this section.

“(b) Use of Fuels as Feedstocks.—If the Secretary determines that an entity has used a covered fuel as a feedstock so that the carbon dioxide associated with the covered fuel will not be emitted, the Secretary shall distribute to that entity, for 2012 and each subsequent calendar year, a quantity of credits equal to the quantity of covered fuel used as feedstock by the entity during that year, measured in carbon dioxide equivalents.

“(c) Exporters of Covered Fuel.—If the Secretary determines that an entity has exported covered fuel, the Secretary shall distribute to that entity, for 2012 and each subsequent calendar year, a quantity of credits equal to the quantity of covered fuel exported by the entity during that year, measured in carbon dioxide equivalents.

“(d) Other Exporters.—If the Secretary determines that an entity has exported hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide, the Secretary shall distribute to that entity, for 2012 and each subsequent calendar year, a quantity of credits equal to the volume of hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, or nitrous oxide exported by the entity during that year, measured in carbon dioxide equivalents.

“SEC. 1619. CREDITS FOR OFFSET PROJECTS.

“(a) Establishment.—The Secretary shall establish, by regulation, a program under which the Secretary shall distribute credits to entities that carry out offset projects in the United States that—

“(1)(A) reduce any greenhouse gas emissions that are not covered greenhouse gas emissions; or

“(B) sequester a greenhouse gas;

“(2) meet the requirements of section 1623(c); and

“(3) are consistent with maintaining the environmental integrity of the program under this subtitle.

“(b) Categories of Offset Projects Eligible for Streamlined Procedures.—

“(1) IN GENERAL.—The program established under this section shall include the use of streamlined procedures for distributing credits to categories of projects for which the Secretary determines there are broadly-accepted standards or methodologies for quantifying and verifying the greenhouse gas emission mitigation benefits of the projects.

“(2) CATEGORIES OF PROJECTS.—The streamlined procedures described in paragraph (1) shall apply to—

“(A) geologic sequestration projects not involving enhanced oil recovery;

“(B) landfill methane use projects;

“(C) animal waste or municipal wastewater methane use projects;

“(D) projects to reduce sulfur hexafluoride emissions from transformers;

“(E) projects to destroy hydrofluorocarbons; and

“(F) such other categories of projects as the Secretary may specify by regulation.

“(c) Other Projects.—With respect to an offset project that is eligible to be carried out under this section but that is not classified within any project category described in subsection (b), the Secretary may distribute credits on a basis of less than 1-credit-for-1-ton.

“(d) Ineligible Offset Projects.—An offset project shall not be eligible to receive a credit under this section if the offset project is eligible to receive credits or allowances under section 1618, 1620, 1621, or 1622(e).

“SEC. 1620. EARLY REDUCTION ALLOWANCES.

“(a) Establishment.—The Secretary shall establish, by rule, a program under which the Secretary distributes to any entity that carries out a project to reduce or sequester greenhouse gas emissions before the initial allocation period a quantity of allowances that reflects the actual emissions reductions or net sequestration of the project, as determined by the Secretary.

“(b) Available Allowances.—The total quantity of allowances distributed under subsection (a) may not exceed the product obtained by multiplying—

“(1) the total number of allowances issued for the calendar year under subsection (a)(3) of section 1613; and

“(2) the percentage available for early reduction allowances for the calendar year under section 1614(c).

“(c) Eligibility.—The Secretary may distribute allowances for early reduction projects only to an entity that has reported the reduced or sequestered greenhouse gas emissions under—

“(1) the Voluntary Reporting of Greenhouse Gases Program of the Energy Information Administration under section 1605(b) of the Energy Policy Act of 1992

(42 U.S.C. 13385(b));

"(2) the Climate Leaders Program of the Environmental Protection Agency; or

"(3) a State-administered or privately-administered registry that includes early reduction actions not covered under the programs described in paragraphs (1) and (2).

"SEC. 1621. AGRICULTURAL SEQUESTRATION PROJECTS.

"(a) Establishment.—The Secretary of Agriculture shall establish, by rule, a program under which agricultural sequestration allowances are distributed to entities that carry out soil carbon sequestration projects [and other projects?] that—

"(1) meet the requirements of section 1623(c); and

"(2) achieve sequestration results that are—

"(A) greater than sequestration results achieved pursuant to standard agricultural practices; and

["(B) long-term.]

"(b) Quantity.—During a calendar year, the Secretary of Agriculture shall distribute agricultural sequestration allowances in a quantity not greater than the product obtained by multiplying—

"(1) the total number of allowances issued for the calendar year under section 1613; and

"(2) the percentage of allowances available for agricultural sequestration under section 1614(c).

"(c) Oversubscription.—If, during a calendar year, the qualifying agricultural sequestration exceeds the quantity of agricultural sequestration allowances available for distribution under subsection (b), the Secretary of Agriculture may distribute allowances on a basis of less than 1-allowance-for-1-ton.

"SEC. 1622. CONGRESSIONAL REVIEW.

"(a) Interagency Review.—

"(1) IN GENERAL.—Not later than January 15, 2016, and every 5 years thereafter, the President shall establish an interagency group to review and make recommendations relating to—

"(A) each program under this subtitle; and

"(B) any similar program of a foreign country described in paragraph (2).

"(2) COUNTRIES TO BE REVIEWED.—An interagency group established under paragraph (1) shall review actions and programs relating to greenhouse gas emissions of—

"(A) each member country (other than the United States) of the Organisation for Economic Co-operation and Development;

“(B) China;

“(C) India;

“(D) Brazil;

“(E) Mexico;

“(F) Russia; and

“(G) Ukraine.

“(3) INCLUSIONS.—A review under paragraph (1) shall—

“(A) for the countries described in paragraph (2), analyze whether the countries that are the highest emitting countries and, collectively, contribute at least 75 percent of the total greenhouse gas emissions of those countries have taken action that—

“(i) in the case of member countries of the Organisation for Economic Co-Operation and Development, is comparable to that of the United States; and

“(ii) in the case of China, India, Brazil, Mexico, Russia, and Ukraine, is significant, contemporaneous, and equitable compared to action taken by the United States;

“(B) analyze whether each of the 5 largest trading partners of the United States, as of the date on which the review is conducted, has taken action with respect to greenhouse gas emissions that is comparable to action taken by the United States;

“(C) analyze whether the programs established under this subtitle have contributed to an increase in electricity imports from Canada or Mexico; and

“(D) make recommendations with respect to whether—

“(i) the rate of reduction of emissions intensity under subsection (a)(2) or (b)(2) of section 1613 should be modified; and

“(ii) the rate of increase of the safety valve price should be modified.

“(4) SUPPLEMENTARY REVIEW ELEMENTS.—A review under paragraph (1) may include an analysis of—

“(A) the feasibility of regulating owners or operators of entities that—

“(i) emit nonfuel-related greenhouse gases; and

“(ii) that are not subject to this subtitle;

“(B) whether the percentage of allowances for any calendar year that are auctioned under section 1614(c) should be modified;

“(C) whether regulated entities should be allowed to submit credits issued under foreign greenhouse gas regulatory programs in lieu of allowances under section 1615;

"(D) whether the Secretary should distribute credits for offset projects carried out outside the United States that do not receive credit under a foreign greenhouse gas program; and

"(E) whether and how the value of allowances or credits banked for use during a future year should be discounted if an acceleration in the rate of increase of the safety valve price is recommended under paragraph (3)(D)(ii).

"(5) NATIONAL RESEARCH COUNCIL REPORTS.—The President may request such reports from the National Research Council as the President determines to be necessary and appropriate to support the interagency review process under this subsection.

"(b) Report.—

"(1) IN GENERAL.—Not later than January 15, 2017, and every 5 years thereafter, the President shall submit to the House of Representatives and the Senate a report describing any recommendation of the President with respect to changes in the programs under this subtitle.

"(2) RECOMMENDATIONS.—A recommendation under paragraph (1) shall take into consideration the results of the most recent interagency review under subsection (a).

"(c) Congressional Action.—

"(1) CONSIDERATION.—Not later than September 30 of any calendar year during which a report is to be submitted under subsection (b), the House of Representatives and the Senate may consider a joint resolution, in accordance with paragraph (2), that—

"(A) amends subsection (a)(2) or (b)(2) of section 1613;

"(B) modifies the safety valve price; or

"(C) modifies the percentage of allowances to be allocated under section 1614(c).

"(2) REQUIREMENTS.—A joint resolution considered under paragraph (1) shall—

"(A) be introduced during the 45-day period beginning on the date on which a report is required to be submitted under subsection (b); and

"(B) after the resolving clause and 'That', contain only 1 or more of the following:

"(i) ', effective beginning January 1, 2017, section 1613(a)(2) of the Energy Policy Act of 1992 is amended by striking "2.6" and inserting "_____".'.

"(ii) ', effective beginning _____, section 1613(b)(2) of the Energy Policy Act of 1992 is amended by striking "3.0" and inserting "_____".'.

"(iii) ', effective beginning _____, section 1612(13)(B) of the Energy

Policy Act of 1992 is amended by striking “5 percent” and inserting “___ percent”.’.

“(iv) ‘the table under section 1614(c) of the Energy Policy Act of 1992 is amended by striking the line relating to calendar year 2022 and thereafter and inserting the following:

Year	Percentage Allocated to Industry	Percentage Allocated to States	Percentage Available for Agricultural Sequestration	Percentage Available for Early Reduction Allowances	Percentage Auctioned
2022 & thereafter	________	________	________	________	________

“(3) APPLICABLE LAW.—Subsections (b) through (g) of section 802 of title 5, United States Code, shall apply to any joint resolution under this subsection.

“(d) Foreign Credits.—

“(1) REGULATIONS.—After taking into consideration the initial interagency review under section (a), the Secretary may promulgate regulations that authorize regulated entities to submit credits issued under foreign greenhouse gas regulatory programs in lieu of allowances under section 1615.

“(2) COMPARABLE PROGRAMS AND PREVENTION OF DOUBLE-COUNTING.—Regulations promulgated by the Secretary under paragraph (1) shall ensure that foreign credits submitted in lieu of allowances are—

“(A) from foreign greenhouse gas regulatory programs that the Secretary determines to have a level of environmental integrity that is not less than the level of environmental integrity of the programs under this subtitle; and

“(B) not also submitted for use in achieving compliance under any foreign greenhouse gas regulatory program.

“(e) International Offsets Projects.—

“(1) ACTION BY THE SECRETARY.—After taking into consideration the results of the initial interagency review under section (a), the Secretary may promulgate regulations establishing a program under which the Secretary distributes credits to entities that—

“(A) carry out offset projects outside the United States that meet the requirements of section 1623(c);

“(B) maintain the environment integrity of the program under this subtitle; and

“(C) do not receive credits issued under a foreign greenhouse gas regulatory program.

“(2) STREAMLINED PROCEDURES AND PREVENTION OF DOUBLE-COUNTING.—Regulations promulgated by the Secretary under the paragraph (1) shall—

“(A) have streamlined procedures for distributing credits to projects for which the Secretary determines there are broadly-accepted standards or methodologies for quantifying and verifying the greenhouse gas emission mitigation benefits of the projects; and

“(B) ensure that offset project reductions credited under the program are not also credited under foreign programs.

“SEC. 1623. MONITORING AND REPORTING.

“(a) In General.—The Secretary shall require, by rule, that a regulated entity shall perform such monitoring and submit such reports as the Secretary determines to be necessary to carry out this subtitle.

“(b) Submission of Information.—The Secretary shall establish, by rule, any procedure the Secretary determines to be necessary to ensure the completeness, consistency, transparency, and accuracy of reports under subsection (a), including—

“(1) accounting and reporting standards for covered greenhouse gas emissions;

“(2) standardized methods of calculating covered greenhouse gas emissions in specific industries from other information the Secretary determines to be available and reliable, such as energy consumption data, materials consumption data, production data, or other relevant activity data;

“(3) if the Secretary determines that a method described in paragraph (2) is not feasible for a regulated entity, a standardized method of estimating covered greenhouse gas emissions of the regulated entity;

“(4) a method of avoiding double counting of covered greenhouse gas emissions;

“(5) a procedure to prevent a regulated entity from avoiding the requirements of this subtitle by—

“(A) reorganization into multiple entities; or

“(B) outsourcing the operations or activities of the regulated entity with respect to covered greenhouse gas emissions; and

“(6) a procedure for the verification of data relating to covered greenhouse gas emissions by—

“(A) regulated entities; and

“(B) independent verification organizations.

“(c) Determining Eligibility for Credits, Agricultural Sequestration Allowances, and Early Reduction Allowances.—

“(1) IN GENERAL.—An entity shall provide the Secretary with the information described in paragraph (2) in connection with any application to receive—

“(A) a credit under section 1618, 1619, or 1622(e);

“(B) an early reduction allowance under section 1620 (unless, and to the extent that, the Secretary determines that providing the information would not be feasible for the entity); or

"(C) an agricultural sequestration allowance under section 1621.

"(2) REQUIRED INFORMATION.—

"(A) GREENHOUSE GAS EMISSIONS REDUCTION.—In the case of a greenhouse gas emissions reduction, the entity shall provide the Secretary with information verifying that, as determined by the Secretary—

"(i) the entity has achieved an actual reduction in greenhouse gas emissions—

"(I) relative to historic emissions levels of the entity; and

"(II) taking into consideration any increase in other greenhouse gas emissions of the entity; and

"(ii) if the reduction exceeds the net reduction of direct greenhouse gas emissions of the entity, the entity reported a reduction that was adjusted so as not to exceed the net reduction.

"(B) GREENHOUSE GAS SEQUESTRATION.—In the case of a greenhouse gas sequestration, the entity shall provide the Secretary with information verifying that, as determined by the Secretary, the entity has achieved actual increases in net sequestration, taking into account the total use of materials and energy by the entity in carrying out the sequestration.

"SEC. 1624. ENFORCEMENT.

"(a) Failure to Submit Allowances.—

"(1) PAYMENT TO SECRETARY.—A regulated entity that fails to submit an allowance (or the safety valve price in lieu of an allowance) for a calendar year not later than March 31 of the following calendar year shall pay to the Secretary, for each allowance the regulated entity failed to submit, an amount equal to the product obtained by multiplying—

"(A) the safety valve price for that calendar year; and

"(B) 3.

"(2) FAILURE TO PAY.—A regulated entity that fails to make a payment to the Secretary under paragraph (1) by December 31 of the calendar year following the calendar year for which the payment is due shall be subject to subsection (b) or (c), or both.

"(b) Civil Enforcement.—

"(1) PENALTY.—A person that the Secretary determines to be in violation of this subtitle shall be subject to a civil penalty of not more than $25,000 for each day during which the entity is in violation, in addition to any amount required under subsection (a)(1).

"(2) INJUNCTION.—The Secretary may bring a civil action for a temporary or permanent injunction against any person described in paragraph (1).

“(c) Criminal Penalties.—A person that willfully fails to comply with this subtitle shall be subject to a fine under title 18, United States Code, or imprisonment for not to exceed 5 years, or both.

“SEC. 1625. JUDICIAL REVIEW.

“(a) In General.—Except as provided in subsection (b), section 336(b) of the Energy Policy and Conservation Act (42 U.S.C. 6306(b)) shall apply to a review of any rule issued under this subtitle in the same manner, and to the same extent, that section applies to a rule issued under sections 323, 324, and 325 of that Act (42 U.S.C. 6293, 6294, 6295).

“(b) Exception.—A petition for review of a rule under this subtitle shall be filed in the United States Court of Appeals for the District of Columbia.

“SEC. 1626. ADMINISTRATIVE PROVISIONS.

“(a) Rules and Orders.—The Secretary may issue such rules and orders as the Secretary determines to be necessary or appropriate to carry out this subtitle.

“(b) Data.—

“(1) IN GENERAL.—In carrying out this subtitle, the Secretary may use any authority provided under section 11 of the Energy Supply and Environmental Coordination Act of 1974 (15 U.S.C. 796).

“(2) DEFINITION OF ENERGY INFORMATION.—For the purposes of carrying out this subtitle, the definition of the term ‘energy information’ under section 11 of the Energy Supply and Environmental Coordination Act of 1974 (15 U.S.C. 796) shall be considered to include any information the Secretary determines to be necessary or appropriate to carry out this subtitle.

“SEC. 1627. EARLY TECHNOLOGY DEPLOYMENT.

“(a) Trust Fund.—

“(1) ESTABLISHMENT.—There is established in the Treasury a trust fund, to be known as the ‘Climate Change Trust Fund’ (referred to in this section as the ‘Trust Fund’).

“(2) DEPOSITS.—The Secretary shall deposit into the Trust Fund any funds received by the Secretary under section 1614(b) or 1616.

“(3) MAXIMUM CUMULATIVE AMOUNT.—Not more than $50,000,000,000 may be deposited into the Trust Fund.

“(b) Distribution.—Beginning in fiscal year 2010, the Secretary shall transfer any funds deposited into the Trust Fund during the previous fiscal year as follows:

“(1) ZERO- OR LOW-CARBON ENERGY TECHNOLOGIES.—50 percent of the funds shall be transferred to the Secretary to carry out the zero- or low-carbon energy technologies program under subsection (c).

“(2) ADVANCED ENERGY TECHNOLOGIES INCENTIVE PROGRAM.—35 percent of the funds shall be transferred as follows:

"(A) ADVANCED COAL TECHNOLOGIES.—28 percent shall be transferred to the Secretary to carry out the advanced coal and sequestration technologies program under subsection (d).

"(B) CELLULOSIC BIOMASS.—7 percent shall be transferred to the Secretary to carry out—

"(i) the cellulosic biomass ethanol and municipal solid waste loan guarantee program under section 212(b) of the Clean Air Act (42 U.S.C. 7546(b));

"(ii) the cellulosic biomass ethanol conversion assistance program under section 212(e) of that Act (42 U.S.C. 7546(e)); and

"(iii) the fuel from cellulosic biomass program under subsection (e).

"(3) ADVANCED TECHNOLOGY VEHICLES.—15 percent shall be transferred to the Secretary to carry out the advanced technology vehicles manufacturing incentive program under subsection (f).

"(c) Zero- or Low-Carbon Energy Technologies Deployment.—

"(1) DEFINITIONS.—In this subsection:

"(A) ENERGY SAVINGS.—The term 'energy savings' means megawatt-hours of electricity or million British thermal units of natural gas saved by a product, in comparison to projected energy consumption under the energy efficiency standard applicable to the product.

"(B) HIGH-EFFICIENCY CONSUMER PRODUCT.—The term 'high-efficiency consumer product' means a covered product to which an energy conservation standard applies under section 325 of the Energy Policy and Conservation Act (42 U.S.C. 6295), if the energy efficiency of the product exceeds the energy efficiency required under the standard.

"(C) ZERO- OR LOW-CARBON GENERATION.—The term 'zero- or low-carbon generation' means generation of electricity by an electric generation unit that—

"(i) emits no carbon dioxide into the atmosphere, or is fossil-fuel fired and emits into the atmosphere not more than 250 pounds of carbon dioxide per megawatt-hour (after adjustment for any carbon dioxide from the unit that is geologically sequestered); and

"(ii) was placed into commercial service after the date of enactment of this Act.

"(2) FINANCIAL INCENTIVES PROGRAM.—During each fiscal year beginning on or after October 1, 2008, the Secretary shall competitively award financial incentives under this subsection in the following technology categories:

"(A) Production of electricity from new zero- or low-carbon generation.

"(B) Manufacture of high-efficiency consumer products.

"(3) REQUIREMENTS.—

"(A) IN GENERAL.—The Secretary shall make awards under this subsection to producers of new zero- or low-carbon generation and to manufacturers of high-efficiency consumer products—

"(i) in the case of producers of new zero- or low-carbon generation, based on the bid of each producer in terms of dollars per megawatt-hour of electricity generated; and

"(ii) in the case of manufacturers of high-efficiency consumer products, based on the bid of each manufacturer in terms of dollars per megawatt-hour or million British thermal units saved.

"(B) ACCEPTANCE OF BIDS.—

"(i) IN GENERAL.—In making awards under this subsection, the Secretary shall—

"(I) solicit bids for reverse auction from appropriate producers and manufacturers, as determined by the Secretary; and

"(II) award financial incentives to the producers and manufacturers that submit the lowest bids that meet the requirements established by the Secretary.

"(ii) FACTORS FOR CONVERSION.—

"(I) IN GENERAL.—For the purpose of assessing bids under clause (i), the Secretary shall specify a factor for converting megawatt-hours of electricity and million British thermal units of natural gas to common units.

"(II) REQUIREMENT.—The conversion factor shall be based on the relative greenhouse gas emission benefits of electricity and natural gas conservation.

"(C) INELIGIBLE UNITS.—A new unit for the generation of electricity that uses renewable energy resources shall not be eligible to receive an award under this subsection if the unit receives renewable energy credits under a Federal renewable portfolio standard.

"(4) FORMS OF AWARDS.—

"(A) ZERO- AND LOW-CARBON GENERATORS.—An award for zero- or low-carbon generation under this subsection shall be in the form of a contract to provide a production payment for each year during the first 10 years of commercial service of the generation unit in an amount equal to the product obtained by multiplying—

"(i) the amount bid by the producer of the zero- or low-carbon generation; and

"(ii) the megawatt-hours estimated to be generated by the zero- or low-carbon generation unit each year.

“(B) HIGH-EFFICIENCY CONSUMER PRODUCTS.—An award for a high-efficiency consumer product under this subsection shall be in the form of a lump sum payment in an amount equal to the product obtained by multiplying—

“(i) the amount bid by the manufacturer of the high-efficiency consumer product; and

“(ii) the energy savings during the projected useful life of the high-efficiency consumer product, not to exceed 10 years, as determined under rules issued by the Secretary.

“(d) Advanced Coal and Sequestration Technologies Program.—

“(1) ADVANCED COAL TECHNOLOGIES.—

“(A) DEFINITION OF ADVANCED COAL GENERATION TECHNOLOGY.—In this paragraph, the term ‘advanced coal generation technology’ means integrated gasification combined cycle or other advanced coal-fueled power plant technologies that—

“(i) have a minimum of 50 percent coal heat input on an annual basis;

“(ii) provide a technical pathway for carbon capture and storage; and

“(iii) provide a technical pathway for co-production of a hydrogen slip-stream.

“(B) DEPLOYMENT INCENTIVES.—

“(i) IN GENERAL.—The Secretary shall use \1/2\ of the funds provided to carry out this subsection during each fiscal year to provide Federal financial incentives to facilitate the deployment of not more than 20 gigawatts of advanced coal generation technologies.

“(ii) ADMINISTRATION.—In providing incentives under clause (i), the Secretary shall—

“(I) provide appropriate incentives for regulated investor-owned utilities, municipal utilities, electric cooperatives, and independent power producers, as determined by the Secretary; and

“(II) ensure that a range of the domestic coal types is employed in the facilities that receive incentives under this subparagraph.

“(C) FUNDING PRIORITIES.—

“(i) PROJECTS USING CERTAIN COALS.—In providing incentives under this paragraph, the Secretary shall set aside not less than 25 percent of any funds made available to carry out this paragraph for projects using lower rank coals, such as subbituminous coal and lignite.

“(ii) SEQUESTRATION ACTIVITIES.—After the Secretary has made awards for 2000 megawatts of capacity under this paragraph, the Secretary shall give priority to projects that will capture and sequester emissions of carbon dioxide, as determined by the Secretary.

"(D) DISTRIBUTION OF FUNDS.—A project that receives an award under this paragraph may elect 1 of the following Federal financial incentives:

"(i) A loan guarantee under section 1403(b).

"(ii) A cost-sharing grant for not more than 50 percent of the cost of the project.

"(iii) Production payments of not more than 1.5 cents per kilowatt-hour of electric output during the first 10 years of commercial service of the project.

"(E) LIMITATION.—A project may not receive an award under this subsection if the project receives an award under subsection (c).

"(2) SEQUESTRATION.—

"(A) IN GENERAL.—The Secretary shall use \1/2\ of the funds provided to carry out this subsection during each fiscal year for large-scale geologic carbon storage demonstration projects that use carbon dioxide captured from facilities for the generation of electricity using coal gasification or other advanced coal combustion processes, including facilities that receive assistance under paragraph (1).

"(B) PROJECT CAPITAL AND OPERATING COSTS.—The Secretary shall provide assistance under this paragraph to reimburse the project owner for a percentage of the incremental project capital and operating costs of the project that are attributable to carbon capture and sequestration, as the Secretary determines to be appropriate.

"(e) Fuel From Cellulosic Biomass.—

"(1) IN GENERAL.—The Secretary shall provide deployment incentives under this subsection to encourage a variety of projects to produce transportation fuels from cellulosic biomass, relying on different feedstocks in different regions of the United States.

"(2) PROJECT ELIGIBILITY.—Incentives under this paragraph shall be provided on a competitive basis to projects that produce fuels that—

"(A) meet United States fuel and emissions specifications;

"(B) help diversify domestic transportation energy supplies; and

"(C) improve or maintain air, water, soil, and habitat quality.

"(3) INCENTIVES.—Incentives under this subsection may consist of—

"(A) additional loan guarantees under section 1403(b) for the construction of production facilities and supporting infrastructure; or

"(B) production payments through a reverse auction in accordance with paragraph (4).

"(4) REVERSE AUCTION.—

"(A) IN GENERAL.—In providing incentives under this subsection, the

Secretary shall—

"(i) prescribe rules under which producers of fuel from cellulosic biomass may bid for production payments under paragraph (3)(B); and

"(ii) solicit bids from producers of different classes of transportation fuel, as the Secretary determines to be appropriate.

"(B) REQUIREMENT.—The rules under subparagraph (A) shall require that incentives shall be provided to the producers that submit the lowest bid (in terms of cents per gallon) for each class of transportation fuel from which the Secretary solicits a bid.

"(f) Advanced Technology Vehicles Manufacturing Incentive Program.—

"(1) DEFINITIONS.—In this subsection:

"(A) ADVANCED LEAN BURN TECHNOLOGY MOTOR VEHICLE.—The term 'advanced lean burn technology motor vehicle' means a passenger automobile or a light truck with an internal combustion engine that—

"(i) is designed to operate primarily using more air than is necessary for complete combustion of the fuel;

"(ii) incorporates direct injection; and

"(iii) achieves at least 125 percent of the 2002 model year city fuel economy of vehicles in the same size class as the vehicle.

"(B) ADVANCED TECHNOLOGY VEHICLE.—The term 'advanced technology vehicle' means a light duty motor vehicle that—

"(i) is a hybrid motor vehicle or an advanced lean burn technology motor vehicle; and

"(ii) meets the following performance criteria:

"(I) Except as provided in paragraph (3)(A)(ii), the Tier II Bin 5 emission standard established in regulations prescribed by the Administrator of the Environmental Protection Agency under section 202(i) of the Clean Air Act (42 U.S.C. 7521(i)), or a lower numbered bin.

"(II) At least 125 percent of the base year city fuel economy for the weight class of the vehicle.

"(C) ENGINEERING INTEGRATION COSTS.—The term 'engineering integration costs' includes the cost of engineering tasks relating to—

"(i) incorporating qualifying components into the design of advanced technology vehicles; and

"(ii) designing new tooling and equipment for production facilities that produce qualifying components or advanced technology vehicles.

"(D) HYBRID MOTOR VEHICLE.—The term 'hybrid motor vehicle' means a motor vehicle that draws propulsion energy from onboard sources of stored energy that are—

"(i) an internal combustion or heat engine using combustible fuel; and

"(ii) a rechargeable energy storage system.

"(E) QUALIFYING COMPONENTS.—The term 'qualifying components' means components that the Secretary determines to be—

"(i) specially designed for advanced technology vehicles; and

"(ii) installed for the purpose of meeting the performance requirements of advanced technology vehicles.

"(2) MANUFACTURER FACILITY CONVERSION AWARDS.—The Secretary shall provide facility conversion funding awards under this subsection to automobile manufacturers and component suppliers to pay 30 percent of the cost of—

"(A) re-equipping or expanding an existing manufacturing facility to produce—

"(i) qualifying advanced technology vehicles; or

"(ii) qualifying components; and

"(B) engineering integration of qualifying vehicles and qualifying components.

"(3) PERIOD OF AVAILABILITY.—

"(A) PHASE I.—

"(i) IN GENERAL.—An award under paragraph (2) shall apply to—

"(I) facilities and equipment placed in service before January 1, 2016; and

"(II) engineering integration costs incurred during the period beginning on the date of enactment of this Act and ending on December 31, 2015.

"(ii) TRANSITION STANDARD FOR LIGHT DUTY DIESEL-POWERED VEHICLES.—For purposes of making an award under clause (i), the term 'advanced technology vehicle' includes a diesel-powered or diesel-hybrid light duty vehicle that—

"(I) has a weight greater than 6,000 pounds; and

"(II) meets the Tier II Bin 8 emission standard established in regulations prescribed by the Administrator of the Environmental Protection Agency under section 202(i) of the Clean Air Act (42 U.S.C. 7521(i)), or a lower numbered bin.

"(B) PHASE II.—If the Secretary determines under paragraph (4) that the program under this subsection has resulted in a substantial improvement in the ability of automobile manufacturers to produce light duty vehicles with improved fuel economy, the Secretary shall continue to make awards under paragraph (2) that shall apply to—

"(i) facilities and equipment placed in service before January 1, 2021; and

"(ii) engineering integration costs incurred during the period beginning on January 1, 2016, and ending on December 31, 2020.

"(4) DETERMINATION OF IMPROVEMENT.—

"(A) IN GENERAL.—Not later than January 1, 2015, the Secretary shall determine, after providing notice and an opportunity for public comment, whether the program under this subsection has resulted in a substantial improvement in the ability of automobile manufacturers to produce light duty vehicles with improved fuel economy.

"(B) EFFECT ON MANUFACTURERS.—In preparing the determination under subparagraph (A), the Secretary shall enter into an agreement with the National Academy of Sciences to analyze the effect of the program under this subsection on automobile manufacturers.

"SEC. 1628. EFFECT OF SUBTITLE.

"Nothing in this subtitle affects the authority of Congress to limit, terminate, or change the value of an allowance or credit issued under this subtitle.".

Appendix C. Provided Bill Summary

Market-Based GHG Emission Trading
Discussion Draft

The 2005 Sense of the Senate resolution on climate change emphasized that the risks associated with a changing climate justify the adoption of mandatory limits on greenhouse gas (GHG) emissions and that an important first step towards addressing climate change can be taken at an acceptable cost. In that spirit, this staff draft outlines a legislative proposal that would begin with a modest emissions-reduction target and strengthen gradually over time. The approach is consistent with that of the successful Acid Rain Program in that it sets a "forward price" on emissions to provide both the flexibility and incentive needed to accelerate technology development and deployment. The long-term price signal that a forward price creates would be critical for giving industry certainty and for focusing its decision-making on lower carbon options. However, the price signal initially imposed under any domestic regime would not likely be strong enough to motivate the development and deployment of the key technologies that will ultimately be needed to stop and reverse GHG emissions. Thus, in order to speed technology deployment, the staff draft includes provisions to create incentives for new technology and provides significant new R&D funding for low- and no-carbon technologies.

Key Features

Target, Timing and Price Cap

- **Emissions Target**: The target is calculated in advance to reflect a 2.6 percent per year decline in the emissions intensity of the U.S. economy (expressed as total GHG emissions per dollar of GDP) for the first period of program implementation (2012 to 2021). The target rate of decline in emissions intensity increases to 3.0 percent per year in the second period (2022 onward). The emissions target establishes the total quantity of allowances available each year.

- **Price Cap:** The government would make additional allowances (above and beyond the quantity initially allocated under the emissions target) available for sale at a fixed price. The price starts at $7 per metric ton of carbon-dioxide-equivalent GHG emissions in the first year of program implementation and rises steadily thereafter at an annual rate of 5 percent above the rate of inflation.

Explanation of Approach

- **Consistent with Sense of Senate Resolution:** By targeting an annual decline in emissions intensity, the proposal is designed to first slow emissions growth (over the period from 2012 through 2021), before attempting to stop emissions growth starting in 2022. Ultimately, emissions will need to decline in absolute terms to stabilize greenhouse gas concentrations in the atmosphere, meaning that the rate of decline in emissions intensity will eventually need to outpace economic growth. This proposal establishes a policy framework for achieving a long-term trajectory of emissions reductions in what would necessarily be a phased process.

- **Limits Costs to the Overall Economy and Provides Price Certainty for Investors:** By making additional allowances available at a known price, the proposal effectively caps the costs imposed on the U.S. economy and on consumers. Additional allowances would be purchased (and emissions would exceed the economy-wide target) only if the market price of allowances were to rise above the price cap. The price cap increases by 5 percent each year above the rate of inflation so as to provide progressively stronger incentives for emissions abatement over time and to establish a predictable market signal for investors.

- **Changes from 2005 Bingaman Proposal:** Based on numerous comments received during the Committee's discussion of this issue, implementation is delayed 2 years, from 2010 to 2012. This change will allow the current voluntary Administration program to run its full course before any new policy takes effect and will provide sufficient time to get the trading program in place. To compensate for the delay, the proposed bill accelerates the rate by which the cost cap increases, from 5 percent nominal to 5 percent above inflation. The bill also changes the targeted decline in emissions intensity from 2.4 percent per year to 2.6 percent per year in the first allocation period, and from 2.8 percent per year to 3.0 percent per year in the second period, to adjust for greater "business-as-usual" reductions in emissions intensity stemming from higher projected energy prices.

Scope and Point of Regulation

- **Scope:** The program is economy-wide.

- **Point of Regulation**: Carbon dioxide (CO_2) emissions from fossil fuels are regulated upstream at the point of fossil fuel production, and regulated entities are required to submit allowances equal to the carbon content of fuels produced or processed at their facilities.

- **Regulated Entities:** Entities required to submit allowances include:
  - Petroleum refineries
  - Natural gas processing facilities
  - Coal mines
  - Fossil fuel importers (for petroleum, this includes refined products only) and importers of gases with high-global warming potential (GWP)
  - Non-CO_2 greenhouse gases: coal mine methane; N_2O from adipic acid production; high-GWP gases

Explanation of Approach

- Placing the point-of-regulation relatively higher up in the progression from energy production to consumption reduces the number of sources that must be regulated and simplifies program administration. This approach more efficiently captures all sources of emissions and all emissions reduction opportunities throughout the economy. In addition, an upstream approach may reduce overall administrative costs.

Allowance Distribution

- **Allocation to Private Sector Entities:** For the first five years of program implementation, 55 percent of the total quantity of allowances available under the emissions target would be allocated without cost to private sector entities. This amount is gradually reduced to 0 percent over 30 years. The industry sectors receiving free allocations under this proposed approach are:
    - Coal mines and coal importers
    - Petroleum refineries and refined-product importers
    - Natural gas processing plants and natural gas importers
    - Non-CO_2 regulated entities
    - Coal, oil and natural gas electric generators
    - Carbon-intensive industrial sectors

- **Auction:** For the first five years of program implementation, 10 percent of the total quantity of allowances available under the emissions target would be auctioned. The share of allowances auctioned would gradually increase to 65 percent over 30 years. Auction revenues are used for R&D and to support the deployment of low- and no-carbon technologies.

- **Agricultural Sequestration:** 5 percent of the total quantity of allowances allocated under the emissions target annually would be for agricultural sequestration activities (see below).

- **Early Reduction Credits:** 1 percent of the total quantity of allowances allocated under the emissions target for each of the first 10 years would be reserved for entities that had undertaken projects resulting in early reductions in greenhouse gases.

- **Distribution by States or the President (to "fine tune" allocation):** 29 percent – 30 percent of the total quantity of allowances allocated under the emissions target:
    - States or the President would distribute allowances for certain defined purposes, such as addressing economic impacts, promoting technology or energy efficiency, and enhancing energy security.
    - If States distribute allowances, their overall amount would be based half on emissions and half on population.

Explanation of Approach

- **Allocation Based on Cost Impacts:** Under the proposal, allowances are allocated in a manner that recognizes and roughly addresses the disparate costs imposed by the program. Allowances are <u>not</u> allocated solely to regulated entities because these entities do not bear all or even most of the costs of the emissions trading program.
- **Auction Phased in Over Time:** Over time, allowance distribution transitions from an approach that fairly compensates sectors for past investments in carbon-intensive technologies to an approach that creates incentives for energy efficiency and lower carbon technologies. This is accomplished by gradually reducing the quantity of allowances given away without cost while gradually increasing the quantity of allowances auctioned.
- **Auction Proceeds for Technology R&D and Incentives:** Virtually all experts agree that significant technology advancements will be needed to adequately and affordably address climate change over the next century. Reserving proceeds from the auction for energy research, development, and deployment would provide the revenue to support significant new development and deployment of the breakthrough technologies needed to address climate change.
- **Allocation for Primary Fuel Producers:** The compliance costs for fossil fuel producers in an upstream system represent only a small portion of the overall costs of any trading program. Most upstream producers can and would simply pass allowance costs through in the form of higher fuel prices, regardless of whether they were to receive free allowances or were required to pay for them. Analysis shows that costs to primary fuel producers would be completely offset by an allocation of roughly 5 percent to 10 percent of the total pool of allowances. However, the EIA analysis of last year's proposal by Senator Bingaman shows that coal companies, while able to pass a substantial portion of their costs through in prices, might be more affected than other energy producers. Although coal demand and sales would continue to grow under the proposed GHG trading program, coal use is projected to grow more slowly under the program than in the absence of regulatory action. Accordingly, the proposal acknowledges the slower growth in coal demand expected as a result of the bill and allocates 7 percent of the total pool of allowances available under the emissions target to coal producers. Oil and gas producers would receive 4 percent and 2 percent, respectively, of that total allowance pool.
- **Allocations for Downstream Electric Generators:** Although electric generators would not be regulated under the staff draft proposal, they would face higher production costs as fossil fuel prices rise. A portion, though not all, of these additional fuel costs would be passed through in higher electricity prices. To the extent that generators were to receive allocations of free allowances, they would be able to sell those allowances and use the revenue to offset higher fuel costs. Based on cost estimates provided by EIA, further analysis suggests that a 10

percent share of the total allocation would fully offset adverse impacts on electric generators. The 10 percent figure assumes that the allocation system perfectly targets allowances to the companies that bear non-recoverable costs. Recognizing that a perfectly targeted allocation is not possible and that some "passed through" costs would revert to fossil-based electric generators, a higher fraction would need to be allocated to fossil generators to fairly offset the impacts of increased fuel prices. If, in the extreme, fossil generators were to bear all program costs without passing any along to rate payers, they would need 40 percent of the total allocation pool to offset their costs. Therefore, between 10 percent and 40 percent of the total allocation reflects the theoretical range of allowances needed to offset the financial impact of increased fuel prices in the electric sector. Using a point in this range, the draft allocates 30 percent of the total pool of allowances available under the emissions target (equal to roughly 75 percent of electricity sector emissions) to fossil-fuel fired generation.

- **Allocations for Carbon-Intensive Industries:** Energy-intensive industries, such as steel, aluminum, chemicals, pulp and paper, and cement, would not be regulated in an upstream trading system. Like electric generators, these industries would, however, face higher prices for fossil fuels under a greenhouse gas trading system. While price increases would be modest, these industries consume significant amounts of fossil fuels and often face stiff competition from foreign competitors, most of whom would not be subject to mandatory greenhouse gas regulation. Including these industries in the allocation would not affect their incentive to improve efficiency and reduce fuel use, but it would offset increased energy costs and help to address competitiveness concerns associated with a domestic greenhouse gas trading program. If one provided allocations of free allowances only to the large, energy-intensive industries noted above—steel, aluminum, chemicals, and pulp and paper—close to 10 percent of the overall allowance pool would be required. The proposal allocates 10 percent of the total annual allocation towards carbon-intensive industries.

- **Allowance Pool to "Fine Tune" Allocation:** Although the approach outlined above generally addresses the cost impacts of the proposal, we recognize that costs are imposed on additional groups and that it may be desirable to address additional policy goals through the allocation process. Therefore, a significant portion of allowances is reserved for these purposes. These allowances would go towards several specific purposes, such as addressing economic impacts, creating incentives for energy efficiency or other "climate friendly" technologies, and enhancing energy security. The proposal presents two options for distributing these allowances: either States would distribute the allowances or the allowances would be distributed according to a process designated by the President.

- **Early Reduction Programs:** For the first ten years, 1 percent of the total pool of allowances available annually under the emissions target would be set aside for an early reduction credit program that would award allowances to companies or other organizations that reduced emissions prior to the implementation of a mandatory program. These include reductions reported through DOE/EIA's 1605b program, and reductions made through other government-sponsored and private programs identified by the Secretary of Energy.

Offset Projects

- **Cost-Effective Reductions:** Allowances could be provided for cost-effective emissions reductions not otherwise covered by the trading program (e.g., capturing and using methane from landfills).
- **Tiered System:** The proposal would establish a tiered system of offsets whereby the most easily verified project types could use a streamlined procedure to apply for allowances.

Explanation of Approach

- Offset projects can provide low-cost emission reductions and create incentives for new technologies and approaches. The proposed approach would encourage investor certainty and lower transaction costs while ensuring that offset projects have environmental integrity.

Incentives for Farmers

- **Agricultural Sequestration:** The proposal creates a significant new pilot program to encourage and evaluate the benefits of agricultural soil sequestration.
- **Allowance Set-Aside:** 5% of the total pool of allowances available annually under the emissions target would be reserved for sequestration projects by farmers.

Explanation of Approach

- Sequestration of carbon in agricultural soils is a potentially important option for addressing greenhouse gases and could eventually create a significant new source of revenue for farmers. However, there is relatively little long-term experience with monitoring, reporting and verifying agricultural sequestration. Providing agricultural sequestration projects with allowances *from within the pool of allowances established under the program target* would allow the nation to benefit from large-scale demonstration projects aimed at resolving some of these issues, while still ensuring that the program achieves its intended environmental goals. Thus, 5 percent of the initial allowance pool would be reserved to provide incentives for agricultural sequestration projects.

International Linkages

- **Review of Actions by Trade Partners and Large Emitters:** Planned increases in the target rate of emissions intensity reductions and in the price cap could be halted or modified if, during a review process that would occur every five years (Five-Year Review), it were determined that major trade partners and other large emitters were not taking appropriate actions to address greenhouse gases.

- **Consider Implications of Linking to Other Trading Programs:** The Five-Year Review Process also provides an opportunity to consider linking the U.S. program to other countries' domestic GHG reduction programs.

Explanation of Approach

- All stakeholders recognize the need to encourage comparable action by other nations that are major trading partners and key contributors to global GHG emissions. The draft acknowledges that the U.S. should show leadership by taking action on greenhouse gases. However, after the initial stage, further steps would be contingent on a review of progress by other nations in addressing their GHG emissions.

- Differences in the design of domestic trading programs (e.g., different target levels, different monitoring and verification systems) might complicate efforts to link programs internationally, especially in the near-term. Thus, rather than providing a provision for formal linkage now, the draft leaves further consideration of these issues to the Five-Year Review process.

Appendix D. Follow Up Request Letter

United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES

WASHINGTON, DC 20510-6150

ENERGY.SENATE.GOV

October 11, 2006

Dr. Howard Gruenspecht
Deputy Administrator
Energy Information Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Dr. Gruenspecht:

This letter follows up on the request of September 27, 2006, that EIA provide an analysis of draft climate legislation. Since the time of that request, I have identified three specific issues that I would like to see explicitly addressed in EIA's report: 1) the impact of higher and lower starting prices for the program's "safety valve" price; 2) the impacts of allowing GHG offsets and the potential impact of not permitting or limiting them; and 3) the impact on program costs and the distribution of those costs associated with using a different point of regulation, specifically an alternative in which the point of regulation for coal was downstream (i.e., at electric power plants and industrial sources). While I would like EIA's report to address these issues, it is not necessary to provide a full presentation of all alternative cases that are run to develop insights into these issues.

Please do not hesitate to contact me if you have any questions regarding this additional request.

Sincerely,

Jonathan Black

Jonathan Black

Clean Energy Portfolio Standard

SEC. —. CLEAN ENERGY PORTFOLIO.

Title VI of the Public Utility Regulatory Policies Act of 1978 is amended by adding at the end the following:

"SEC. 609. CLEAN ENERGY PORTFOLIO STANDARD.

“(a) Findings.— Congress finds that

“(1) The development of the country’s clean energy resources is a high priority. The diversification of the nation’s electricity generation base through the implementation of a Federal clean energy portfolio standard will help to ensure national energy and economic security, while producing environmental improvements and addressing global climate change.

“(2) Emissions of greenhouse gases resulting the generation of electricity have been linked to global climate change. A Federal clean energy portfolio standard will reduce the electricity sector’s contribution to global climate change by encouraging the use of conservation, renewable energy and advanced electricity generating technologies with no CO2 emissions. A Federal clean energy portfolio standard will establish the technological foundation for signficant future reduction of emissions of greenhouse gases.

"(3) A Federal clean energy portfolio standard will help improve the the nation's air quality by increasing the use of technologies to generate electricity without the production of sulfur dioxide, nitrous oxide, mercury and other emissions.

"(3) The development and deployment of clean energy resources would also reduce the nation's reliance on natural gas for the generation of electricity. A Federal clean energy portfolio standard would reduce the price of natural gas used in home heating and industrial applications.

"(4) A Federal clean energy portfolio standard would encourage the introduction of new energy technologies and promote environmentally responsible economic development. Reduction of consumer demand for electricity through deployment of energy efficient technologies in the residential, business and commercial sector; implementation of demand response, smart metering and other programs that give end users tools to reduce energy consumption; and greater use of on site generating technologies, including solar, photovoltaic, combined heat and power, and fuel cells, also will contribute to national energy and economic security, environmental improvement and market opportunities for advanced technologies.

"(5) A Federal clean energy portfolio standard will reduce future emissions of greenhouse gases and other pollutants, ensure national energy security and promote the development of new energy technologies without causing significant increases in electricity prices or disrupting economic growth in the United States.

"(6) Nearly one-half of all States have implemented or are in the process of implementing programs, including Renewable Portfolio Standard ("RPS") programs, intended to diversify the mix of fuels used in the generation of electricity by requiring that a percentage of electricity sold, generated or otherwise supplied to end users be generated from designated renewable energy resources, or otherwise have programs in effect that encourage the generation of renewable or inherently clean sources of electricity.

"(7) These programs have been developed on a state-by-state basis in recognition of specific state and regional needs, interests, and resource availability.

"(8) The proliferation of various state programs addressing CO2 emissions from the electric generation sector threatens efficiencies, generation fuel diversification and consumer electricity prices.

"(9) To ensure the most efficient use of existing resources and facilities,and to ensure that a signficant portion of the increased future demand for electricity is served by clean energy resources, a Federal clean energy porfolio standard should be applied to a retail electric supplier's total electric sales to consumers.

"(b) Minimum Renewable Generation Requirement.— For each calendar year beginning in calendar year 2015,each retail electric supplier shall submit to the Secretary, not later than April 1 of the following calendar year, clean energy credits in an amount equal to the required annual percentage specified in subsection (c) of the retail electric supplier's total retail electric sales, except that a retail electric supplier shall not be required to submit clean energy credits in an amount greater than its incremental electric sales to electric consumers in excess of the retail electric supplier's base amount.

"(c) Required Annual Percentage.— The required annual percentage submitted in a calendar year shall be the amount specified in the following table:

Calendar year:	**Minimum annual percentage**
2015-2019	10%
2020-2024	17%
2025 and thereafter	25%

"(d) Clean Energy Credits.— (1) A retail electric supplier may satisfy the requirements of subsection (b) through the submission of clean energy credits--

"(A) issued to the retail electric supplier under subsections (e) and (g);

"(B) obtained by purchase or exchange under subsection (f);

"(C) borrowed under subsection (h); or

"(D) purchased from the Secretary under subsection (i).

"(2) No more than 10% of a retail electric supplier's obligation under subsection (b) may be satisfied through use of credits issued under subsection (e)(3)(B) (credits associated with sequestration or offset technologies).

"(3) A clean energy credit may be counted toward compliance with subsection (b) only once.

"(e) Issuance of Credits.— (1) The Secretary shall establish by rule, not later than 1 year after the date of enactment of this section, a program to issue, monitor the sale or exchange of, and track clean energy credits.

"(2) Under the program established under this section, an entity that generates electric energy through the use of a clean energy resource may apply to the Secretary for the issuance of clean energy credits. If the electricity is generated outside the United States, the applicant must demonstrate to the Secretary that the electricity is sold for ultimate consumption in the United States. The application shall indicate--

"(A) the type of clean energy resource used to produce the electricity,

"(B) the location where the electric energy was produced, and

"(C) any other information the Secretary determines to be appropriate.

"(3)(A) Except as provided in the subparagraphs that follow, the Secretary shall issue annually to each entity that generates electric energy one clean energy credit for each kilowatt hour of electric energy the entity generated in the prior calendar year through the use of clean energy.

"(B) The Secretary shall establish by rule, within one year after the date of enactment, a program for verifying the reduction of CO2 emissions into the atmosphere through permanent geological sequestration, bio-sequestration or through other verifiably permanent reductions in CO2 emissions from the installation of technology on existing power plants that improves the efficiency of the power plants and reduces CO2 emissions as related to net power output of the existing power plant or from the permanent reduction in CO2 emissions from industrial or other sources. The Secretary shall issue 1,000 credits for each ton of CO2 that has been verifiably and permanently sequestered, reduced or that verifiably has been sequestered through bio-sequestration. Credits issued under this subparagraph shall have the same value as credits issued under any other subparagraph of this subsection and may be used for purposes of complying with the minimum generation requirements under subsections (b) and (c) of this section, except as provided in subsection (d)(2). Projects eligible under this section shall include bio sequestration or other offset projects located outside the United States or verifiable carbon dioxide reductions obtained through international carbon dioxide trading markets.

"(C) The Secretary shall issue two clean energy credits for each kilowatt hour of electric energy generated and supplied to the grid in the prior calendar year through the use of clean energy at a facility located on Indian land. For purposes of this paragraph, clean energy generated by biomass cofired with other fuels is eligible for two credits only if the biomass was grown on such land.

"(D) In the case of a retail electric supplier that is subject to a State renewable standard program that requires the generation or purchase of electricity from renewable energy; provides for alternative compliance payments in satisfaction of applicable State requirements under the program; provides for compliance through the acquisition of certificates or credits; provides for other financial compliance mechanisms; or imposes a penalty in the event of a failure to meet applicable requirements, the Secretary shall issue clean energy credits in an amount that corresponds to the kilowatt-hour obligation represented by the State alternative compliance payment, other financial compliance payment or penalty payment as though that payment had been made to the Secretary under subsection (i).

Such clean energy credits may be applied against the retail electric supplier's own required annual percentage under subsection (b) or may be transferred for use only by an associate company of the retail electric supplier. For purposes of this subsection, “associate company” shall have the meaning in Section 1262 of the Public Utility Holding Company Act of 2005.

“(E) In the case of a retail electric supplier that makes expenditures for eligible demand side management products or services, the Secretary shall issue clean energy credits in an amount that corresponds to the amount of expenditures on eligible demand side management products or services as though those expenditures had been payments made to the Secretary under subsection (i). Such clean energy credits may be applied against the retail electric supplier’s own required annual percentage or may be transferred for use only by an associate company of the retail electric supplier.

“(F) In the case of a new nuclear power facility qualifying as an inherently low emissions facility, the Secretary shall issue one credit for each kilowatt hour of production.

"(G) To be eligible for a clean energy credit, the unit of electric energy generated through the use of a clean energy resource must be either sold or used by the generator. If both a clean energy resource and a non-clean energy resource are used to generate the electric energy, the Secretary shall issue clean energy credits based on the proportion of the clean energy resources used. The Secretary shall identify clean energy credits by type and year of generation.

"(H) When a generator sells electric energy generated through the use of a clean energy resource to a retail electric supplier under a contract subject to section 210 of this Act or pursuant to a State net metering program, the retail electric supplier shall be treated as the generator of the electric energy for the purposes of this section for the duration of the contract.

“(I) The Secretary shall issue clean energy credits for electricity generated by a new or existing integrated gasification combined cycle generation facility, pulverized coal generation facility or other generation facility that provides for carbon dioxide capture and sequestration in proportion to the fraction of carbon dioxide captured and sequestered. The Secretary shall calculate the amount of clean energy credits issued to such facility by multiplying the kilowatt hours generated by the facility and supplied to the grid during the prior year by the ratio of the amount of carbon dioxide captured from the facility and sequestered to the sum of the amount of carbon dioxide captured from the facility and sequestered plus the amount of carbon dioxide emitted from the facility during the same year. Clean energy credits issued under this subsection are not subject to the limits set forth in subsection (d)(2).

"(f) Clean Energy Credit Trading.— A clean energy credit may be sold, transferred or exchanged by the entity to whom issued or by any other entity who acquires the renewable energy credit, except for those clean energy credits issued pursuant to subsections (e)(3)(D) and (E). A clean energy credit for any year that is not used to satisfy the minimum clean energy generation requirement of subsection (b) for that year may be carried forward for use within any subsequent year.

“(g) Early Action.-- A retail electric supplier generating electric energy through the use of a clean energy resource (except for an inherently low emissions facility), at any time after 2009 and before 2015, is eligible to receive credits from the Secretary, and the Secretary is directed to issue such credits, on the same basis as if the generation occurred in 2015 or thereafter. Such credits shall have the same value and may be used for any purpose authorized under this section.

"(h) Clean Energy Credit Borrowing.— At any time before the end of calendar year 2015 and any subsequent calendar year, a retail electric supplier that has reason to believe it will not have sufficient clean energy credits to comply with subsection (b) may --

"(1) submit a plan to the Secretary demonstrating that the retail electric supplier will earn sufficient credits within the next 3 calendar years (or longer if the retail electric supplier intends to obtain credits for new nuclear power) which, when taken into account, will enable the retail electric supplier's to meet the requirements of subsection (b) for calendar year 2015 and the subsequent calendar years involved; and

"(2) upon the approval of the plan by the Secretary, apply clean energy credits that the plan demonstrates will be earned within the next 3 calendar years (or longer if the retail electric supplier intends to obtain credits for new nuclear power) to meet the requirements of subsection (b) for each calendar year involved.

"(i) Credit Cost Cap.— The Secretary shall offer clean energy credits for sale at 2.5 cents per kilowatt-hour beginning in 2015 and shall offer credits for sale in subsequent years at the same price after adjusting for inflation.

"(j) Enforcement.— The Secretary may assess a civil penalty on a retail electric supplier that does not comply with subsection (b), unless the retail electric supplier was unable to comply with subsection (b) for reasons outside of the supplier's reasonable control (including weather-related damage, mechanical failure, lack of transmission capacity or availability, strikes, lockouts, or actions of a governmental authority). A retail electric supplier who does not submit the required number of clean energy credits under subsection (b) shall be subject to a civil penalty of not more 200 percent of the average market value of credits for the compliance period for each clean energy credit not submitted.

"(k) Information Collection.— The Secretary may collect the information necessary to verify and audit--

"(1) the annual electric energy generation and clean energy generation of any entity applying for clean energy credits under this section,

"(2) the validity of clean energy credits submitted by a retail electric supplier to the Secretary, and

"(3) the quantity of electricity sales of all retail electric suppliers.

"(l) Environmental Savings Clause.— Qualified hydropower production shall be subject to all applicable environmental laws and licensing and regulatory requirements.

"(m) Existing Programs.— (1) State Savings Clause.--This section does not preclude a State from imposing additional clean energy requirements in that State, including specifying eligible technologies under such State requirements.

“(2) Coordination. --In the rule establishing this program, the Secretary shall incorporate common elements of existing clean energy programs, including state programs, to ensure administrative efficiency, market liquidity and effective enforcement. The Secretary shall work with the States to minimize administrative burdens and costs and to avoid duplicating compliance charges to retail electric suppliers.

"(n) Definitions.— For purposes of this section:

"(1) Biomass.--The term `biomass' means any organic material that is available on a renewable or recurring basis, including dedicated energy crops, trees grown for energy production, wood waste and wood residues, plants (including aquatic plants, grasses, and agricultural crops), residues, fibers, animal wastes and other organic waste materials, and fats and oils, except that with respect to material removed from National Forest System lands the term includes only organic material from --

"(A) thinnings from trees that are less than 12 inches in diameter;

"(B) slash;

"(C) brush; and

"(D) mill residues.

“(2) Bio-sequestration.- The term ‘bio-sequestration’ means the capture and storage of carbon in biological organisms.

"(3) Clean energy.--The term `clean energy' means electric energy generated by or from a clean energy resource.

"(4) Clean energy resource.--The term `clean energy resource' means solar, wind, ocean, or geothermal energy, fuel cells (including zero emission regenerative fuel cell technology), biomass, solid waste (as defined in the Solid Waste disposal Act, 42 U.S.C. sec. 6901 et seq.), landfill gas, qualified hydropower production, as defined in section 45 (c)(8) of the Internal Revenue Code or an inherently low emissions facility.

"(5) Demand side management.- The term 'demand side management' means management of customer consumption of electricity or the demand for electricity through the implementation of energy efficiency technologies, management practices or other measures relating to residential, commercial, industrial, institutional or government customers that reduce electricity consumption by those customers or industrial by-product technologies consisting of the use of a by-product from an industrial process, including the reuse of energy from exhaust gasses or other manufacturing by-products that are used in the direct production of electricity at the facility of a customer. Such term shall also include –

"(A) distributed generation technologies, including on-site renewable energy systems and fuel cells;

"(B) energy efficiency technologies, including generation technologies to improve efficiency and grid technologies to reduce line losses and otherwise improve transmission efficiency; and

"(C) demand management techniques or processes.

“(6) Expenditures on eligible demand side management products or services.- The term ‘expenditures on eligible demand side management products or services’ means expenditures incurred, including administration and overhead costs, for demand side management measures offered by a retail electric supplier pursuant to energy conservation, efficiency and/or demand side management plans and programs established under state law or regulation and approved by the appropriate state regulatory authorities.

''(7) Indian land.--The term `Indian land' means--

''(A) any land within the limits of any Indian reservation, pueblo, or rancheria,

''(B) any land not within the limits of any Indian reservation, pueblo, or rancheria title to which was on the date of enactment of this paragraph either held by the United States for the benefit of any Indian tribe or individual or held by any Indian tribe or individual subject to restriction by the United States against alienation,

''(C) any dependent Indian community, and

''(D) any land conveyed to any Alaska Native corporation under the Alaska Native Claims Settlement Act.

''(8) Indian tribe.--The term `Indian tribe' means any Indian tribe, band, nation, or other organized group or community, including any Alaskan Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.), which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

"(9) Inherently low emissions facility. The term 'inherently low emissions facility' means a new or existing integrated gasification combined cycle generation facility, pulverized coal generation facility or other generation technology that provides for carbon capture and sequestration, or a new nuclear power facility.

"(10) New nuclear power. The term 'new nuclear power' means electric energy that is generated from a nuclear facility placed in service after January 1, 2015.

"(11) Retail electric supplier.--The term `retail electric supplier' means an electric utility that sold not less than 500,000 megawatt hours of electric energy to electric consumers for purposes other than resale in any calendar year before January 1, 2015, and an electric utility that first sold electric energy to electric consumers for purposes other than resale after January 1, 2015.

"(12) Retail electric supplier's base amount.--The term `retail electric supplier's base amount' means the average annual amount of electric energy sold by the retail electric supplier to electric consumers for purposes other than resale, expressed in terms of kilowatt hours, during calendar years 2008 to 2011 or as otherwise determined by the Secretary. The Secretary shall issue rules within two years of enactment of this Act to establish the calculation of the base amount for retail electric suppliers that initiate sales after January 1, 2010, and how adjustments will be made for material changes in marketing patterns or other unusual circumstances in or since the base period.

"(13) Retail electric supplier's incremental electric sales. The term 'retail electric supplier's incremental electric sales' means the difference between a retail electric supplier's sales to electric consumers in a given year and the retail electric supplier's base amount.

"(14) Retail electric supplier's total retail electric sales. The term "retail electric supplier's total retail electric sales" means the total retail electric sales made to consumers in the previous calendar year by a retail supplier but excluding sales associated with electricity generated by a hydro-electric facility (but excluding qualified hydropower production as defined by section 45 (c)(8) of the Internal Revenue Code).

"(15) "Sequestration" means the permanent disposal of carbon dioxide in a geological formation and includes, but is not limited to, the use of carbon dioxide to promote the production of additional oil from oil fields.

"(o) Recovery of Costs.— Any costs that will be incurred by a retail electric supplier in order to comply with the requirements of this section shall be deemed necessary and reasonable costs and shall be fully and contemporaneously recoverable in all jurisdictions. Costs necessary to comply with this section include, but are not limited to, the costs of purchase of clean energy credits and any associated energy, the costs of generation of clean energy credits, and the costs of firming, shaping, balancing, backup and delivery services prudently incurred to maintain a reliable and well-functioning electric system that incorporates energy from clean energy resources. A retail electric supplier whose sales of electric energy are subject to any form of rate regulation, including any utility whose rates are regulated by the Commission and any State regulated electric utility, shall not be denied the opportunity to recover the full amount of the prudently incurred incremental cost of energy obtained to comply with the requirements of subsection (b) for sales to electric customers which are subject to any form of rate regulation, notwithstanding any other law, regulation, rule, administrative order or any agreement between the electric utility and either the Commission or a State regulatory authority. For the purpose of this subsection, the term `incremental cost of energy' means--

"(1) the cost to the electric utility for the purchase of energy associated with the acquisition of clean energy credits or for the generation of energy to satisfy the minimum clean energy generation requirement of subsection (b), including any costs incurred by the electric utility to receive such energy on its system and deliver such energy to its retail loads either over existing transmission facilities or newly constructed transmission facilities. Receipt and delivery costs include transmission and distribution costs or charges, any losses and associated ancillary service charges assessed by any applicable transmission provider or provided for pursuant to an electric utility's own Commission-accepted open access transmission tariff, and any firming, shaping, backup or delivery services necessary to balance clean energy; and

"(2) the cost to the electric utility for acquiring renewable energy credits to satisfy the minimum clean energy- generation requirement of subsection (b), including the costs for alternative compliance payments, credit or certificate purchases and other financial compliance payments made to states.

"(p) Program Review.— The Secretary shall conduct a comprehensive evaluation of all aspects of the Clean Energy Standard program within 10 years of enactment of this section and every 5 years thereafter. The study shall include an evaluation of --

"(1) The effectiveness of the program in increasing the market penetration and lower the cost of the eligible renewable technologies,

"(2) The opportunities for any additional technologies emerging since enactment of this section,

"(3) The impact on the regional diversity and reliability of supply sources, including the power quality benefits of distributed generation,

"(4) The regional resource development relative to renewable potential and reasons for any under investment in renewable resources,

"(5) The net cost/benefit of the clean energy standard to the national and state economies, including retail power costs, economic development benefits of investment, avoided costs related to environmental and congestion mitigation investments that would otherwise have been required, impact on natural gas demand and price, effectiveness of green marketing programs at reducing the cost of renewable resources, and

"(6) The flexibility granted to any State under subsection (r).

The Secretary shall transmit the results of the program review and any recommendations for modifications and improvements to the program to Congress not later than January 1, 2019.

"(q) Program Improvements.— Using the results of the review under subsection (p), the Secretary shall by rule, within 6 months of the completion of the review, make such modifications to the program as may be necessary to improve the efficiency of the program and maximize the use of clean energy under the program. In making such rule, the Secretary shall be authorized to expand the definition of clean energy resource in subsection (m)(4) or inherently low emissions facility in subsection (m)(10) to include new technologies the Secretary determines have characteristics in common with other energy resources listed in those subsections.

"(r) State Flexibility.— Within one year of enactment of this Section, any State that has reason to believe that the cost of complying with the requirements of this section shall cause undue economic hardship to the ultimate purchasers of electricity in that State, including manufacturing and industrial users of electricity, may petition the Secretary to grant a waiver from the requirements of this section for retail electric suppliers selling electricity to end use customers in that State. The Secretary shall grant such a waiver if he finds that the requirements of this section are likely to cause undue economic hardship to ultimate purchasers of electricity in that State. In making a determination on a State petition under this paragraph, the Secretary shall take into account (a) the adequacy of commercially available clean energy resources within the State, (b) the potential clean energy resources available within the region and (c) the cost of developing those resources at current and reasonably expected levels of technology, including the cost and availability of existing and needed transmission facilities to transmit electric energy from such clean energy resources to customers within the State, and (d) the economic and related impacts of such costs on ultimate purchasers within the State.

"(s) Additional Clean Energy Requirements after 2030.–

"(1) On or before January 1, 2025, the Secretary shall propose a regulation revising the Clean Energy Portfolio Standard established under this Section so that emissions of carbon dioxide associated with the electricity supplied to consumers by retail electric suppliers in the United States shall not exceed in any calendar year the amount specified in the following table:

Calendar year:	**Maximum annual emissions:**
2030	2.5 billion tons
2035	2.25 billion tons
2040	2 billion tons.

To meet these carbon dioxide emissions goals, the Secretary may revise the required annual percentage set forth in subsection (c), the limitation on the use of carbon dioxide offsets set forth in subsection (d)(2), or the credit cost cap set forth in subsection (i). If the Secretary finds that the cost of achieving the maximum annual emissions set forth in this subsection would cause undue economic hardship on American citizens or significantly harm the competitiveness of American industries, the Secretary may propose revisions to the standard that result in acceptable economic impact while still achieving additional carbon dioxide emissions reductions.

“(2) The Secretary shall promolgate a proposed rule reflecting the proposed changes pursuant to paragraph (1) and shall provide at least 180 days for public comment.

“(3) At the time that the rule proposed by the Secretary under paragraph (1) is published in the Federal Register, the President shall transmit the proposed rule to Congress, together with an analysis of the economic and environmental implications of the proposed rule. In his transmittal, the President may, in his discretion, propose additional initiatives for Congressional action associated with or arising from the proposed rule or this subsection, including proposals for more stringent emission goals or clean energy standards or the creation of a carbon dioxide emission control program.

“(4) Notwithstanding any other provision of this section, the Secretary shall not promulgate a final rule under this paragraph until a date that is at least three years after transmission of the proposed rule, analysis and recommendations to Congress under subsection (s)(3).

“(5) Any final rule promulgated pursuant to this subsection shall not be effective until January 1, 2030.

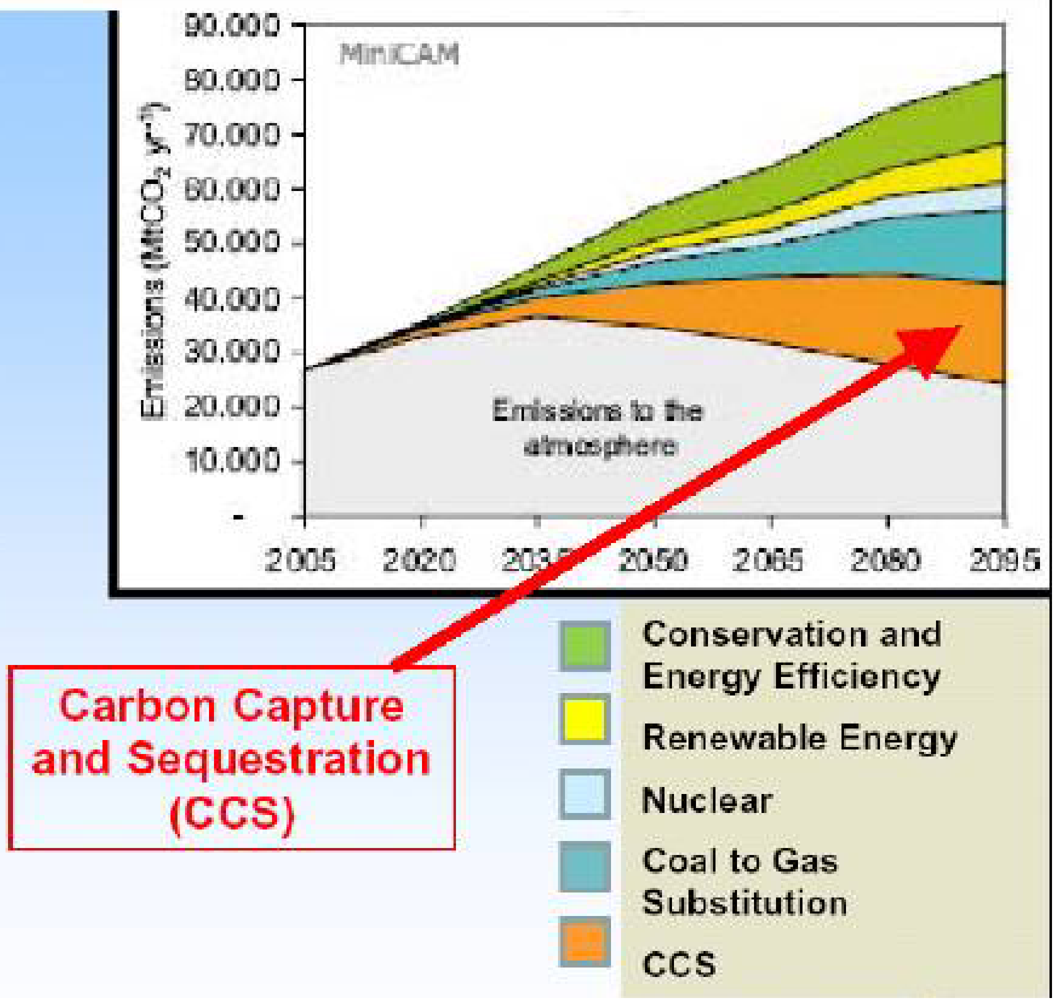
“(t) Other Climate Change Policies Relating to Electric Power Sector.—

“Within one year after the date of enactment of this section, and every five years thereafter, the Secretary shall assess whether the efficiency of the nation’s electric system and clean energy credit trading market, generation fuel diversification, affordable consumer electricity prices, or the implementation of other purposes of this section are or are likely to be adversely affected by the adoption or enforcement of any new or existing State or local renewable portfolio standard, clean energy standard or other requirement the purpose of which is to control the emissions of carbon dioxide from any facility that generates electricity for sale to consumers. In preparing the assessment required by this subsection, the Secretary shall consider impacts of State and local programs on a national as well as regional and local basis. The Secretary shall transmit the results of its initial assessment and any recommendations for modifications and improvements to the program to Congress not later than January 1, 2009."

Importance of CO_2 capture & sequestration in a carbon constrained world

- The IPCC reports CCS as providing a considerable portion of total CO_2 “least cost” reductions during this century.

- IPCC estimates that widespread availability of CCS will reduce total carbon mitigation costs by 30%.



Source: Intergovernmental Panel on Climate Change, *Carbon Capture and Storage*, 2005, p. 13.