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Energy and Economic Impacts of H.R.5049, the Keep America Competitive Global Warming Policy Act

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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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Contents

Tables

Figures

Executive Summary

Background

This report responds to a request from Congressmen Tom Udall and Tom Petri for an economic and industry analysis of the greenhouse gas (GHG) emissions regulations specified in H.R.5049, the Keep America Competitive Global Warming Policy Act. The legislation, introduced March 29, 2006, establishes a market-based emission allowance program to cap GHG emissions at their 2009 projected level and to limit the potential impacts of the bill on energy prices through the sale of additional allowances at a "safety-valve" price. The safety-valve provision, if triggered, implicitly relaxes the emissions cap.

H.R. 5049 specifies guidelines for allocating tradable emission allowances to compensate affected parties, provide transition and low-income assistance, fund research and development programs, and assist with emissions reduction projects in developing countries. Up to 10 percent of the emission allowances are to be allocated for free to the oil, natural gas, and coal industries, which must submit allowances equal to the carbon dioxide (CO_2) emissions from their fuel sales. The rest of the allowances are allocated to State governments, the electric power industry, energy-intensive industries, and the U.S. Departments of State, Energy, and Treasury. Although not explicitly stated in the bill, these recipients are presumed to sell the allowances to entities that are required to hold them to cover emissions associated with their activities.

The GHG provisions of the bill were modeled using the National Energy Modeling System and compared to the reference case projections from the *Annual Energy Outlook 2006 (AEO2006*). Four alternative analysis cases were prepared. The H.R.5049A case assumes the nominal safety-valve price growth matches the Consumer Price Index (CPI) plus an increment of 1 percentage point per year. The H.R.5049B case assumes a 2 percentage point increment to the CPI for the safety-valve escalation rate. The H.R.5049C is similar to the H.R.5049A case, but assumes 50 percent lower market response to emissions abatement opportunities for the non-CO_2 gases than the emissions abatement supply curve for those gases provided by the Environmental Protection Agency (EPA). The No-Safety case simulates a hypothetical version of the bill without its safety-valve provision, using the original EPA-supplied emission abatement curves for non-CO_2 gases.

The modeled impacts of H.R. 5049 are summarized as follows:

Emissions and the Allowance Price

- The legislation leads to lower CO_2 emissions than in the reference case, particularly in the electric power and industrial sectors, slows the growth of GHG emissions other than CO_2, and increases carbon sequestration in forestry and agriculture.

- Compared to the *AEO2006* reference case, the allowance program achieves a combination of reductions in GHG emissions and increases in sequestration totaling

827 million metric tons CO_2 equivalent (10 percent) in 2020 and 1,105 million metric tons CO_2 equivalent (11 percent) in 2030 in the H.R.5049A case.

- Beginning in 2018, (2016 in the H.R.5049C case), the market price of an allowance reaches the safety-valve price and triggers additional allowance sales, allowing covered emissions, net of carbon sequestration offsets, to exceed the emissions cap. In the No-Safety case, the allowance price continues to grow throughout the projection, reaching $30 per metric ton carbon dioxide equivalent (2004 dollars) in 2030, compared to the $8 per metric ton price in the H.R. 5049A case and $10 per metric ton price in the H.R. 5049B case.

- Less than half of the projected emissions impacts are due to reductions in energy-related CO_2, but the share of energy-related emissions reductions in total emissions reductions grows over time. The combination of a reduction in non-CO_2 gases and an increase in carbon sequestration accounts for between 74 and 80 percent of the total GHG impacts in 2020, and between 54 and 64 percent in 2030, the range based on variations in the assumed market response to emission abatement opportunities in the H.R.5049A and H.R.5049C cases.

Energy Markets

- With the added cost of GHG allowances, projected prices of fossil fuels and electricity increase relative to the reference case. In the H.R.5049A case, the average delivered coal price is 46 percent above the reference case price in 2030, while gasoline is priced 3 percent higher, natural gas is 5 percent higher, and electricity is 6 percent higher in 2030.

- In the electric power sector, projected changes in the policy cases include shifts in the types of new power plants added, with an increased reliance on natural gas, renewable energy, and nuclear power to supply electricity and less reliance on coal and petroleum. In the H.R.5049A case, reductions in CO_2 emissions in the electricity sector account for 68 percent of the total energy-related CO_2 reductions in 2030.

- The projected demand for industrial coal is 14 percent lower in 2020 and 26 percent lower in 2030 in the H.R.5049A case than in the reference case. In the *AEO2006* reference case, industrial coal use is projected to grow rapidly in the latter half of the projection as coal-to-liquids plants are introduced. Under the policy cases, the cost of coal reduces the economic potential for these plants, curtailing the associated growth in coal use, along with the associated CO_2 emissions. As a result, domestic petroleum supply from coal-to-liquids plants is 445 thousand barrels per day lower in 2030 in the H.R.5049A case, compared to the reference case.

Allowance Revenues

- The projected revenue from sales of allowances is a function of the market price of the allowances, the number of allowances issued by the EPA, and the number of additional

allowances sold by the U.S. Treasury if the safety valve price is triggered. In H.R.5049A, the safety valve is triggered in 2018.

- In the H.R.5049A case, projected revenue for the allowances increases from $0.6 billion in 2009, the implementation year, to $59.3 billion in 2017, the last year before the safety valve is exceeded. In 2030, projected revenue for the allowances is $103.6 billion and that for the additional safety-valve allowances is $17.8 billion, totaling $121.4 billion.

- In the H.R.5049B case, the safety-valve price increases by 2 percentage points above the previous year's change in the CPI, compared with 1 percentage point in the H.R.5049A case. The higher safety-valve case generates higher revenue. In 2030, projected revenue reaches $145.9 billion.

- With fewer abatement opportunities for other greenhouse gases, allowance prices in the H.R.5049C case are higher in the first few years of implementation. The allowance price is projected to reach the safety-valve price by 2016, 2 years earlier than in the H.R.5049A case. In 2030, the projected allowance revenue is estimated to be $124.7 billion, similar to that in the H.R.5049A case.

Prices and Economic Activity

- As a direct consequence of the emission allowance costs, aggregate energy prices in the U.S. economy are expected to rise by approximately 6 percent by 2020.

- Ultimately the consumer sees higher prices directly through the final prices for energy goods and services, plus the indirect price increases that come about as intermediate goods and services prices rise. The impact on consumer prices, measured by the All-Urban CPI, is approximately 0.6 percent above the reference case in 2020 and remains approximately at this percent difference through 2030.

- In the H.R.5049A case, the loss in gross domestic product (GDP) relative to the reference case grows through 2017, but then the loss in GDP moderates as the allowance price triggers the safety valve and the impact on prices moderates. By 2020, the loss in GDP is $27 billion (0.15 percent) relative to the reference case level[1]. By 2030, the loss in GDP increases to $38 billion (0.16 percent) relative to the reference case level.

- Measured over the 2009 to 2030 period, the average annual loss in GDP is approximately $20 billion out of an average annual $17.5 trillion economy. This represents a loss of 0.11 percent in the cumulative GDP over the 22-year period. The bill's safety-valve provision is important in limiting the economic impacts: in the hypothetical No-Safety case, the estimated average annual GDP loss is over twice as high at $43 billion (0.24 percent.)

[1] Unless otherwise noted, all dollar values for the economic impacts are in real 2000 dollars, and energy prices are in real 2004 dollars

- The H.R.5049B case, with a higher safety-valve permit price than the H.R. 5049A case, shows slightly larger GDP impacts over the entire 22-year period. The average impact on GDP in the H.R.5049B is $23 billion (0.13 percent). For the H.R.5049C case, the loss in GDP is slightly higher than for the H.R.5049A case through 2017 reflecting the higher permit price early on, but then the impacts moderate. Overall, the average annual loss in GDP is $21 billion (0.12 percent).

Consumer Spending

Whereas GDP is a measure of what the economy produces, consumers are interested in purchasing goods and services (consumption). In general, losses to consumption increase faster until 2017, when the safety valve begins to moderate price increases.

- By 2030, consumption losses range from $38 to $46 billion. The average impact between 2009 and 2030 for H.R.5049A case is $19 billion, while for the other two cases it is between $21 and $22 billion.

- Another way to look at the impact on the consumer is to calculate the loss in consumption on a per capita basis. By 2020, the per capita loss in consumption is between $71 and $83, while the loss in 2030 ranges between $103 and $126 for the three cases.

Industry Output and Employment

- The implementation of H.R.5049 impacts all production activities. The purchase of allowances increases the production costs of the emitting sectors and the increase in energy prices raises the factor input cost for all industries, requiring industries to adjust their production to changing final demands for their products.

- In the H.R.5049A case for the period 2009-2030, production of the energy-intensive manufacturing sector is projected to be reduced by an average of 0.64 percent relative to the reference case, non-energy-intensive manufacturing by an average of 0.43 percent, non-manufacturing industries by 0.26 percent, and services by 0.11 percent.

- Among the detailed energy-intensive industries, aluminum production, which is an electric-intensive process, is expected to fall by 4.7 percent on average. Production of glass, iron and steel, and basic inorganic chemicals are also expected to fall by more than 1 percent. The largest sector in this group, food processing, is only marginally affected.

- The average loss of total employment for the period 2009-2030 is projected to be 58 thousand, or 0.04 percent relative to the reference case. Estimated average job loss in the manufacturing and non-manufacturing industries is 70 thousand, or 0.28 percent. Part of this loss is compensated for by an increase in the service sector employment.

1. Background

This service report was prepared by the Energy Information Administration (EIA), in response to a May 2, 2006, request from Congressmen Tom Udall and Tom Petri (Appendix A). A follow-up letter dated June 13, 2006, provided further guidance (Appendix B). These communications request an economic and industry analysis of the impacts that would result from enactment of H.R.5049, the Keep America Competitive Global Warming Policy Act.

Bill Summary

Under H.R.5049, emissions of greenhouse gases (GHG) would be regulated through a market-based emission allowance program. A fixed number of tradable allowances would be issued to establish a cap on emissions, but with additional allowances created and sold at a "safety-valve" price to limit the potential cost of the program.

The bill states that the allowance program would begin 3 years after enactment and that the Environmental Protection Agency (EPA) would establish the number of the allowances, or cap, based on emissions over the prior 3 years. The follow-up letter to the analysis request specified that the assumed cap should go into effect in 2009 and be based on projected emissions for 2009 from the reference case of EIA's *Annual Energy Outlook 2006 (AEO2006*).[2] In the absence of the cap, energy-related carbon dioxide ($CO_{2)}$ emissions in the reference case are projected to grow from 5,900 million metric tons in 2004 to 6,281 million metric tons in 2009, and to 8,114 million metric tons in 2030. Under the cap, the emissions reduction needed to comply with the cap would become more stringent over time as the economy and energy consumption grow, suggesting a rising cost of compliance over time that would eventually trigger the safety-valve price for allowances.

The safety-valve price is initially set to $25 nominal per metric ton of carbon equivalent, or $6.82 per metric ton carbon dioxide equivalent. The safety-valve price increases each year at a percentage equal to the growth in the Consumer Price Index—All Urban (CPI), plus an increment of either 1 or 2 percentage points, with the 2 percentage point increase contingent on whether five developing countries with the greatest emissions have adopted comparable emissions control actions.

The bill calls for fossil energy suppliers, including producers and importers, to submit allowances for carbon dioxide emissions associated with the fuels sold. Targeting suppliers, rather than intermediate or final consumers, is intended to simplify the administration of the program. In addition to energy-related CO_2, the bill also regulates emissions of the other GHGs: nitrous oxide, methane, and the fluorinated gases

[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.

(hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). The bill exempts emission sources where measurement or estimation is deemed infeasible by the EPA.

In the follow-up letter to the analysis request, EIA was asked to assume coverage applies to energy-related CO_2 and those gases for which available information on abatement costs was available, similar to its other recent studies on this issue.[3] Emissions abatement cost curves for several classes of GHG sources have been provided by EPA and used by EIA in several of its recent analysis reports.[4] These sources include the fluorinated gases, methane from coal mining, landfills, and natural gas systems, and nitrous oxide from adipic and nitric acid production. By assumption, then, the uncovered sources include non-energy-related carbon dioxide, nitrous oxide emissions from agriculture and vehicles and methane emissions from agriculture and vehicles. These uncovered sources represented 9 percent of the total greenhouse gases reported by EIA in 2004.

The *AEO2006* projects energy-related CO_2 emissions using the National Energy Modeling System[5] (NEMS) through 2030. For this analysis, the *AEO2006* reference case emissions for energy-related CO_2 emissions were augmented with baseline emissions projections for other GHGs to create a baseline for total GHG emissions and total covered emissions. Projections for other GHG emissions are derived from an unpublished EPA "no-measures" case, developed by EPA for use in the U.S. Climate Action Report 2006.[6] Based on this combined projection of covered GHGs in 2009, the assumed allowance cap is 6,956 million metric tons carbon dioxide equivalent and remains at that level thereafter.

Section 7 of the bill establishes a program to credit increases in carbon sequestration from proposed projects that would not have been undertaken in the absence of the program. Potential projects would include CO_2 capture and storage and biogenic carbon sequestration projects, such as tree planting, forest management, and cropland tillage practices. The owners of approved projects would be granted emission allowances equal

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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/pdf/sroiaf(2005)02.pdf
Also, Energy Information Administration, *Energy Market Impacts of Alternative Greenhouse Gas 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

[4] For example, see Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003*, SR/OIAF/2003-02, (Washington, DC, June 2003), web site www.eia.doe.gov/oiaf/analysispaper/sacsa/index.html, for a description of the emission abatement curves and data sources.

[5] Energy Information Administration, *The National Energy Modeling System—An Overview 2003*, DOE/EIA-0581(2003) (Washington, DC, March 2003), web site www.eia.doe.gov/oiaf/aeo/overview/index.html.

[6] Personal communication from Casey Delhotal, of the Environmental Protection Agency, to Daniel Skelly, of the Energy Information Administration, on July 7, 2005. EIA adjusted the EPA 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 projection, 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 based on the average annual growth rates of individual emission sources from 2015 to 2020.

to the amount of greenhouse gases sequestered, in carbon dioxide equivalence, adding to the pool of allowances available.

The bill calls for up to 10 percent of the emission allowances to be allocated for free to the oil, natural gas, and coal industries, which are required to submit allowances equal to the CO_2 emissions from their fuel sales. The rest of the allowances are allocated to State governments, the electric utility industry, energy-intensive industries, the Department of State, the Department of Energy, and the U.S. Treasury. These recipients are presumed to sell their share of the allowances on the open market. Proceeds would compensate affected parties and provide transition and low-income assistance, fund research and development programs, and raise government revenue.

Methodology

The analysis of emission regulations of the bill was conducted with NEMS as used for the reference case projection in EIA's *Annual Energy Outlook 2006*, with modifications to reflect the bill's provisions. NEMS endogenously calculates energy-related CO_2 emissions. The cost of using each fossil fuel includes the costs associated with the GHG allowances needed to cover the emissions produced when the fuel is used. These price 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 abatement cost relationships supplied by EPA and used in previous EIA studies, as discussed above. NEMS solves for the allowance price such that the emissions target is achieved or else the price reaches the safety-valve level. If the safety-valve price is attained, covered GHG emissions can exceed the target, as unlimited additional allowances can be purchased at the safety-valve price.

The Macroeconomic Activity Module (MAM) 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 and consumption, 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 sale of the GHG allowances generates revenue streams to the government, private, and international sectors. The MAM represents the revenue streams accruing to these sectors based on the allowance allocations specified in the bill. Together, these energy-related price, quantity, and revenue allocation effects impact on the aggregate level of prices, output, and employment within the economy.

Policy Cases

Three principal analysis variations on the bill are presented in this report and referred to as the H.R.5049A, H.R.5049B, and H.R.5049C policy cases.

The H.R.5049A case represents the emission regulation policy with the reference case assumptions and assumes the nominal safety-valve price escalates at a rate matching the projected change in the CPI reported in the *AEO2006*, plus an increment of 1 percentage point per year. The H.R.5049B case is similar to the H.R.5049A case but assumes a 2 percentage point increment to the CPI for the safety-valve escalation rate.

The H.R.5049C is similar to the H.R.5049A case but varies a key assumption concerning abatement cost curves for non-CO_2 gases provided by EPA, which indicate that substantial emissions reductions are economical at very low GHG allowance prices based on engineering cost analyses. However, the operation of real-world behavioral factors could significantly reduce the market response to the opportunities identified by EPA. The H.R.5049C case assumes 50 percent lower abatement response for the non-CO_2 gases than the H.R.5049A case.

A fourth case, the No-Safety case, simulates a hypothetical version of the bill without its safety-valve provision. The case is mentioned briefly to highlight the importance of the safety valve in limiting the potential economic impacts.

Uncertainty

NEMS, like all models, is a simplified representation of reality. The projections are dependent on the data, methodologies, model structure, and assumptions. 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 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.

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.

The bill also authorizes additional energy research and technology development, including the creation of a new program in the Department of Energy: the "Advanced Research Projects Agency—Energy" (ARPA-E). The new program would be funded by revenue generated from sales of greenhouse gas allowances allocated to the Department of Energy. The potential impacts from the research and development provisions of the bill are not evaluated in this report.

2. Energy Market Impacts

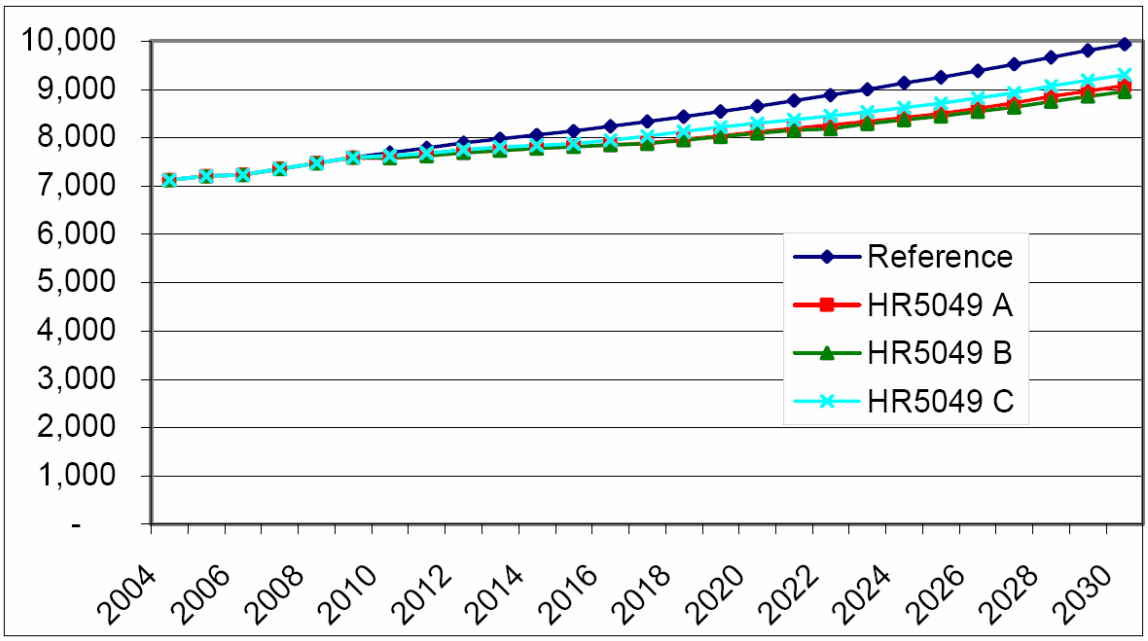
Greenhouse Gas Emissions and Allowance Prices

Compliance with the GHG regulations imposed by H.R.5049 slows GHG emissions growth after 2009, the assumed first year of the bill's allowance program. Total projected greenhouse gas emissions[7] under the three policy cases continue to rise slowly after 2009, but at a slower rate than in the *AEO2006* reference case (Figure 2.1). In 2030, total GHG emissions range from 6 to 10 percent lower across the policy cases (Table 2.1).

While the bill effectively caps GHG emissions by issuing a given level of emissions allowances, the projected emissions continue to rise after the program is in place. Emissions rise because some emissions sources are assumed to be exempt from the allowance program and because offsetting emission credits are assumed to be issued for approved increases in carbon sequestration, as provided under Sec. 7. In addition, the safety-valve program provides for unlimited, supplementary sales of emission allowances at a specified price to control the potential cost of the program.

Figure 2.1 Total greenhouse gas emissions in the *AEO2006* reference and H.R.5049 policy cases, 2004-2030

(million metric tons carbon dioxide equivalent)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

[7] The projections of total greenhouse gas emissions in the policy cases cited here and plotted in the figure are gross emissions and do not reflect the offset in emissions from the increase in carbon sequestration induced under Section 7 of the bill.

Table 2.1. Summary Energy Market Results from the Reference and Policy Cases

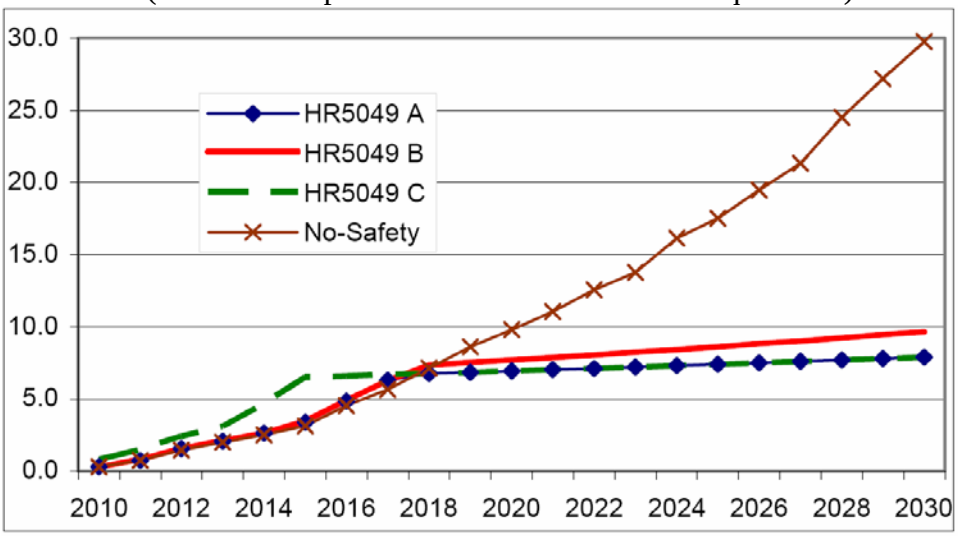
Projection	2004	2020				2030			
		AEO2006 Reference	HR5049 A	HR5049 B	HR5049 C	AEO2006 Reference	HR5049 A	HR5049 B	HR5049 C
Emissions of greenhouse gases (million metric tons carbon dioxide equivalent)									
Energy-related carbon dioxide	5,900	7,119	6,953	6,933	6,947	8,114	7,714	7,612	7,708
Other covered emissions	594	880	512	508	696	1,140	687	667	914
Total covered emissions	6,494	7,999	7,465	7,440	7,644	9,255	8,400	8,279	8,621
Total greenhouse gases	7,122	8,649	8,115	8,090	8,293	9,930	9,076	8,955	9,297
Emission reduction from reference case (million metric tons carbon dioxide equivalent)									
Energy-related carbon dioxide	-	-	166	186	172	-	401	502	407
Other covered emissions	-	-	368	373	184	-	454	473	227
Carbon sequestration	-	-	293	304	293	-	250	270	251
Total	-	-	827	863	649	-	1,105	1,245	884
Allowance price (2004 dollars per metric ton carbon dioxide equivalent)	-	-	6.9	7.7	6.9	-	7.9	9.7	7.9
Delivered energy prices (2004 dollars per physical unit, as indicated)									
Motor gasoline (per gallon)	1.90	2.08	2.13	2.14	2.13	2.19	2.25	2.27	2.25
Jet fuel (per gallon)	1.22	1.42	1.50	1.50	1.50	1.56	1.62	1.65	1.62
Distillate (per gallon)	1.74	1.93	2.03	2.03	2.03	2.06	2.17	2.18	2.17
Natural gas (per thousand cubic feet)	7.74	7.14	7.51	7.58	7.51	8.22	8.59	8.77	8.64
Residential	10.72	10.48	10.82	10.89	10.82	11.67	12.04	12.23	12.10
Electric power	6.07	5.53	5.93	6.00	5.92	6.41	6.80	7.02	6.87
Coal (per short ton)	28.81	28.55	41.71	42.97	41.60	30.30	44.03	47.12	44.11
Electricity (cents per kilowatthour)	7.57	7.25	7.66	7.71	7.66	7.51	7.99	8.15	8.02
Fossil energy consumption (quadrillion Btu)									
Petroleum	40.1	48.1	47.3	47.2	47.2	53.6	52.4	52.3	52.4
Natural gas	23.1	27.7	27.3	27.3	27.2	27.7	27.4	27.7	27.6
Coal	22.5	27.6	26.8	26.6	26.8	34.5	31.3	30.1	31.1
Electric power sector generation (billion kilowatthours)									
Petroleum	115	92	39	35	36	101	37	36	36
Natural gas	619	968	1,012	1,023	1,004	822	893	938	916
Coal	1,954	2,435	2,374	2,354	2,375	3,205	2,920	2,790	2,891
Nuclear	789	871	871	871	871	871	968	1,017	953
Renewable	323	469	493	498	499	504	644	678	656
Total	3,799	4,835	4,788	4,781	4,785	5,503	5,462	5,458	5,453

Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

The trading price for emission allowances, reflecting the marginal cost of emission abatement, is projected to reach the safety-valve level between 2016 and 2018 in the three policy cases (Figure 2.2). In the H.R.5049A case, covered GHG emissions from 2009 to 2017, less the offset for increased carbon sequestration, match the assumed covered emissions cap of 6,956 million metric tons carbon dioxide equivalent. Once the allowance price reaches the safety-valve price in 2018, additional allowances are issued and purchased each year, and so covered emissions are no longer constrained, but emissions continue to be influenced by the allowance cost incentive. As a result, projected GHG emissions begin to grow faster beginning in 2018, but at a slower rate than in the *AEO2006* reference case.

Figure 2.2. Greenhouse gas allowance prices in the H.R.5049 policy cases, 2010-2030

(2004 dollars per metric ton carbon dioxide equivalent)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, UPCAPLOTH.D073106A and UPNOSAFE.D081606A.

In both the H.R.5049A and H.R.5049B cases, the projected allowance prices first reach the safety-valve level in 2018. After 2018, the safety-valve program continues to limit the allowance market trading price. However, in the H.R.5049A case, the real dollar safety-valve price grows at a rate of 1.3 percent per year, as called for under Section 5(a).[8] In the H.R.5049B case, the safety-valve price is assumed to grow at 2.3 percent per year, as could occur under Section 5(b). With higher allowable permit prices projected in the H.R.5049B case, GHG emissions are reduced by a greater amount than in the H.R.5049A case, and higher levels of carbon sequestration are projected (Figure 2.3).

In the No-Safety case, the allowance price continues to grow throughout the projection, reaching $30 per metric ton carbon dioxide equivalent (2004 dollars) in 2030, compared to $8 per metric ton in the H.R. 5049A case and $10 per metric ton in the H.R. 5049B case. In the No-Safety case, covered GHG emissions, less offsets for carbon sequestration, remain at the 2009 level through 2030.

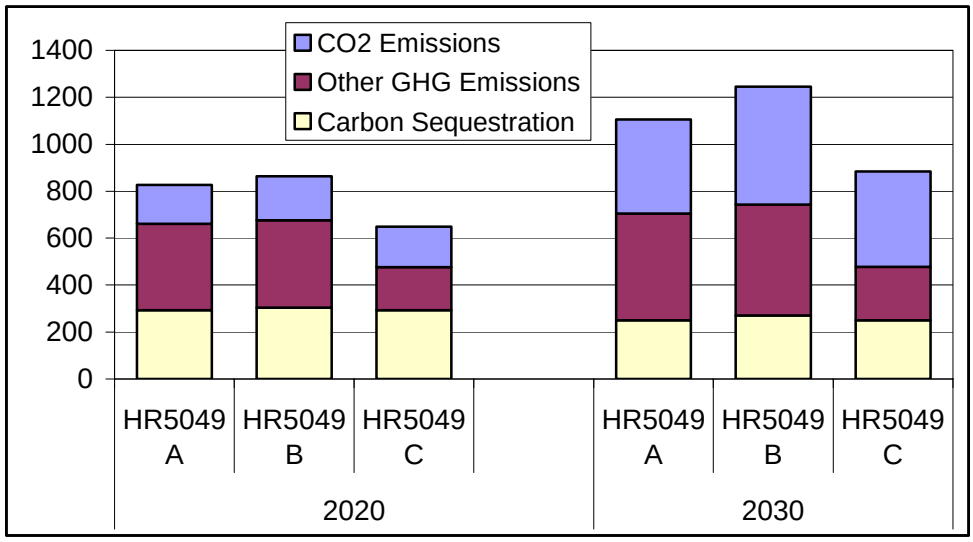
Figure 2.3 compares the emissions-related impacts of the policy cases relative to the *AEO2006* reference case, including the estimated carbon sequestration effects. A large share of the emissions impacts in the policy cases are attributed to the gases other than energy-related CO_2 and to carbon sequestration. The projected impacts from the non-CO_2 sources are based on marginal abatement cost curves derived from EPA analyses.

[8] The bill specifies that the growth rate of the safety-valve price based on the growth in the All-Urban Consumer Price Index, plus 1 percentage point. This nominal dollar safety-valve price assumption is deflated to constant, or real, dollars for analysis purposes based on the projected estimate of the GDP chain-linked price deflator in each policy case. Because inflation as measured by the GDP price deflator is less than with the CPI, the real dollar safety valve price increases at 1.3 percent per year in the H.R.5049A case and 2.3 percent per year in the H.R.5049B case.

The analyses suggest that substantial emissions reductions are economical in the range of GHG allowance prices considered in this analysis.

Figure 2.3. Greenhouse gas emission reductions and carbon sequestration in the policy cases, 2020 and 2030

(million metric tons carbon dioxide equivalent)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

In the H.R.5049A case, the combined reduction in non-CO_2 gases and carbon sequestration accounts for 80 percent of the total GHG impacts in 2020 and 64 percent in 2030. While the non-CO_2 abatement curves reflect emission reductions that are economical based on engineering cost analyses, the market response to those opportunities may be significantly less. The H.R.5049C case assumes 50 percent lower abatement response for the non-CO_2 gases and holds the carbon sequestration abatement curves at the same level.[9] The percentage contribution of the non-CO_2 sources in the H.R.5049C is 74 percent in 2020 and 54 percent in 2030. Initially, projected allowances prices are driven higher in the H.R.5049C case, as more pressure is put on energy markets to reduce emissions of CO_2. As a result, the allowance price first reaches the safety-valve level in 2016 in the H.R.5049C, 2 years earlier than in the other cases.

[9] The carbon sequestration assumptions in this analysis are the same as used in EIA's *Analysis of S.139, the Climate Stewardship Act of 2003* and already reflect a 50-percent reduction from the estimates of economic potential to account for uncertainty and the likelihood that the market response would be lower than the economic potential. The carbon sequestration offset estimates in this analysis are similar in magnitude to more recent estimates published in November 2005 by EPA in *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture* (EPA 430-R-05-006) in its $5-per-ton, constant-price scenarios for 2015 and 2025.

Energy Sector Impacts

H.R.5049 requires producers and importers of fossil fuels—coal, natural gas, and petroleum—to submit emission allowances equal to CO_2 emissions that will result from the use of the fuel supplied. While the Federal government will distribute up to 10 percent of the allowances for free to the oil, natural gas, and coal industries, the suppliers will need to purchase most of the allowances from other recipients.[10] EIA assumes that energy suppliers will pass on the actual or opportunity cost of the allowances by raising energy prices by a surcharge proportional to the CO_2 emissions per unit of energy. As a result, the delivered prices to final consumers of using fossil fuels will reflect the cost of allowances needed.

Because fuel suppliers pass on their allowance costs in the prices they charge, the delivered prices of coal, natural gas, petroleum, and electricity all increase in the policy cases relative to the *AEO2006* reference case.[11] In percentage terms, coal prices are most affected by allowance costs: the projected average delivered coal price in the H.R.5049A case is 46 percent above the reference case price in 2030. In comparison, projected average gasoline prices are higher by 3 percent in 2030, natural gas by 5 percent, and electricity by 6 percent.

The demand for energy adjusts to higher energy prices, thereby reducing the associated CO_2 emissions. The demand adjustments are varied and include short- and long-term changes in the energy consumption sectors. The energy sector also responds to the macroeconomic effects resulting from higher energy prices and the government's collection and distribution of allowance revenue.

Energy demand across each of the energy consumption sectors—residential, commercial, industrial, transportation, and electricity—will respond in different degrees to the energy price changes (Figure 2.4). The electricity sector is projected to be most responsive to changes in fossil fuel prices, as fuel prices represent a significant share of its operating costs, and the ability to switch from coal to less carbon-intensive energy sources is greater.

In the H.R.5049A case, reductions in CO_2 emissions in the electricity sector account for 68 percent of the total energy-related carbon dioxide reductions in 2030, compared to the *AEO2006* reference case. When the CO_2 emissions from electricity are apportioned to the end-use sectors, the industrial sector has the largest emission reduction, while transportation has the least (Figure 2.5).

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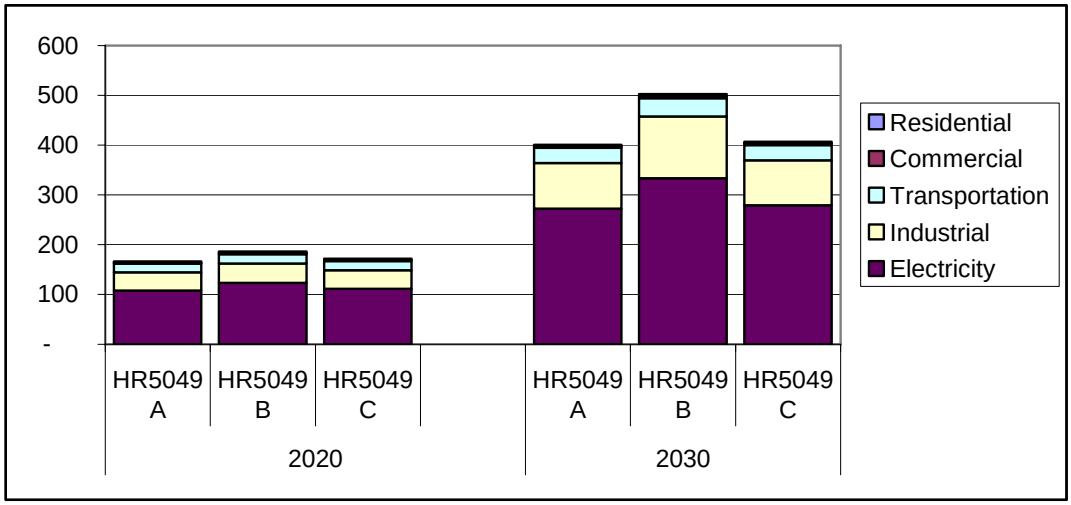
[10] Other recipients include State governments, the electric power industry, energy-intensive industries, the Department of State, the Department of Energy, and the U.S. Treasury. These recipients are presumed to sell their share of the allowances on the open market. Proceeds would compensate affected parties and provide transition assistance, fund research and development programs, and raise government revenue.

[11] While the price increases may be attenuated somewhat by the supply response to reduced fuel demand, which tends to reduce marginal cost of fuel supplied, the overwhelming impact is to increase fuel prices. For electricity, higher projected prices result not only from higher fossil fuel costs, but also from higher capital costs associated with less carbon-intensive plant additions in the future.

Figure 2.4. Energy-related CO_2 emissions reductions by primary sector

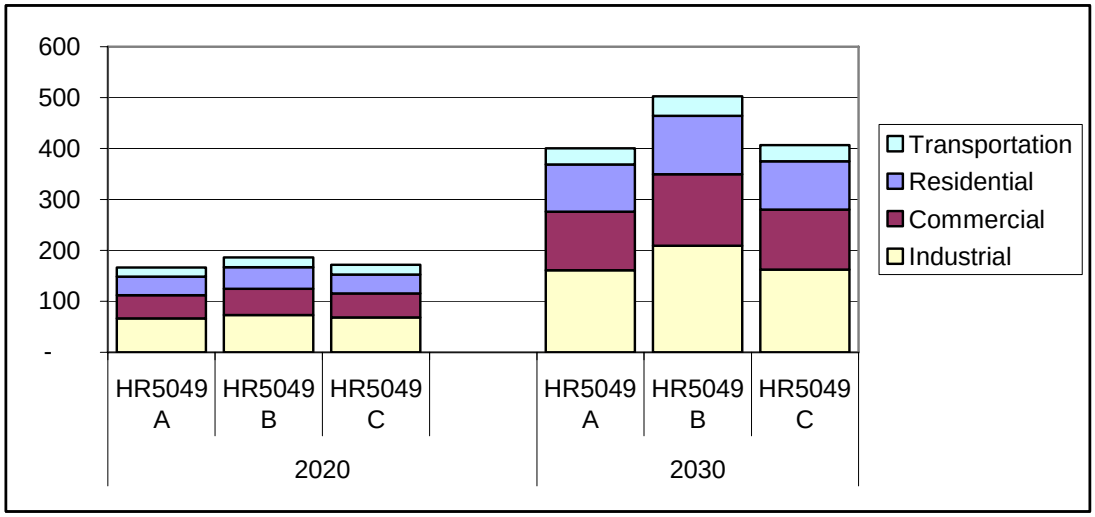
(million metric tons carbon dioxide)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

Figure 2.5. Energy-related CO_2 emissions reductions by end-use sector

(million metric tons carbon dioxide)



Note: Emissions from the electric power sector have been allocated to the end-use sectors in proportion to projected electricity sales.

Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

In the end-use sectors, the demand for energy is relatively insensitive to changes in price, especially in the short term, for a variety of reasons. Adoption of more efficient, less carbon-intensive technologies may require higher initial costs, and cost-effective adoption of further efficiency improvements is delayed by the long lifetimes of the existing stock of vehicles, equipment, buildings, and appliances. As a result, the effect on projected end-use sector fossil fuel demand in the policy cases is modest in most areas but tends to grow over time. Projected consumption of petroleum and natural gas

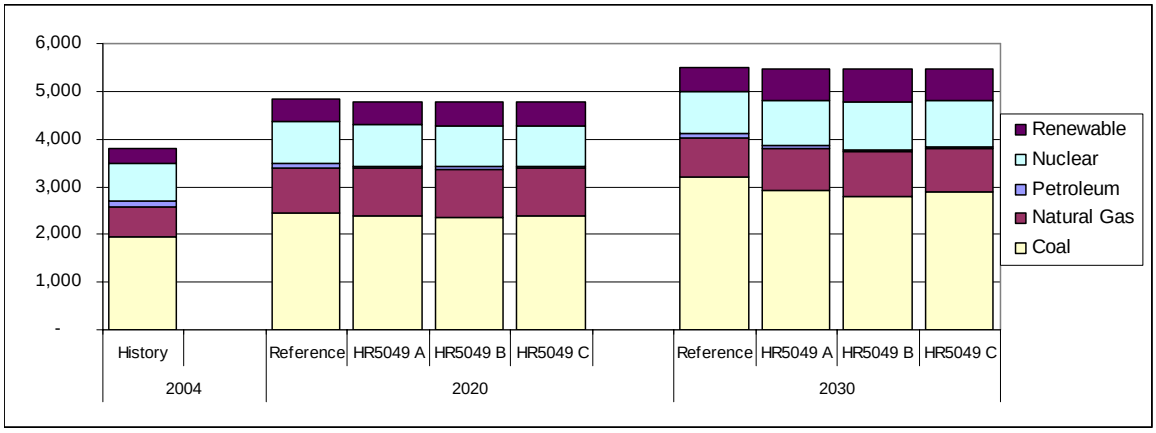
combined in the four end-use sectors in the policy cases is reduced by less than 1 percent in 2030, relative to the *AEO2006* reference case.

The most significant change in end-use sector energy consumption occurs to coal in the industrial sector. The projected demand for industrial coal is 14 percent lower in 2020 and 26 percent lower in 2030 in the H.R.5049A case than in the reference case. In the *AEO2006* reference case, industrial coal use is projected to grow rapidly in the latter half of the projection as coal-to-liquids plants are introduced. Under the policy cases, the cost of coal reduces the economic potential for these plants, curtailing the associated growth in coal use, along with the associated CO_2 emissions. As a result, domestic petroleum supply from coal-to-liquids plants is 445 thousand barrels a day lower in 2030 in the H.R.5049A case, compared to the reference case. Because the coal–to–liquids plants are also combined heat–and–power plants, the projected generation of end-use sector electricity is also reduced under the policy cases.

In the electric power sector, projected changes in the policy cases include shifts in the types of new power plants added, with an increased reliance on natural gas, renewable energy, and nuclear power to supply electricity and less reliance on coal and petroleum (Figure 2.6). These changes accumulate over time and, as a result, the most significant impacts are reflected at the end of the projection period.

Figure 2.6. Electric power sector generation in the reference and policy cases, 2004, 2020, and 2030

(billion kilowatthours)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A.

In the *AEO2006* reference case, coal generation in the power sector increases from 1,954 in 2004 to 3,205 billion kilowatthours in 2030, providing 58 percent of the total power sector generation in 2030. In the H.R.5049A case, projected coal generation in 2030 is 2,920 billion kilowatthours, 9 percent lower than in the reference case, but still a 49-percent increase over the 2004 level. While carbon capture and storage technologies could allow coal-fired plants to be more competitive under a GHG allowance program, the allowance prices are not sufficiently high in the policy cases to compensate for the

increased capital and operating costs. As a result, no power plants using carbon capture and storage are projected to be built within the 2030 time frame in the policy cases.

Projected power-sector generation from natural gas, which emits lower CO_2 emissions per kilowatthour generated than coal, increases from 822 billion kilowatthours in 2030 in the reference case to 893 billion kilowatthours in the H.R.5049A case. While over the longer-term, natural gas generation is higher in the policy cases than in the reference case, natural gas fuel use in the electric power sector is lower in the near-term between 2011 and 2020. Older, less efficient steam plants fueled by natural gas and oil are projected to be used less or retired to a greater extent under the proposed bill. However, as more combined-cycle plants are added in the latter half of the projection under the policy cases, natural gas use in the policy cases approaches levels in the reference case.

Projected power-sector generation from renewable sources, mainly biomass and wind, changes most in percentage terms under the policy cases compared to the reference case. Renewable generation in 2030 is 644 billion kilowatthours in the H.R.5049A case, 28 percent higher than the 504 billion kilowatthours in the reference case. Biomass generation, exempt from the bill's CO_2 allowance requirement, accounts for 82 percent of the change in generation between the two cases, while wind accounts for 15 percent.

In the *AEO2006* reference case, 6 gigawatts of new nuclear capacity is projected, partly spurred by subsidies called for in the Energy Policy Act of 2005. Under the policy cases, the comparative economics of nuclear power is improved because its use requires no emission allowances. Projected nuclear additions by 2030 are 19 gigawatts in the H.R.5049A case and 25 gigawatts in the H.R.5049B case.

The allowance allocation provisions of the bill may influence electricity prices in ways that have not been quantified in this analysis. While electricity suppliers are not required to submit allowances based on their fossil fuel use, their fuel suppliers would include the allowance cost in the prices charged. As a result, it is assumed that electricity suppliers would price electricity according to their higher fuel cost, generally passing on their higher cost to consumers. However, H.R.5049 calls for the electricity industry to receive up to 5 percent of the GHG allowances created. This transfer would subsidize the industry but have an uncertain effect on electricity prices, particularly for unregulated companies. Regulated utilities, however, would probably be directed to pass on most of the allowance proceeds to rate-payers. As a result, electricity prices, particularly in heavily regulated regions, might not increase as much as reflected in this analysis.

Other impacts on energy supply markets are most noteworthy for the coal industry. Projected coal production in the H.R.5049A case in 2030 is 1,511 million short tons, 11 percent lower than in the reference case. The change in projected coal supply in 2030 is greater for coal mined west of the Mississippi, a source of much of the incremental supplies in the projections. Western coal production in 2030 is 13 percent lower, from 1,070 million tons in the reference case to 933 million tons in the H.R.5049A case. Eastern coal production in 2030 declines by 9 percent between cases, from 633 million tons in the reference case to 578 million tons in the H.R.5049A case.

Projected petroleum demand in 2030 is 27.6 million barrels per day in the reference case, 27.0 million barrels per day in the H.R.5049A case, and 26.9 million barrels per day in the H.R.5049B case, a change of between 0.6 and 0.7 million barrels per day in the policy case projections. Projected petroleum production from coal-to-liquids plants in 2030 is about 0.4 million barrels per day lower in the H.R.5049A case than in the reference case and 0.6 million barrels per day lower in the H.R.5049B case. In addition, projected net imports of petroleum products are somewhat lower, accounting for much of the remaining differences in petroleum supply between cases in 2030.

3. Impacts on the Economy

Allocation of Allowance Revenue

The bill discusses two sources of allowances. First, the EPA Administrator will issue allowances based on emissions estimates computed from the preceding 3 years. Second, the Secretary of the Treasury will offer an unlimited number of allowances for sale at the safety-valve price.

Allowances issued by EPA will be distributed to the affected industries and various government agencies as follows:

Allowance Allocation	**Percentage Allocation**
Advanced research projects through the Department of Energy	25
Investment/assistance to developing countries through the Department of State	10
Industries affected:	
- fossil fuel-fired electric generating industry	5
- petroleum and natural gas industry	5
- coal industry	5
- energy-intensive industries	5
Transition assistance to displaced workers and to local governments	15 percent in first year, reduced by 1.5 percent per year
Low-income home energy assistance	5
U.S. Treasury	25 percent, plus the portion from reduction in transition assistance

The projected revenue from sales of allowances is a function of the market price of the allowances, the number of allowances issued by EPA, and the number of additional allowances sold by the Treasury if the safety valve price is triggered. Two streams of projected revenues are generated for the two sources of allowances. In the H.R.5049A case, projected revenue for the EPA allowances increases from $0.6 billion[12] in 2009 to $59.3 billion in 2017. In 2018, the projected allowance price reaches the safety valve price level, whereby all allowances, including the additional allowances provided by the Treasury, will be sold at the safety valve price. In 2030, projected revenue for the EPA allowances is $103.6 billion, and that for the additional safety valve allowances is $17.8 billion, totaling $121.4 billion. This represents 0.26 percent of the projected nominal GDP in that year.

[12] Revenues from the sales of allowances are reported in nominal dollars.

Table 3.1. Summary Economic Results from the Reference and Policy Cases

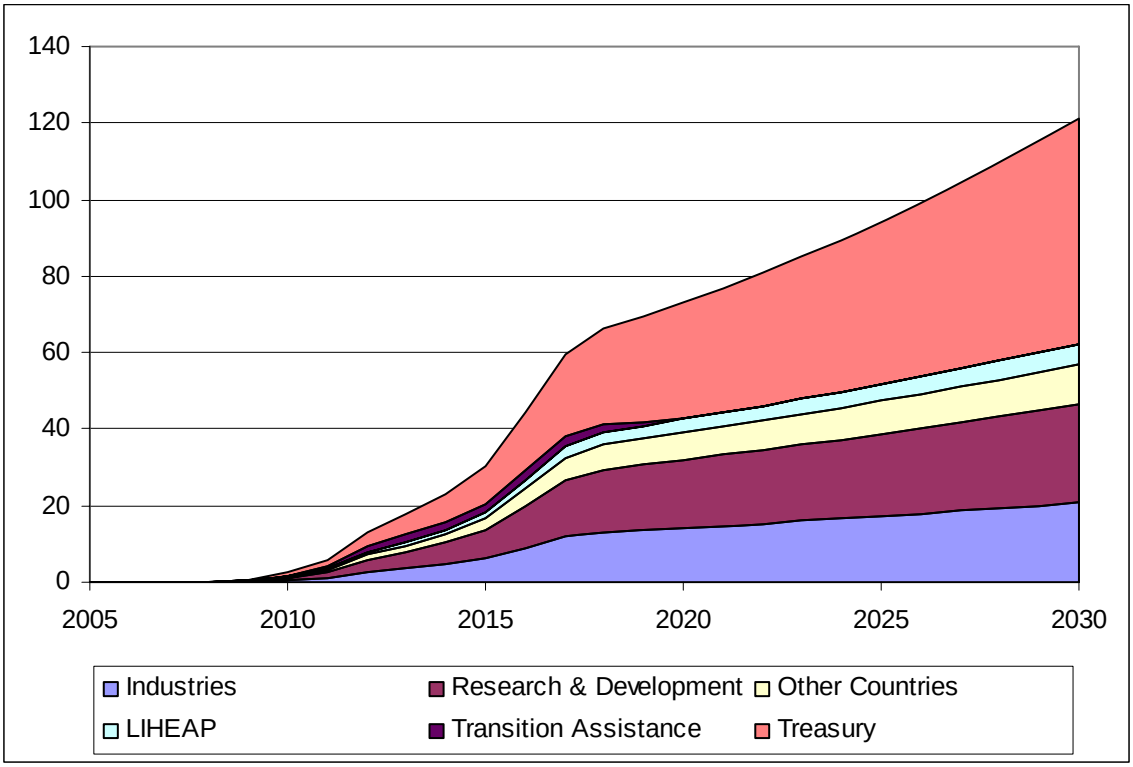
Projection	2004	2020				2030			
		AEO2006 Reference	HR5049 A	HR5049 B	HR5049 C	AEO2006 Reference	HR5049 A	HR5049 B	HR5049 C
Allocation of Allowance Revenue (billion nominal dollars)									
Industries	-	-	14.2	15.7	14.2	-	20.7	25.3	20.7
Research & Development	-	-	17.7	19.7	17.7	-	25.9	31.7	25.9
Other Countries	-	-	7.1	7.9	7.1	-	10.4	12.7	10.4
LIHEAP	-	-	3.5	3.9	3.5	-	5.2	6.3	5.2
Transition Assistance	-	-	0.0	0.0	0.0	-	0.0	0.0	0.0
U.S. Treasury	-	-	30.6	33.5	32.4	-	59.2	69.9	62.5
Total Revenue	-	-	73.2	80.8	75.0	-	121.4	145.9	124.7
Aggregate Prices in the Economy									
WPI - Fuel & Power (1982=1.0)	1.27	1.77	1.88	1.89	1.88	2.49	2.65	2.69	2.65
CPI - Energy (1982/84 = 1.0)	1.51	2.19	2.28	2.29	2.28	2.96	3.10	3.13	3.10
CPI - All Urban (1982/84 = 1.0)	1.89	2.86	2.88	2.88	2.88	3.78	3.80	3.81	3.80
Inflation Rate, Unemployment Rate and the Federal Funds Rate									
Inflation	2.68	3.06	3.10	3.11	3.10	2.67	2.66	2.65	2.65
Unemployment Rate	5.53	4.37	4.43	4.43	4.42	4.90	4.95	4.96	4.95
Federal Funds Rate	1.35	5.24	5.25	5.25	5.24	5.04	4.98	4.97	4.97
Components of GDP (billion 2000 dollars)									
GDP	10,756	17,541	17,514	17,511	17,517	23,112	23,075	23,063	23,075
Consumption	7,589	11,916	11,891	11,888	11,892	15,352	15,315	15,306	15,312
Investment	1,810	3,293	3,288	3,287	3,292	4,985	4,988	4,988	4,988
Government	1,952	2,464	2,475	2,476	2,475	2,838	2,852	2,855	2,852
Exports	1,118	3,776	3,760	3,759	3,759	6,833	6,800	6,793	6,801
Imports	1,719	3,659	3,656	3,655	3,658	6,156	6,158	6,160	6,156
Industry Output (billion 2000 dollars)									
Energy-Intensive Manufacturing	1,161	1,441	1,428	1,427	1,428	1,627	1,612	1,608	1,612
Non-Energy-Intensive Manufacturing	3,044	4,528	4,504	4,501	4,503	5,882	5,848	5,840	5,849
Non-Manufacturing	1,439	1,808	1,802	1,802	1,805	2,069	2,064	2,063	2,065
Services	17,250	28,709	28,660	28,652	28,668	39,053	39,007	38,993	39,005
Total	22,893	36,486	36,394	36,383	36,404	48,630	48,531	48,503	48,530
Industry Employment (thousand)									
Energy-Intensive Manufacturing	2,731	2,764	2,745	2,743	2,744	2,719	2,700	2,695	2,700
Non-Energy-Intensive Manufacturing	11,597	10,513	10,449	10,443	10,450	9,928	9,869	9,853	9,872
Non-Manufacturing	10,634	11,647	11,621	11,619	11,634	12,384	12,382	12,379	12,385
Services	109,593	134,054	134,059	134,057	134,090	150,970	150,954	150,935	150,949
Total	134,555	158,979	158,875	158,862	158,918	176,000	175,904	175,862	175,906

Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

The allocation of allowances or allowance revenues has effects on several categories of the national accounts in the macroeconomic module of NEMS. In the H.R.5049A case, the 25 percent of revenue distributed by the Department of Energy for advanced research, ranging from $0.2 billion in 2009 to $25.9 billion in 2030, is interpreted as an increase in government consumption expenditures. Ten percent of the revenue for developing countries ($0.1 billion in 2009 to $10.4 in 2030) is considered transfer payments out of the United States. Ten percent of the allowances are given to the oil, natural gas, and coal industries which are responsible for submitting allowances for energy-related CO_2 emissions, and 10 percent are given to the electric power sector and energy-intensive industries. Transition assistance is treated as transfer payments from the government to individuals, increases from $0.1 billion in 2009 to $2.7 billion in 2017 and gradually falls to zero in 2020. Five percent ($0.1 billion in 2009 to $5.2 in 2030) goes to the Low-

Income Home Energy Assistance Program (LIHEAP), another type of government transfer payments to individuals. The remainder, plus the revenues from sales of safety-valve allowances by the Treasury, is retained as government revenue (see Figure 3.1).

Figure 3.1. Allocation of allowance revenue in the H.R.5049A case
(billion nominal dollars)



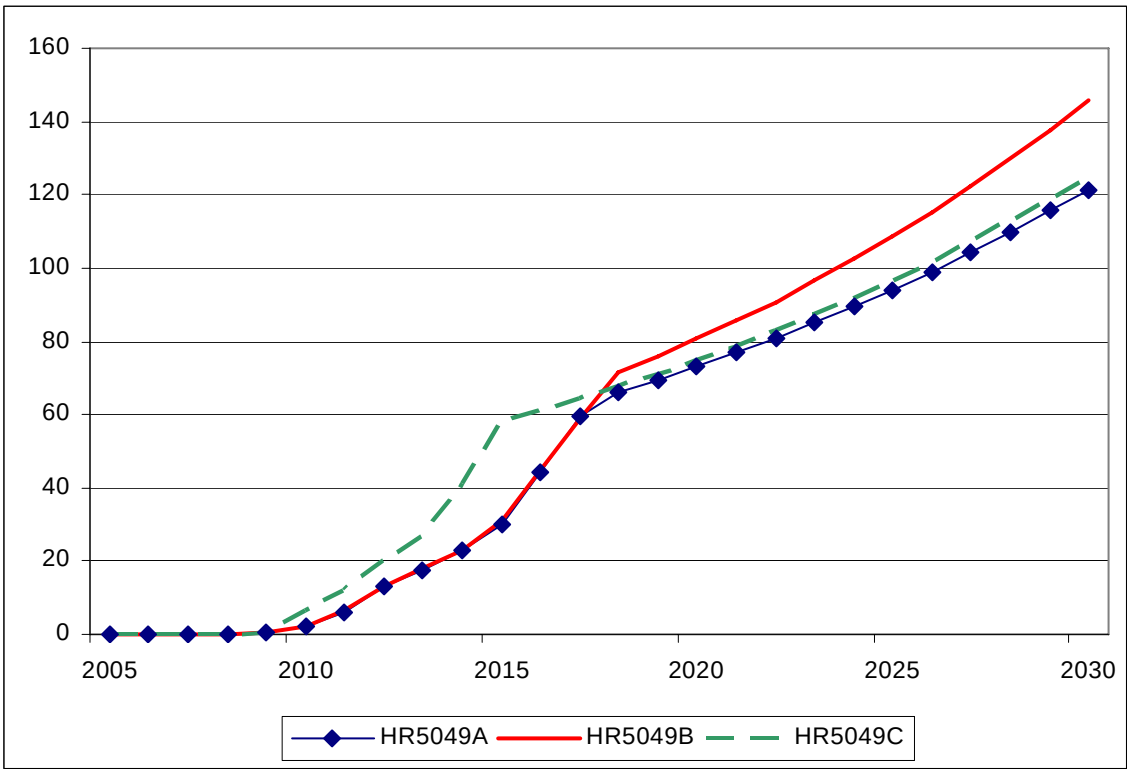
Source: National Energy Modeling System run UPCAP.D080106A

In the H.R.5049B case, the safety-valve price increases by 2 percentage points above the previous year's change in the CPI, compared with 1 percentage point in the H.R.5049A case. Before the allowance price reaches the safety valve, the revenues are the same in both cases. When the allowance price is bound by the safety-valve price, the higher price level in the H.R.5049B case generates higher revenue. In 2030, projected revenue reaches $145.9 billion.

With a lower marginal abatement curve for other GHGs in the H.R.5049C case, demand for the allowances bids up the allowance price, generating more revenue in the first few years of implementation. The allowance price is projected to reach the safety-valve price by 2016, 2 years ahead of the H.R.5049A case. From then onwards, total revenue is constrained by the safety-valve price. In 2030, projected revenue is estimated to be $124.7 billion.

Figure 3.2. Allowance revenue comparison

(billion nominal dollars)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

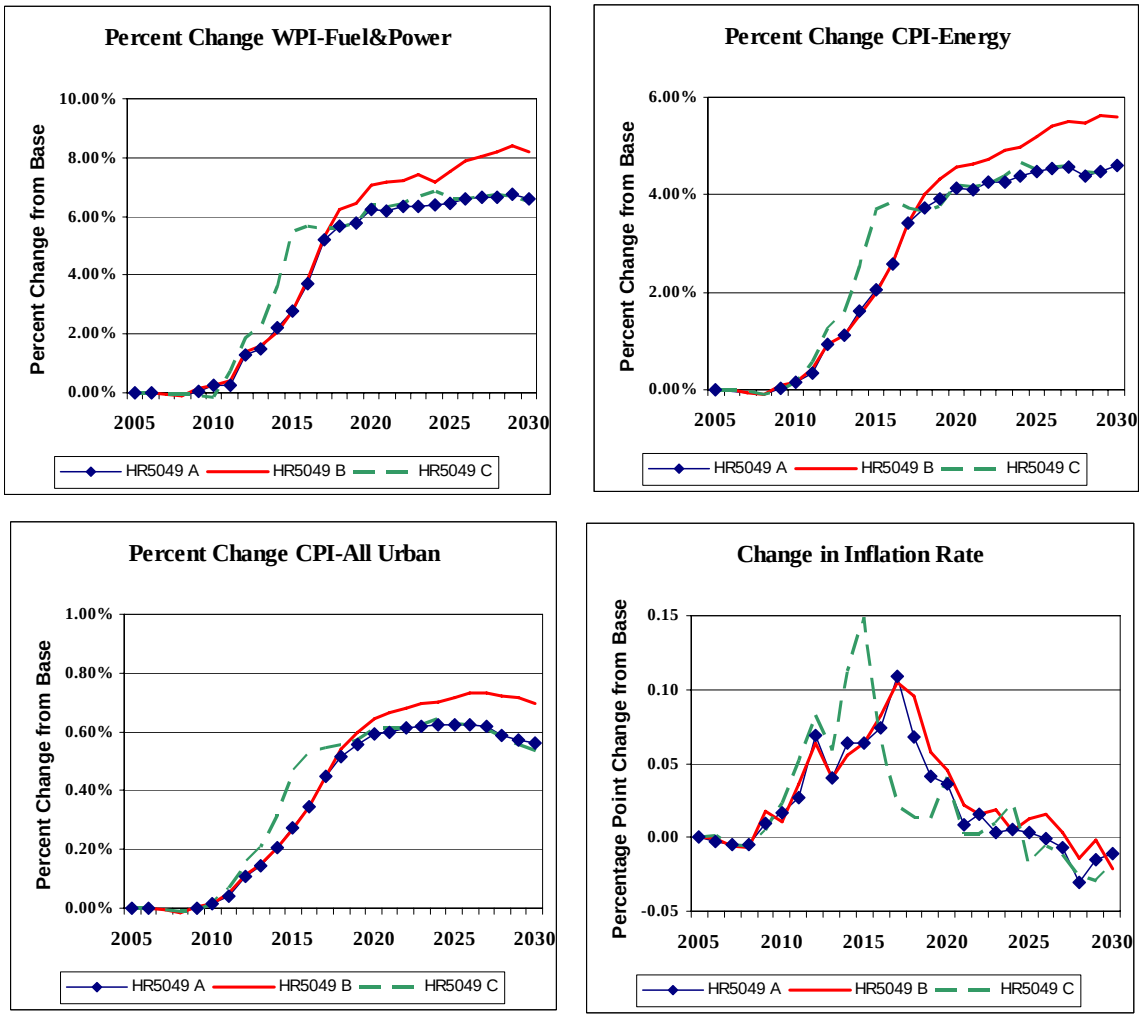
Higher Prices in the Economy

As a direct consequence of the emission allowance costs, aggregate energy prices in the U.S. economy are expected to rise. One way to measure this effect is to look at the percentage change in the *level* of prices in the economy (Figure 3.3). Focusing on the H.R.5049A case, the wholesale price index (WPI) for Fuel & Power rises steadily beginning in 2009 through 2017, reaching approximately 6 percent above the reference case in 2020, but then begins to level off for the remainder of the forecast period as the safety valve limits the rise in permit prices. At the consumer level, the CPI for Energy (CPI-E) reflects the broad effects on the aggregate price for energy goods and services. The CPI-E rises to approximately 4 percent above the reference case by 2020, but begins to level off as the safety valve comes into play. Ultimately consumer sees higher prices directly through final price for energy goods and services paid directly, plus the indirect price increases that come about as intermediate goods and services prices rise as well. The impact on consumer prices is measured by the All-Urban CPI, which rises to 0.6 percent above the reference case in 2020 and remains approximately at this percent difference through 2030. The fourth chart in Figure 3.3 shows the **change in the inflation rate** as opposed to the **percent change in the leve**l of the CPI. The inflation rate is the year-to-year percent change in the level of the CPI. Through 2017, with

energy prices on the rise, the inflation rate is higher than in the reference case. However, by around 2017, the impact on the CPI begins to level off, and the year-to-year (inflation rate) change in the CPI returns to baseline levels. Post 2017, the economy has a higher price level, but it no longer is experiencing higher inflation, and it is actually slightly below the reference case level of inflation after 2025.

Figure 3.3. The Impact on aggregate prices in the economy

(percent change)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

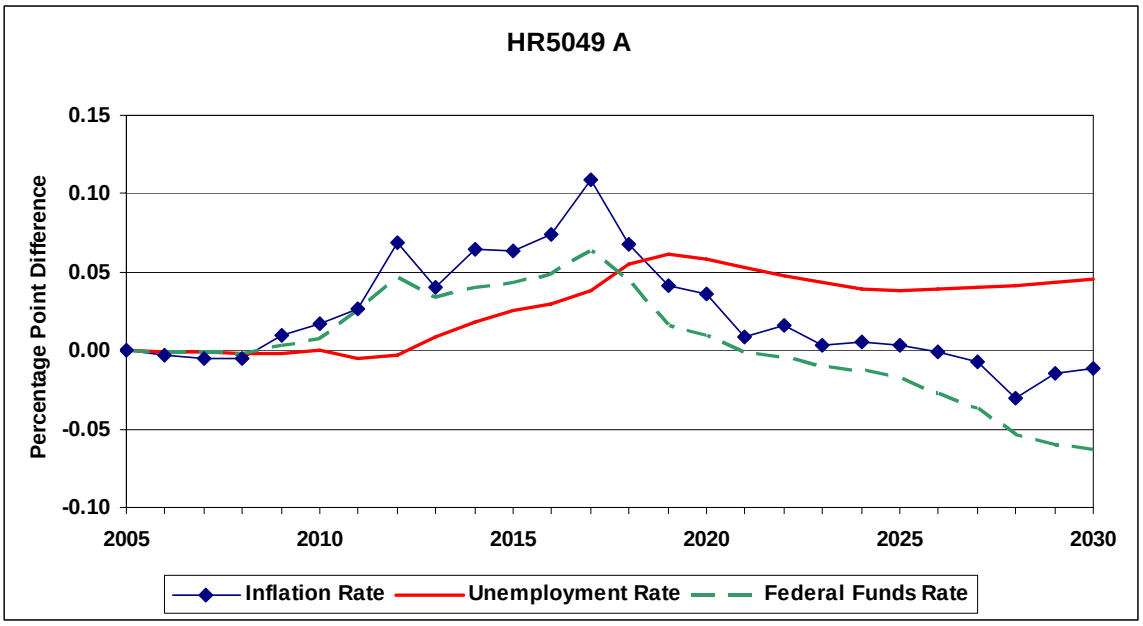
As might be expected, the H.R.5049B case follows the same trajectory as H.R.5049A through 2017, however the higher limit for the safety-valve price results in the permit price rising further. The H.R.5049C case reflects the faster rise in the permit price through 2016 relative to the two other cases, with a faster rise in wholesale and consumer price through 2016. However, once the safety-valve price becomes binding at the H.R.5049A level, this case tracks the H.R.5049A wholesale and consumer price impacts.

Inflation, Unemployment and the Federal Funds Rate

Figure 3.4 focuses on the H.R.5049A case, showing the relationship between changes in projected inflation, the unemployment rate, and the Federal Funds rate. With higher energy prices going though the economy, the price level of the economy continues to rise through 2017 and then levels off at a higher level relative to the reference case, but the rate of change in the price level–the rate of inflation–decelerates after 2017. For example, the inflation rate between 2016 and 2017 in H.R.5049A is 3.12 percent as compared to 3.01 percent in the reference case. The difference in the inflation rate for 2017 is 0.11 percentage point. After 2017, with the slowing in the rise in energy price due to the safety valve, the difference in the inflation rates diminishes and in the 2025 to 2030 period where the inflation rate is below the reference case.

Figure 3.4. Inflation, unemployment rate and the Federal funds rate

(percentage point difference from reference case)



Source: National Energy Modeling System runs AEO2006.D111905A and UPCAP.D080106A

The responses of inflation and unemployment tend to be asymmetric over time. There is a lag between the two effects, with output and employment effects lagging behind price effects by roughly a year. Prices rise in the economy in response to the initial energy price increase then in response to secondary price effects as the costs of intermediate goods and services rise. Businesses, in response to rising prices and lower aggregate demand, absorb the near-term output loss but eventually reduce their use of labor. The Federal funds rate first rise above reference case levels in response to rising prices in the economy. As the impact on the inflation rate lessens, but with the unemployment rate still above reference cases levels, the Federal funds rate falls below the reference case in order to lessen the impact on output and employment in the economy.

Impacts on GDP and its Components

In the long run, higher energy costs would reduce the use of energy by shifting production toward less energy-intensive sectors, by replacing energy with labor and capital in specific production processes, and by encouraging energy conservation. Although reflecting a more efficient use of higher cost energy, this gradual reduction in energy use would tend to lower the productivity of other factors in the production process. The ultimate impacts of greenhouse mitigation policies on the economy will be determined by complex interactions between elements of aggregate supply and demand, in conjunction with monetary and fiscal policy decisions. As such, cyclical impacts on the economy are bound to be characterized by uncertainty. Raising energy prices and, as a result, downstream prices in the rest of the economy could introduce cyclical behavior in the economy, resulting in employment and output losses in the short run. The measurement of losses in actual output for the economy, or real GDP, incorporates the transitional cost to the aggregate economy as it adjusts to its long-run path. Resources may be less than fully employed, and the economy may move in a cyclical fashion as the initial cause of the disturbance— the increase in energy prices—plays out over time. Figure 3.5 shows the impact on GDP in the three cases.[13]

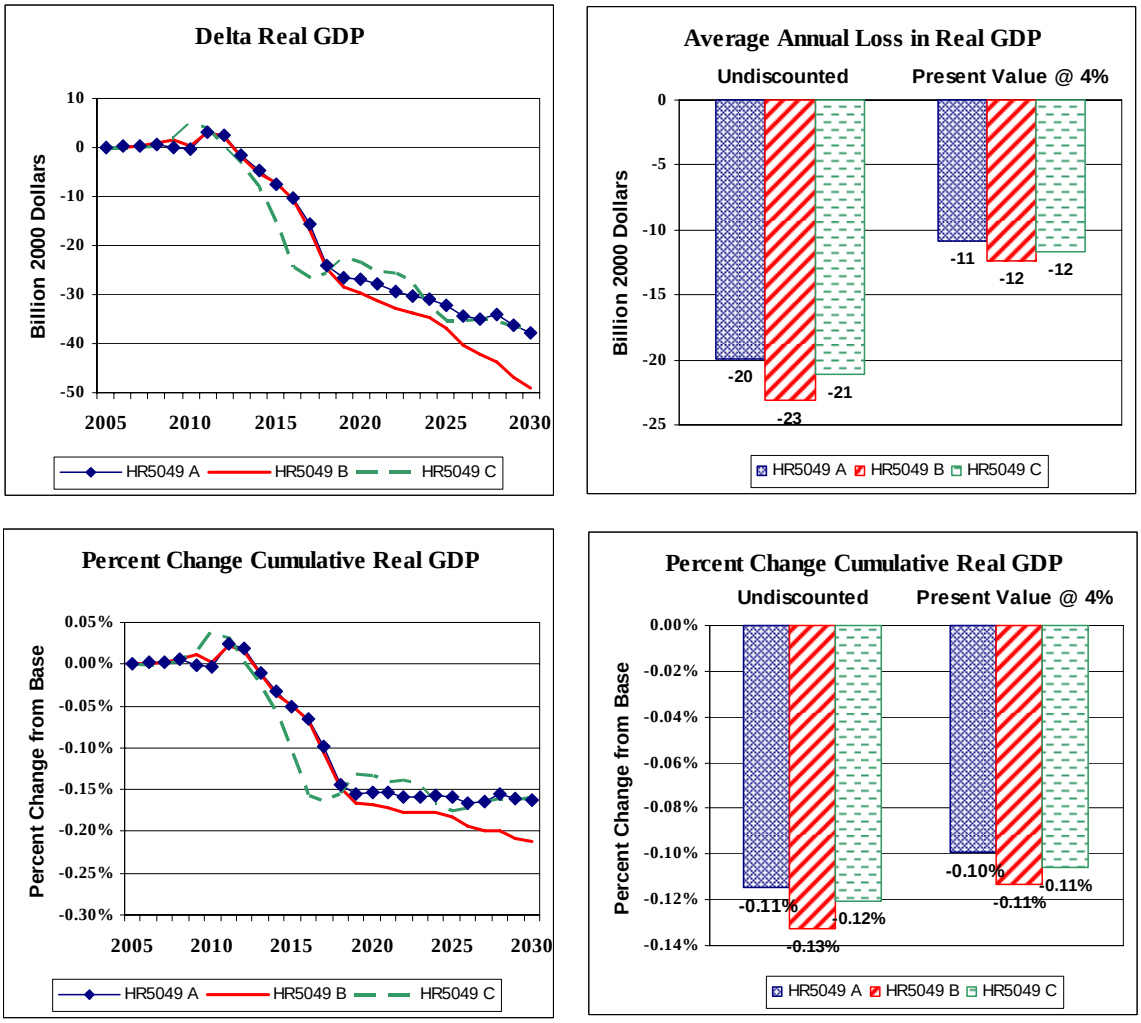
Considering the H.R.5049A case, the loss in GDP increases throughout the entire period, but the most rapid loss occurs between 2009 and 2017. This coincides with the steady upward increase in the allowance price. However, when the allowance price reaches the safety-valve price, the impact on GDP is moderated. By 2020 the loss in GDP is $27 billion, or approximately 0.15 percent, relative to the reference case level in that year. By 2030, the loss in GDP increases to $38 billion, or 0.16 percent of the reference case value which also growing over time. Measured over the entire forecast period, the average annual loss in GDP is approximately $20 billion out of an average annual $17.5 trillion economy between 2009 and 2030. This represents a loss of 0.11 percent in the cumulative GDP in the H.R.5049A case over the 22-year period, relative to the reference case. If the results are computed on a present value basis (starting in 2009 and going through 2030 using a 4-percent discount rate), the average loss in GDP is $11 billion and represents a one-tenth of 1 percent loss in cumulative GDP.

As pointed out in the discussion of the impacts on aggregate prices in the economy, the H.R.5049B case, with a higher safety-valve permit price, and the H.R. 5049C case, with lower availability of abatement for GHGs outside the energy sector, show slightly larger GDP impacts. The view cutting across the three cases reveals that the projected GDP loss in 2030 ranges from $37 to $49 billion (0.16 to 0.21 percent) out of a $23 trillion economy.

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

Figure 3.5. GDP impacts

(difference and percent change)

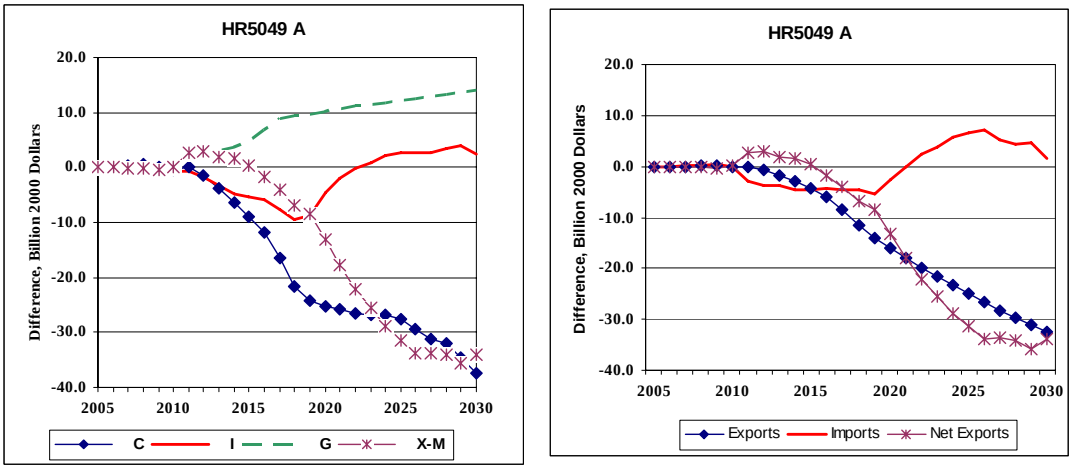


Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

The bill's safety-valve provision has an important role in limiting projected adverse economic impacts. In the No-Safety case the allowance price is $30 per metric ton carbon dioxide equivalent in 2030, over three times as high as the safety-valve price. The loss in GDP in that year is $137 billion as compared to $38 billion in H.R.5049A. The average annual loss is $43 billion, 0.24 percent, in the No-Safety case, compared to a loss of $20 billion, 0.11 percent, in H.R.5049A.

Figure 3.6 focuses on the H.R.5049A case and highlights the relative impacts on components of actual GDP. As discussed above, the loss in GDP reaches $27 billion in 2020 and by 2030 is $38 billion. However, the pattern of impacts varies considerably by component. Consumption of goods and services shows the largest loss over the period, falling by $25 billion in 2020 due to the rise in energy prices and a decline in disposable income. However, after 2020 the impact on consumption is moderated as inflation begins to stabilize to near reference case levels.

Figure 3.6. The impact on components of GDP
(difference)



Source: National Energy Modeling System runs AEO2006.D111905A and UPCAP.D080106A.
Note: C = Consumption; I = Investment; G = Government Spending; (X-M) = Net Exports

Investment is typically a relatively volatile component of GDP. When the economy is growing rapidly, there is a great incentive to invest in order to expand plant and equipment to meet expected new product demand. However, if the economy slows, investment is postponed until the economic outlook is better. Along with these real output effects on investment, interest rates play an important role in business investment incentives. In the H.R.5049A case, investment declines in the 2009-2017 period, in part because of the loss in output in the economy and in part because of an increase in interest rates. However, beginning in 2018, with the impact on consumption moderating and interest rates beginning to move toward, and then below, reference case rates, business investment begins to pick up. This trend continues through 2030.

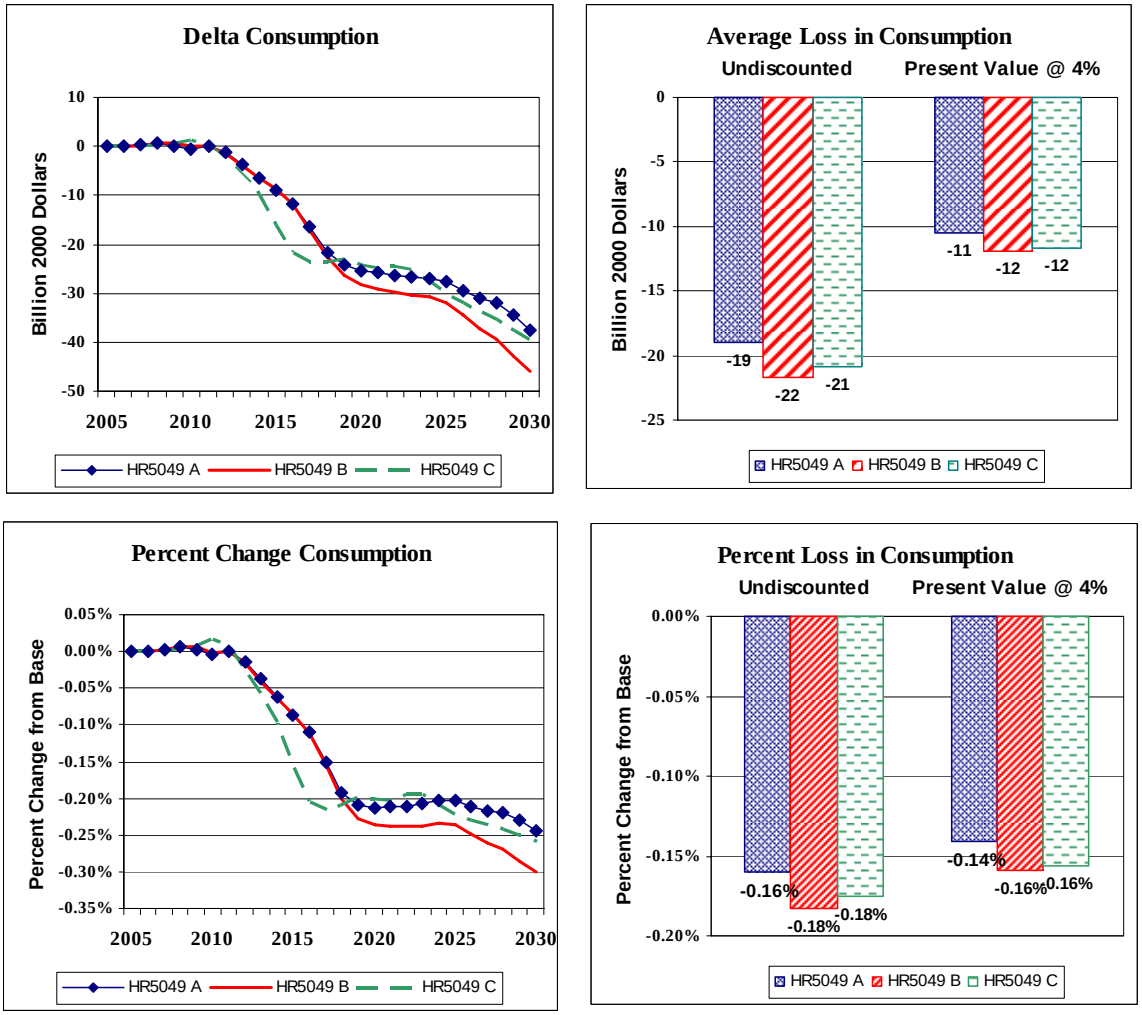
One of the key provisions of the bill calls for the Department of Energy to use 25 percent of the revenue distributed for advanced research. This represents in increase in Federal government consumption expenditures. The nominal dollar values range from $0.3 billion in 2010 to $25.9 billion in 2030. This is reflected in the Government line in Figure 3.6 and is expressed in constant 2000 dollars. By 2020, government expenditures are $10 billion above reference case levels, and although the rate of increase tapers off, government expenditures in 2030 are $14 billion above reference case levels.

Consumption Impacts

Whereas GDP is a measure of what the economy produces, ultimately consumers are interested in purchasing goods and services, which is measured by consumption. As noted above, the loss in consumption represents the largest loss of the four major elements of GDP, consumption, investment, government, and net exports. The top charts in Figure 3.7 show the dollar value loss in consumption over time and the average loss over the entire 2009 to 2030 period. In general, the losses increase faster during the period before the safety-valve price constrains the rise in the permit price, then grow more slowly after 2017 through 2030. The H.R.5049C case shows somewhat larger

impacts early but then are similar to the H.R.5049A case after 2017. The H.R.5049B case is identical to the H.R.5049A case through 2017, but then is slightly worse given the higher safety-valve price. By the end of the forecast period, the consumption losses are all between $38 to $46 billion below the reference case. The average impact for H.R.5049A case reflects a loss of $19 billion, while the other two cases are between $21 and $22 billion.

Figure 3.7. The impact on consumption
(difference and percent change)



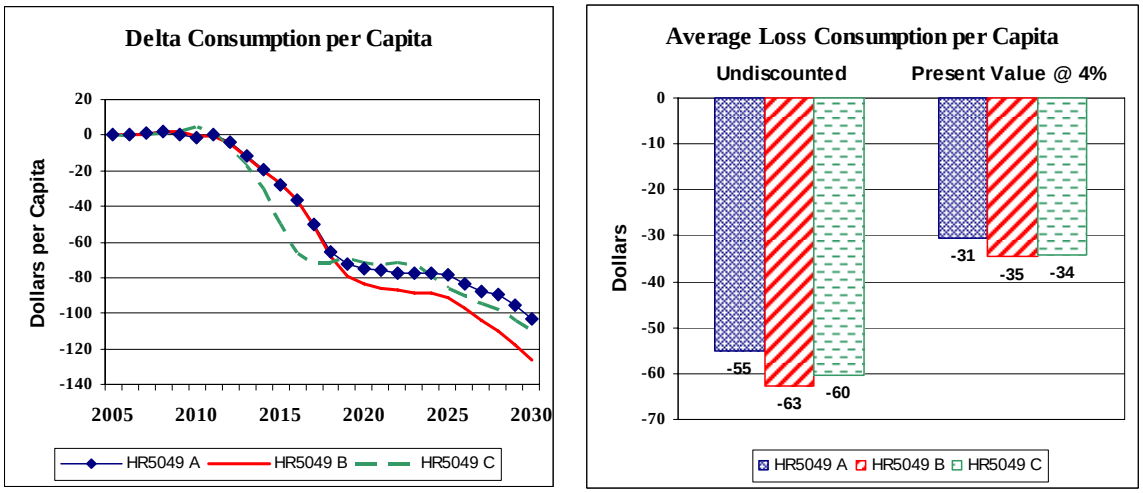
Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

From the perspective of a percent change in consumption relative to reference case levels, the loss is relatively small. By 2030, the three cases range between 0.24 and 0.30 percent below reference case levels. The average percent loss in consumption is between 0.16 and 0.18 percent of the reference case.

Another way to look at the impact on consumers is to calculate the loss in consumption on a per capita basis, as shown in Figure 3.8. By 2020, the loss in consumption is between $71 and $83 per capita, with the loss in 2030 between $103 to $126 per capita.

For the entire period the H.R.5049A shows an average loss in consumption per capita of $55, H.R.5049B $63, and H.R.5049C $60.

Figure 3.8. The impact on consumption per capita
(difference)



Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

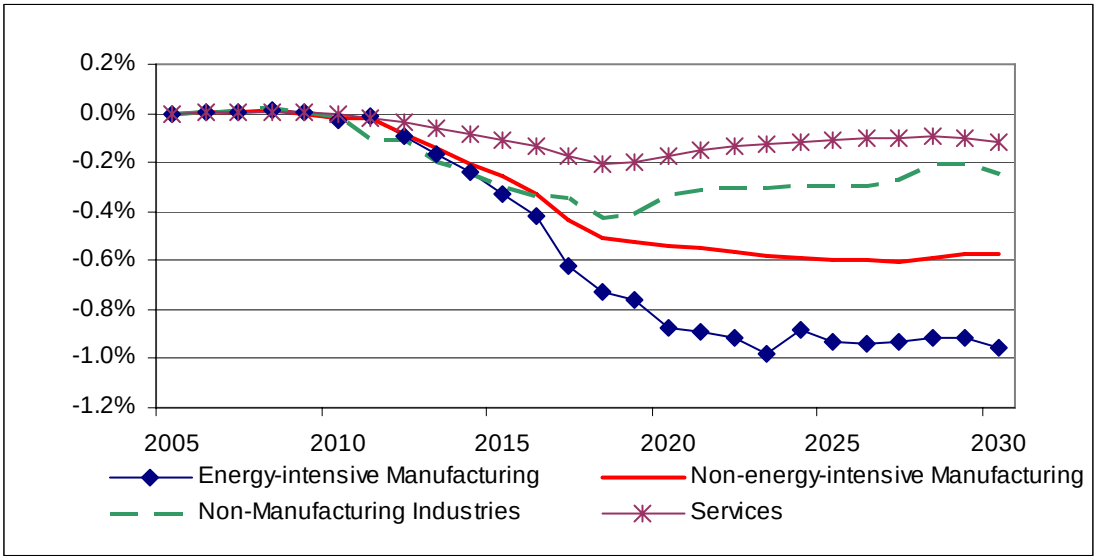
Impacts on Industry Output and Employment

The implementation of H.R.5049 impacts all production activities. The purchase of allowances increases the cost of the emitting sectors, increases in energy prices raise the factor input cost for all industries, and changes in demand for goods and services, as reflected in the final demand categories of consumer spending, investment, government spending and trade, require industries to adjust their production accordingly.

Figure 3.9 shows the trajectories of projected loss in gross output (production in real value terms) in the H.R.5049A case. The energy-intensive manufacturing industries[14] are impacted the most. As the producer prices of fuel and power rises steadily in the first 10 years of implementation to about 6 percent above the reference case, the gross output of this group of industries is expected to be lower by 0.8 percent when compared with the reference case. When the energy prices level off in the latter part of the forecast period, the loss in gross output stabilizes to around 1 percent. The non-energy-intensive manufacturing industries are also affected by the rise in energy prices and fall in final demand, reaching a reduction of 0.6 percent by 2030. The loss in the non-manufacturing industry sector, which covers agriculture, mining, and construction, is expected to be around 0.4 percent and gradually improving to a loss of 0.2 percent below the reference case. Mining of fossil fuels is projected to fall considerably, but the other industries in this group are not affected as much by the bill. Finally, the projected output loss in the services sector varies between 0.1 and 0.2 percent.

[14] Energy-intensive manufacturing industries in NEMS include food, paper, inorganic and organic chemicals, resins, agricultural chemicals, petroleum refining, glass, cement, iron and steel, and aluminum.

Figure 3.9. Change in gross output in the H.R.5049A case relative to the reference case, 2005-2030 (percent)



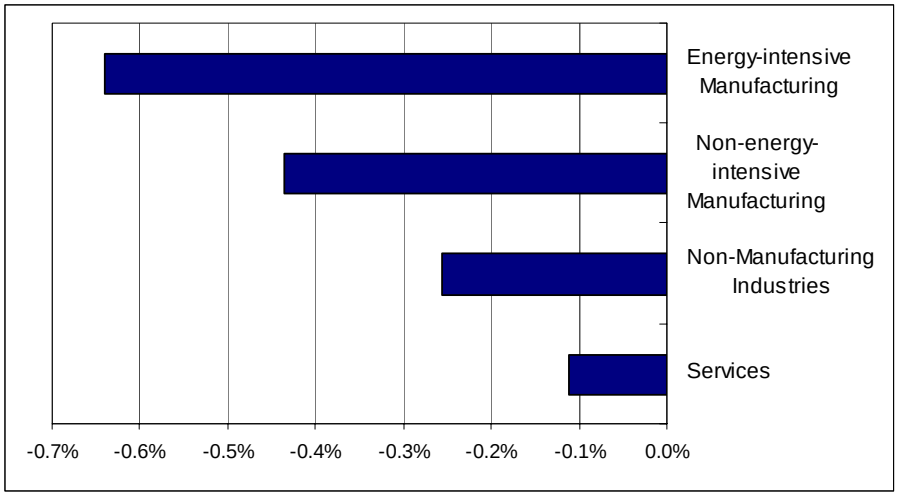
Source: National Energy Modeling System runs AEO2006.D111905A, UPCAP.D080106A, UPCAPS2.D073106B, and UPCAPLOTH.D073106A

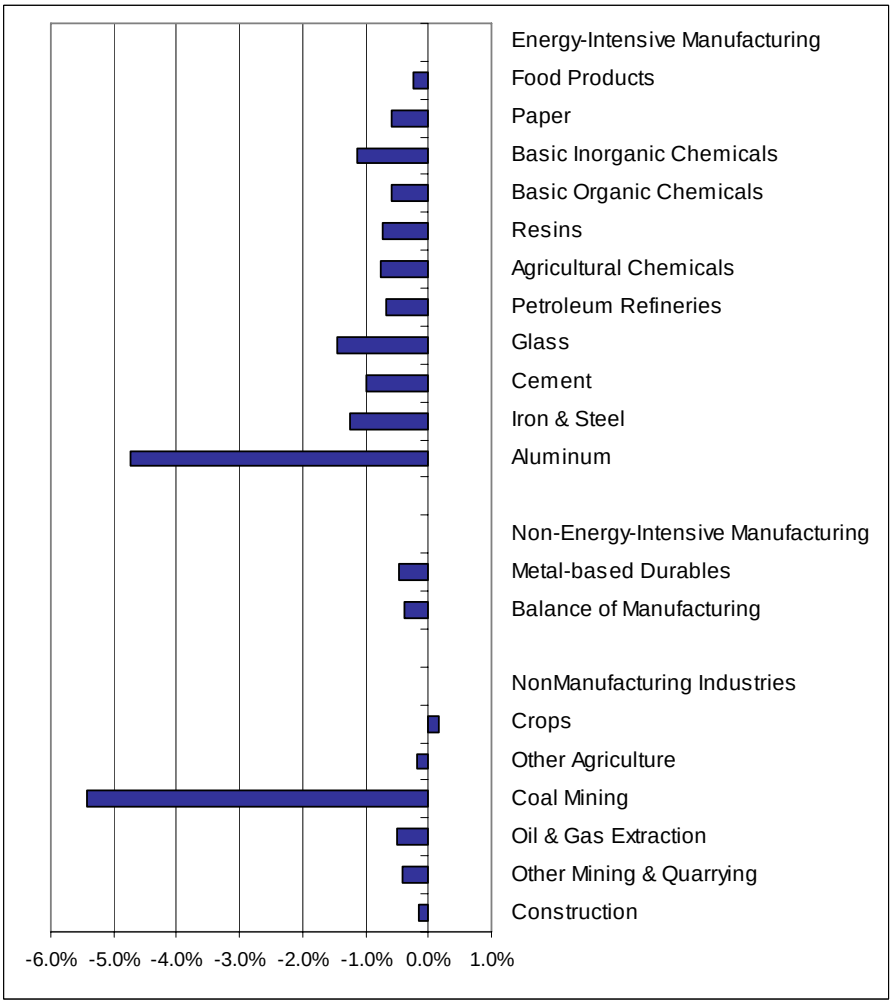
Figures 3.10 shows the average loss in gross output for the broad sectors and the detailed industrial sectors for the period 2009-2030 for the H.R.5049A case. Production of the energy-intensive manufacturing sector is projected to be reduced by an average of 0.64 percent, non-energy-intensive manufacturing by an average of 0.43 percent, non-manufacturing industries by 0.26 percent, and services by 0.11 percent.

Among the detailed energy-intensive industries, aluminum production, which is a heavy user of electricity, is expected to fall by 4.7 percent on average (Figure 3.10). Production of glass, iron and steel, and basic inorganic chemicals are also expected to fall by more than 1 percent. The largest sector in this group, food products, is only marginally affected.

Among the non-manufacturing industries, coal mining is projected to fall by 5.4 percent, followed by oil and natural gas extraction at 0.5 percent. Construction, the largest industry in this group, is expected to have a small impact, as investment in structures recovers quickly in the latter part of the forecast period. Crop production, which includes corn for production of ethanol, is projected to increase slightly.

Figure 3.10. Average change in gross output in the H.R.5049A case relative to the reference case, 2009-2030 (percent)





Source: National Energy Modeling System runs AEO2006.D111905A and UPCAP.D080106A.

H.R.5049 is projected to have a smaller impact on employment than output. First, a portion of employment is not engaged in direct production. Second, the level of direct labor input, especially in the short-run, may be less flexible than the level of production. Also, in the long-run, higher energy prices will induce some substitution from energy to other inputs such as labor, resulting in a higher labor-to-output ratio. Table 3.2 shows the average loss in employment for the period 2009-2030 under the H.R.5049A case. The average loss of total employment is projected to be 58 thousand, or 0.04 percent. Estimated average job loss in the manufacturing and non-manufacturing industries is 70 thousand, or 0.28 percent. Part of this loss is compensated for by an increase in jobs in public service, covered under the service sectors.

Table 3.2. Average Change in Employment in the H.R.5049A Case Relative to Reference Case, 2009-2030

	Thousand	Percent
Total employment	-58	-0.04%
Industrial sectors	-70	-0.28%
Manufacturing	-58	-0.44%
Energy-intensive	-13	-0.47%
Non-energy-intensive	-45	-0.43%
Non-manufacturing	-12	-0.10%
Service sectors	+12	+0.01%

Source: National Energy Modeling System runs AEO2006.D111905A and UPCAP.D080106A.

Appendix A. Analysis Request Letter

Congress of the United States
Washington, DC 20515

May 2, 2006

The Honorable Guy Caruso
Administrator
Energy Information Administration
1000 Independence Avenue S.W.
Washington, D.C. 20585

Dear Administrator Caruso,

We are writing to request an economic and industry analysis of the impacts that would result from enactment of H.R. 5049, the Keep America Competitive Global Warming Policy Act. A similar analysis was done by EIA concerning S. 139, the Climate Stewardship Act and subsequent amendments to that policy.

H.R. 5049 is a new approach to the global warming issue, more modest than its predecessors. The policy we set forth in our legislation takes steps to minimize the negative effects greenhouse gas emissions policy might have on the American economy. For example, greenhouse gas emission allowances are allocated to energy producers and those individuals and communities who are potentially dislocated by the policy. In short, we believe our policy will not cost Americans their jobs. The bill also employs a policy device known as a safety valve to limit cost run-up in the cap and trade allowance system, providing certainty to investors in the energy sector.

This matter is of increasing importance to the American people and we would appreciate a timely response in order to better inform debate on the House floor.

Sincerely,

Tom Udall
Member of Congress

Tom Petri
Member of Congress

Appendix B. Followup Letter

Congress of the United States
Washington, DC 20515

June 13, 2006

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

Dear Mr. Caruso

In a letter dated May 2, 2006, we requested that the Energy Information Administration (EIA) analyze the economic and industry impacts that would result from enactment of H.R. 5049, the Keep America Competitive Global Warming Policy Act.

Recently, our staff met with Ron Earley, Dan Skelly, and Erik Rasmussen of your staff, who asked that we provide further guidance regarding the interpretation of specific aspects of our bill and certain key assumptions to be used in the analysis. Accordingly, we offer the following guidance:

In general:

1. In keeping with the conventions used in your *Annual Energy Outlook 2006*, report energy and allowance costs in constant 2004 dollars, and report macroeconomic indicators, such as GDP, in constant 2000 dollars.

Allowance System

2. Assume the allowance system regulations are issued on July 1, 2008, and that allowances are issued annually beginning on January 1, 2009.

3. Section 3(b) in the bill provides some latitude to the EPA Administrator in establishing the prospective number of allowances issued based on the emissions trend over the three preceding years. For purposes of the EIA analysis, assume that the number of allowances issued per Sec. 3(b) in 2009 and thereafter is equal the forecast values for greenhouse gas (GHG) emissions for 2009 as presented in the 2006 Annual Energy Outlook (AEO 2006). Assume the allowances issued remain at that level throughout your projection horizon.

4. Based on Section 4 of the bill, assume the allowances are allocated as follows:

25 % DOE for R&D programs
10 % State Department for investment in developing countries

35 % EPA for use
5 % to fossil fuel electric generation industry
5 % to petroleum and natural gas industries
5% to coal industry
5% to energy-intensive industries
15% to transition assistance to individuals and local government through states in year 1 (reduced by 1.5 percent per year thereafter)

5% Low Income Home Energy Assistance Program (LIHEAP) assistance to individuals through states

25% U. S. Treasury general fund

5. Assume there is no allowance banking, given the 2-year expiration time for allowances.

6. Per Sec. 5, analyze two possible trends for safety valve allowance prices, each starting at $25 per metric ton of carbon in 2009 (nominal dollars). In the first case, assume the nominal safety valve price grows each year at a rate matching the projected growth in the Consumer Price Index--All Urban, plus 1.0 percentage point. In the second case, assume a 2.0 percentage point addition to the projected CPI-All Urban growth rate. For projections, use the CPI—All Urban rates presented in AEO2006.

7. Per Sec. 5, the U.S. Treasury can sell an unlimited number of allowances at the safety valve price. Assume all proceeds from the sale of these safety valve allowances flow to the general fund in the U.S. Treasury.

8. The bill addresses emissions of six classes of greenhouse gases, as well as carbon sequestration. We understand that EIA's model provides estimates of energy-related carbon dioxide emissions and that in previous studies you have used external estimates of abatement opportunities for the other greenhouse gases and carbon sequestration outside the energy sector. For this analysis, assume the bill coverage extends to the other greenhouse gases for which you have readily available abatement cost and sequestration information, consistent with assumptions in your recent analyses of the Climate Stewardship Act and the climate proposal by the National Commission on Energy Policy.

Spending Provisions of the Bill

9. We understand that no program-specific content can be modeled by EIA in NEMS, with one possible exception -- LIHEAP. This would lower the price paid for energy to this group and lower the overall price for energy by a small margin.

10. We understand that the analysis will indicate that there is a flow of funds from the Federal government to individuals, but the EIA will not do a detailed assessment of the impact of the state level features of the bill.

11. Also, there will be a flow of funds from the Federal government to finance projects overseas. We understand that EIA cannot assess these overseas projects.

12. Although there may be Federal budget implications of the provisions of this bill, EIA will not analyze the possible Federal budget impacts.

We understand that this request is coming to you just as you are beginning the development of the 2007 Annual Energy Outlook. We request that this analysis be completed by mid-August, as discussed with your staff.

Please do not hesitate to contact us or our staff should you have questions regarding any of the above.

Sincerely,

Tom Udall

Tom Petri