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Assessment of Selected Energy Efficiency Policies

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Executive Summary

This report responds to a request from Senator Byron L. Dorgan, asking the Energy Information Administration (EIA) to undertake a quantitative analysis of a variety of energy efficiency policies using assumptions provided by the Alliance to Save Energy (ASE). EIA screened a broad range of potential policies and provided preliminary estimates of their energy market impacts. Based on this information, two multi-policy cases were identified as the subject for more detailed analysis.

The analysis was conducted using the National Energy Modeling System (NEMS) of EIA, incorporating the data and assumptions from the reference case of the *Annual Energy Outlook 2005* (*AEO2005*).[1] The reference case assumes that all current laws and regulations remain as enacted, with no additional policy changes other than those assumed in this analysis.

Case 1 includes:

- Tax credits from 2006 to 2010 for builders of new homes and owners of existing homes for the adoption of building upgrades and the installation of new equipment and appliances meeting certain efficiency criteria.[2]
- Upgraded efficiency standards for residential furnaces and furnace fans in 2011, for torchiere lamps in 2007, for ceiling fan light kits in 2009, and for manufactured homes in 2007.
- Tax credits for commercial building owners for new heating and cooling equipment installed between 2006 and 2010 that meets certain efficiency criteria.
- Upgraded commercial efficiency standards for pre-rinse spray valves in 2008 and for air conditioners, reach-in refrigerators, and distribution transformers in 2010.
- Tax credits for small combined heat and power systems (less than 15 megawatts generating capacity) installed between 2006 and 2008.
- A voluntary agreement policy to achieve an industrial energy intensity reduction of 2.5 percent annually from 2006 to 2016, with assumed participation by 10 percent of the sector.
- Reform of the current Corporate Average Fuel Economy (CAFE) test procedures to eliminate a 20-percent shortfall between tested fuel economy values and those achieved during actual on-road driving, to be phased-in between 2008 and 2012.
- Implementation of an Energy Efficiency Performance Standard (EEPS) for natural gas and electricity suppliers in five States to reduce growth in their customers' energy use by 0.75 percent per year from 2009 to 2025. The natural gas and electricity suppliers in five "average States" would be required to implement or sponsor efficiency programs to achieve verifiable energy savings in the residential, commercial, and industrial sectors.

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[1]Energy Information Administration, *Annual Energy Outlook 2005*, DOE/EIA-0383(2005) (Washington, DC, February 2005), web site www.eia.doe.gov/oiaf/aeo/index.html.

[2]The tax credits for new homes and existing home envelopes were assumed to apply from 2006 to 2008. The credits for new appliances were assumed to apply from 2006 to 2010.

In addition to the policies in Case 1, Case 2 includes:

- Revisions to residential building codes in 2009, 2012, and 2015 and to commercial building codes in 2007, 2010, and 2013 to improve energy efficiency.
- A voluntary agreement program in the electric and natural gas industries to increase their energy efficiency from 2006 to 2016. The energy intensity reduction goals are 5 percent for electricity, applied to fossil- and biomass-fueled plants, and 5 percent for natural gas, applied to 25 percent of pipeline fuel and lease and plant fuel.
- The EEPS for natural gas and electricity suppliers would be implemented nationally, with an annual growth reduction target of 0.5 percent per year.

EIA simulated some of the policies, including most of the tax incentives, appliance standards, and building code policies, based on the effective changes in cost resulting from the tax incentives or the changes in efficiency mandated by the regulations. However, the voluntary programs and energy efficiency performance standards could not be explicitly modeled within NEMS. These policies reflect efficiency targets to be achieved without regard to how the goals are met. Because of the generic nature of these policies, it was not possible to model them in detail or to evaluate their feasibility or costs. For these policies, this report uses assumptions regarding the degree of compliance and energy savings achieved that were provided to EIA as a part of the request for this study. EIA has no basis for taking a position on whether such programs would actually achieve the specified outcomes or whether they would be cost-effective.

Summary of Results

Energy Consumption. Compared to the reference case of the *AEO2005*, total projected energy consumption in 2025 is reduced by 3.9 quadrillion Btu (2.9 percent) in Case 1 and by 9.3 quadrillion Btu (7.0 percent) in Case 2. The energy reductions under both policy cases increase over time, as the policies are generally phased-in or are targeted to achieve a steady reduction in energy growth. Also, policies that call for improvements in the efficiency of new equipment and vehicles will impact the market slowly because of gradual equipment turnover. As a result, projected policy impacts on total energy consumption in 2015 are roughly half the 2025 impacts in both policy cases.

Energy Reductions by Fuel Type. The 2025 energy reduction in Case 1 consists of petroleum (2.4 quadrillion Btu, or a 4.5-percent reduction), followed by coal (1.0 quadrillion Btu, or 3.4 percent), and natural gas (0.5 quadrillion Btu, or 1.6 percent). In Case 2, projected coal use is reduced by 12.7 percent compared to the reference case in 2025, natural gas by 7.9 percent, and petroleum by 4.8 percent.

Energy Reductions by Sector. About half of the Case 1 reductions in energy use in 2025 occur in the transportation sector as a result of the more stringent CAFE testing policy, which requires manufacturers to increase the average fuel economy of new light-duty vehicles.

In Case 2, the energy savings are more evenly split across the four end-use sectors. The Case 2 energy savings in 2025 attributed to electricity generation account for just over half the total reductions. These savings occur primarily as a result of the national-level EEPS policy for electricity and the electricity sector voluntary agreement policy.

Sales of electricity in 2025 are 2.4 percent less in Case 1 than in the *AEO2005* reference case, while power sector energy use falls by 1.6 percent. Because the reduced electricity demand also reduces the need for new, more efficient generating capacity, the average efficiency of electricity generation in Case 1 is less than in the *AEO2005* reference case. As a result, the reductions in energy use for generation are less than proportional to the reductions in electricity demand.

Import Dependence. The net import share of oil consumption falls from 68.4 percent in 2025 in the reference case to 67.3 percent in both multi-policy cases. The Case 2 polices, which result in a substantial reduction in natural gas consumption in 2025 (7.9 percent) compared to the reference case, also reduce dependence on imported natural gas in 2025 from 28.2 percent in the reference case to 26.1 percent in Case 2.

***Prices*.** Given the absence of information regarding the implementation of key policies included in the two integrated policy suites, EIA was not able to reliably estimate impacts on delivered energy prices and energy expenditures. For example, based on experience, it would be reasonable to expect that programs used to meet demand-reduction obligations placed on electricity and gas suppliers subject to an EEPS would be financed through surcharges on consumer bills. However, estimates of the cost of demand reduction in past programs vary widely, and there is no clear basis for using a particular estimate to represent the unspecified programs that might be pursued. While demand reduction itself tends to lower retail energy prices, the cost of programs used to reduce demand in these policy suites could partially, fully, or more than fully offset this effect.

***Macroeconomic Impacts*.** The macroeconomic impacts from the policies are uncertain, because the implementation costs are not fully reflected in the modeling of energy prices. Therefore, the cumulative losses from the policies on the demand side of the economy, as measured by actual gross domestic product (GDP), could not be quantified. Such losses would arise from the adjustment and relocation costs associated with changing energy consumption as the economy adjusts to a longer-run equilibrium path. However, some indication of the macroeconomic impact of the policies can be inferred from the effect of reduced energy use on the supply potential of the economy, as measured by potential GDP.[3] The productivity of the economy is reduced as the mix of energy, labor, and capital stock adjusts to the new policies. Based on productivity losses alone, the estimated cumulative loss in potential GDP for Case 1 is $445 billion, which represents 0.14 percent of total potential GDP over the entire 2006 to 2025 period. For Case 2, the cumulative loss is $864 billion and represents a loss of 0.27 percent of potential output over the entire period. These losses in potential GDP would be mitigated if implementation of the proposed policies resulted in a reduction in delivered energy prices.

[3]The aggregate supply potential of the economy is embodied in a concept identified as potential GDP. Potential GDP reflects the supply potential of the economy at full employment, while real GDP (or actual GDP) reflects the actual economy, which may have unemployed or underutilized resources.

Carbon Dioxide Emissions. Overall carbon dioxide emissions in 2025 are reduced by 282 million metric tons (3.5 percent) in Case 1, relative to the *AEO2005* reference case, and by 671 million metric tons (8.3 percent) in Case 2.

Contribution of Individual Policies

Table ES1 summarizes the effects of the individual policies on energy consumption relative to the *AEO2005* reference case.

As indicated previously, the energy reductions for the voluntary programs and EEPS policies reflect assumptions provided to EIA as part of the request for this study. The EEPS for natural gas and electricity suppliers alone provides 63 percent (5.9 quadrillion Btu) of the total energy savings of 9.3 quadrillion Btu in Case 2 in 2025. The smaller five-State EEPS programs included in Case 1 account for about 22 percent of the projected Case 1 energy savings of 3.9 quadrillion Btu in 2025.

The CAFE reform policy, included in both multi-policy cases, accounts for 50 percent of the energy savings projected for 2025 in Case 1 and 21 percent of the Case 2 savings in 2025.

The policies having the least cumulative impact on energy consumption are the tax incentives (tax credits for new and existing homes, residential and commercial tax credits for efficient equipment and building shells, and an investment tax credit for small combined heat and power plants). Together, these policies, which have a greater impact early in the projection period when the incentives are in effect, reduce projected energy consumption in 2010 by 0.04 quadrillion Btu (less than 0.1 percent) compared to the reference case.

CAFE Test Reform. The CAFE test reform policy has the following impacts, which are virtually identical in Case 1 and Case 2:

- Compared to the *AEO2005* reference case, the increased light-duty vehicle fuel economy projected in Case 1 reduces transportation petroleum consumption by 3.3 percent (1.1 quadrillion Btu) in 2015 and by 5.0 percent (1.9 quadrillion Btu) in 2025.
- In Case 1, light-duty vehicle travel in 2025 increases by 2.2 percent (91 billion miles annually) compared to the *AEO2005* reference case, because increased vehicle fuel economy reduces the cost of driving.
- The increased penetration of advanced technologies required to meet the more stringent CAFE test procedures increases the average price of a new light-duty vehicle in Case 1 compared to the *AEO2005* reference case. In 2015, the average price of a new car is $530 higher and the average price of a new light truck is $620 higher (2003 dollars). In 2025, the average incremental price increase for cars is $400 and for light trucks is $480.
- As a result of increased new vehicle prices, projected sales of new light-duty vehicles decrease relative to the *AEO2005* reference case. In 2015, new light-duty vehicle sales decrease by 2.5 percent (470,000 vehicles), with 61 percent of that reduction attributed to a decrease in sales of light trucks. In 2025, new light-duty vehicle sales decrease by 2.2

percent (460,000 vehicles), with the decrease in new light truck sales accounting for 67 percent of the total reduction.

Table ES1. Policy Impacts Relative to the *AEO2005* Reference Case
(Quadrillion Btu)

	2010	2015	2020	2025	Cumulative 2006-2025
Primary Energy Use by Sector in the *AEO2005* Reference Case					
Residential	23.47	24.58	25.56	26.62	491.5
Commercial	20.29	22.18	24.24	26.74	449.6
Industrial	35.47	36.58	38.19	39.53	737.4
Transportation	32.04	34.96	37.61	40.28	700.9
Total	**111.27**	**118.29**	**125.60**	**133.18**	**2,379.4**
Change in Energy Use from the Reference Case by Sector and Policy					
Residential					
Ceiling Fan Efficiency Standard	-0.055	-0.127	-0.214	-0.300	-2.736
Furnace/Furnace Fan Standard	-0.012	-0.076	-0.119	-0.153	-1.551
Torchiere Lamp Standard	-0.044	-0.086	-0.088	-0.092	-1.371
Building Codes (HUD Type)	-0.005	-0.009	-0.013	-0.016	-0.184
Building Codes (Non-HUD Type)	-0.020	-0.097	-0.186	-0.264	-2.253
New Home Tax Credits	-0.001	-0.001	-0.001	-0.001	-0.024
Existing Home Tax Credits	-0.024	-0.021	-0.020	-0.018	-0.406
Equipment Tax Credits	-0.011	-0.011	-0.008	-0.005	-0.166
Commercial					
Air Conditioner Efficiency Standard	-0.011	-0.052	-0.078	-0.097	-0.986
Refrigerator Efficiency Standard	-0.001	-0.003	-0.005	-0.006	-0.059
Pre-rinse Spray Valve Standard	-0.045	-0.077	-0.077	-0.078	-1.235
Distribution Transformer Standard	0.000	0.000	0.000	0.000	-0.001
Equipment Tax Deductions	-0.005	-0.003	-0.002	-0.001	-0.053
Building Codes	-0.085	-0.238	-0.379	-0.529	-5.047
Other Policies Modeled Using NEMS					
CAFE Reform, Fuel Economy Testing	-0.258	-1.125	-1.582	-1.942	-20.581
CHP Tax Credits[1]	NA	NA	NA	NA	NA
Multi-Policy Cases, Including EEPS and Voluntary Policies					
Case 1	-0.603	-2.005	-2.868	-3.914	-39.759
Case 1 Subset[2]	-0.399	-1.493	-2.022	-2.663	-27.346
Case 2	-1.530	-4.517	-7.258	-9.335	-93.443

CHP: Combined heat and power. HUD Type: Manufactured homes regulated by the U.S. Department of Housing and Urban Development. NA: not applicable.

[1]The induced increase in CHP capacity increases commercial and industrial energy consumption while decreasing electric power sector consumption. The overall effect is a reduction in primary energy use of less than 0.005 quadrillion Btu per year, the amount dependent on the type of power plants displaced. With the relatively small change in CHP capacity, a precise estimate of the differences in energy use is unavailable, given the solution tolerances in NEMS.

[2]This case includes all the policies in Case 1 except for the five-State EEPS and the industrial voluntary agreements case.

Source: Energy Information Administration, National Energy Modeling System. *AEO2005*, run AEO2005.D102004A; Case 1, run DORG_V1.D031105A; Case 2, run DORG_V2.D031105A; Case 1 Subset, run DORG_V1E.D041305A. Other results from individual sector model test runs derived from the reference case and multi-policy runs.

1. Background

In a letter on September 29, 2004,[1] Senator Byron L. Dorgan requested that the Energy Information Administration (EIA) conduct a quantitative analysis of a broad set of energy efficiency policies that have evolved from his staff's work with the Alliance to Save Energy (ASE). Senator Dorgan asked EIA to meet with his staff to obtain details on the policies to be analyzed and the assumptions to be made in the analysis. In the letter, EIA was asked to examine the energy and economic impacts of the policies and to identify those policies with the potential to significantly reduce the dependence of the United States on imported energy and reduce emissions. EIA used the National Energy Modeling System (NEMS)[2] to represent the policies, with the results of the *Annual Energy Outlook 2005 (AEO2005)*[3] used as a policy-neutral reference case.

An initial list of approximately 50 candidate policies and variations was provided to EIA. EIA was able to represent many of the policies in NEMS and completed 30 preliminary, partial NEMS runs to evaluate the policies individually. In most of the runs, only the portion of NEMS representing the sector affected by the policy was used. While such partial runs provide some insight into first-order impacts, they do not include all the price and macroeconomic feedbacks that would occur in a full, integrated NEMS run. Based on this preliminary screening, two multi-policy cases were identified as the subject for more detailed analysis. The reference case assumes that all current laws and regulations remain as enacted, with no additional policy changes other than those assumed in this analysis. The policies included in the two multi-policy cases are as follows.

Case 1 includes:

- Tax credits from 2006 to 2010 for builders of new homes and owners of existing homes for the adoption of building upgrades and the installation of new equipment and appliances meeting certain efficiency criteria.[4]
- Upgraded efficiency standards for residential furnaces and furnace fans in 2011, for torchiere lamps in 2007, for ceiling fan light kits in 2009, and for manufactured homes in 2007.
- Tax credits for commercial building owners for new heating and cooling equipment installed between 2006 and 2010 and that meets certain efficiency criteria.
- Upgraded commercial efficiency standards for pre-rinse spray valves in 2008 and for air conditioners, reach-in refrigerators, and distribution transformers in 2010.

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[1]See Appendix A for a copy of the letter requesting the analysis.

[2]Energy Information Administration, *The National Energy Modeling System: An Overview 2003*, DOE/EIA-0581(2003) (Washington, DC, March 2003). Detailed documentation is available on the EIA web site at www.eia.doe.gov/bookshelf/docs.html.

[3]Energy Information Administration, *Annual Energy Outlook 2005*, DOE/EIA-0383(2005) (Washington, DC, February 2005), web site www.eia.doe.gov/oiaf/aeo/index.html.

[4]The tax credits for new homes and existing home envelopes were assumed to apply from 2006 to 2008. The credits for new appliances were assumed to apply from 2006 to 2010.

- Tax credits for small combined heat and power systems (less than 15 megawatts generating capacity) installed between 2006 and 2008.
- A voluntary agreement policy to achieve an industrial energy intensity reduction of 2.5 percent annually from 2006 to 2016, with assumed participation by 10 percent of the sector.
- Reform of the current Corporate Average Fuel Economy (CAFE) test procedures to eliminate a 20-percent shortfall between tested fuel economy values and those achieved during actual on-road driving, to be phased-in between 2008 and 2012.
- Implementation of a five-State Energy Efficiency Performance Standard (EEPS) for natural gas and electricity suppliers to reduce growth in their customers' energy use by 0.75 percent per year from 2009 to 2025. The natural gas and electricity suppliers in five "average States" would be required to implement or sponsor efficiency programs to achieve verifiable energy savings in the residential, commercial, and industrial sectors.

In addition to the policies in Case 1, Case 2 includes:

- Revisions to residential building codes in 2009, 2012, and 2015 and to commercial building codes in 2007, 2010, and 2013 to improve energy efficiency.
- A voluntary agreement program in the electric and natural gas industries to increase their energy efficiency from 2006 to 2016. The energy intensity reduction goals are 5 percent for electricity, applied to fossil- and biomass-fueled plants, and 5 percent for natural gas, applied to 25 percent of pipeline fuel and lease and plant fuel.
- The EEPS for natural gas and electricity suppliers would be implemented nationally, with an annual reduction target of 0.5 percent per year.

The treatments of these policies in NEMS fall into two categories: (1) policies represented explicitly by the specific end use or equipment class affected and (2) policies included in the projections with assumed impacts to meet aggregate targets. For policies in the first category, including the tax incentives, appliance standards, building codes, and CAFE testing reform, the impacts were estimated in NEMS by simulating the market response to the specific changes in costs and regulations or to per-unit equipment savings. The other policies, including the EEPS and the three voluntary agreement programs, reflect aggregate fuel- or sector-level efficiency targets to be achieved without regard to how the goals are met. Because of the generic nature of such policies, it was not possible to represent them in detail or to evaluate their feasibility or costs. The policy goals specified in the analysis request were assumed to be met, and the associated reductions in energy use were reflected in the analysis.[5]

The remainder of this section discusses the policies that were considered in the analysis, beginning with the policies whose assumed impacts were provided to EIA as part of the request for the study, followed by a section on those specific policies that were represented explicitly by end use or equipment.

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[5]Despite these limitations, there are benefits to representing the efficiency policies in an integrated modeling system, even when some of the policy impacts are assumed. The modeling system provides a consistent energy accounting framework and simulates the energy market impacts that would occur with changes in energy demand. In addition, some of the macroeconomic implications of the policies are captured because of the program impacts on energy consumption and wholesale prices. As a result, the primary implications of the policies on energy imports, carbon dioxide emissions, and potential economic output can be addressed.

Policies Represented Using Assumed Impacts Provided to EIA in the Study Request

This section discusses the assumptions for and impacts of the general policies that were represented broadly in NEMS to meet aggregate targets. The policies include the EEPS and three voluntary programs.

Energy Efficiency Performance Standards

The EEPS[6] establishes State- or national-level targets for reducing the growth of electricity and natural gas consumption. Fuel suppliers would be required to implement programs to promote energy savings and to document the program impacts. The policies establish procedures for retail energy suppliers to follow in measuring, verifying, and reporting energy savings. Examples of methods to achieve the savings include appliance rebate programs, information programs, energy audits or other technical assistance programs, and financial incentives. Some governing body, such as a State utility commission, would be required to verify the reported savings and enforce the policy. EEPS policies have been proposed along with Public Benefits Funds to pay for the efficiency measures through surcharges added to consumers' fuel bills.[7]

Two versions of the policy were considered. In the first, five "average States" were assumed to adopt the policy with a targeted reduction in growth rates of electricity and natural gas demand growth of 0.75 percent per year beginning in 2009. In the second version, the EEPS policies were assumed to be national in scope,[8] with a growth rate reduction target of 0.5 percent per year.

The *AEO2005* reference case was used as the baseline from which the assumed growth rate reductions were taken. The policies were assumed to apply equally across the residential, commercial, and industrial sectors. Natural gas use in the electric power sector was excluded. The transportation sector, which consumes only a small amount of electricity and natural gas, was also assumed to be exempt. Because the five States were not specified, the five-State policy was assumed to reflect a goal achieved by one-tenth of the country (5 of 50 States), with the reductions distributed across Census divisions in proportion to regional consumption. The reduction in the average annual growth rate, from a no-action base year of 2008 through 2025, was translated into an average annual reduction in energy demand, beginning in 2009, and then shared to sectors in proportion to projected sectoral demands.

It was not possible to simulate behavioral or economic aspects of the policy in NEMS. Instead, the energy reduction targets were assumed to occur and the annualized deductions

[6]For example, see American Council for an Energy-Efficient Economy, "The Energy Efficiency Performance Standard: A Fair and Effective Way to Realize the Economic and Environmental Benefits of Greater Energy Efficiency," web site www.aceee.org/energy/eestndrd.htm.

[7]Alliance to Save Energy, "Energy Efficiency in the Electric System" (Washington, DC, May 2004), web site www.ase.org/section/_audience/policymakers/eleceff/.

[8]Although the policies are assumed to be national in scope, they probably would be administered at the State level.

were subtracted from the model's estimated energy demand in each projection year. No attempt was made to estimate the cost of the programs, and no markups to delivered prices were added, as might occur through a Public Benefits Fund surcharge. As a result, the representation of these policies in NEMS was by assumption and was not meant to reflect any judgment about the reasonableness or likelihood of the targets being achieved.

Electricity and Natural Gas Voluntary Agreements

Two voluntary policies would require the Federal Government to enter into agreements with the electric power and natural gas industries to improve their energy efficiency. The target for the electricity industry is to reduce primary energy intensity (energy consumption per unit of output) by 5 percent from a no-action base year of 2006 through 2016. The policy would apply to fossil- and biomass-fueled power plants (excluding other renewable sources and nuclear power), with intensity reductions of about 0.5 percent per year beginning in 2007.

In the *AEO2005* reference case, the energy intensity of fossil and biomass plants is projected to decline by 3.2 percent from 2006 to 2016. Although the heat rates (or energy intensity) for existing plants were assumed to be constant in the reference case, an overall intensity decline is projected as new, more efficient plants replace or supplement the use of existing plants. To simulate the effect of the policy, heat rates of existing fossil and biomass plants were assumed to decline by 3 percent from 2006 to 2016 and remain constant thereafter, resulting in an overall intensity decline of about 5 percent from 2006 to 2016.

In the natural gas industry, the voluntary agreements would target energy intensity in two activities: (1) pipeline energy use per unit of natural gas delivered and (2) lease and plant fuel used per unit of dry natural gas production. The policy goals are to reduce the intensity measures cumulatively by 5 percent below the baseline from 2006 to 2016, with 25 percent of the suppliers agreeing to the target. In aggregate, the industry was assumed to achieve a reduction in these activities of 1.25 percent (the 5-percent target applied to 25 percent of the industry).

In the *AEO2005* reference case, pipeline fuel use is estimated on the basis of pipeline flows and fuel use factors that vary by transit route but are assumed to be constant over time. The cumulative projected decline in pipeline fuel intensity from 2006 to 2016 is 10 percent in the reference case because of changing distribution patterns. To reflect the efficiency policy, fuel use factors were assumed to decline by 1.25 percent cumulatively from 2006 to 2016.

Lease and plant fuel use is estimated on the basis of assumed factors that are multiplied by dry gas production. Lease and plant fuel intensity is projected to remain constant in the *AEO2005* reference case. To reflect the policy, the factors were assumed to decline by 1.25 percent cumulatively from 2006 to 2016.

The electricity and natural gas industries would incur costs to achieve the energy reduction goals of these voluntary programs; however, no attempt to estimate such costs was made, and the delivered prices of electricity and natural gas do not include any markups to reflect those additional costs.

Industrial Voluntary Agreements

The industrial voluntary agreements policy requires the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) to enter into agreements with industrial entities based on a goal to reduce energy intensity[9] by 2.5 percent per year from a no-action base year of 2006 to 2016, with reductions starting in 2007. In the *AEO2005* reference case, industrial delivered energy intensity is projected to fall by 1.4 percent per year between 2006 and 2016. Therefore, on average, entities agreeing to achieve an *incremental* reduction in energy intensity of 1.1 percent per year would meet the 2.5-percent-per-year objective of the voluntary program.

By ASE assumption, entities representing 10 percent of U.S. energy consumption and 10 percent of industrial output would agree to participate and would, on average, achieve an incremental energy intensity reduction of 1.1 percent per year. The 10-percent participation rate, together with the further assumption that the participants' energy intensity would improve at the average rate for all industry in the baseline scenario, implies that the program would achieve an overall incremental reduction in energy intensity of 0.11 percent per year (10-percent participation multiplied by an average 1.1-percent-per-year reduction). Therefore, with the voluntary agreements, overall energy intensity is assumed to decline by 1.5 percent per year between 2006 and 2016, compared with 1.4 percent per year over that period in the reference case.

To represent the policy in NEMS, the energy technology adoption assumptions in the model were modified such that an incremental energy intensity reduction of 0.11 percent per year would occur over the 2006 to 2016 period. After 2016, the technology adoption parameters in the model were assumed to revert to the reference case values. Therefore, program savings are largely sustained, but do not increase, after 2016. Also, the approach to modeling the voluntary programs caused the assumed incremental impacts to be included when the policy was combined with other policies that independently reduce energy consumption.

For each of the programs outlined above, Table 1 presents estimates of the absolute change in energy use that would occur if the assumed program targets were realized. These calculations were made separately for each program relative to the reference case projections in *AEO2005* and do not include feedbacks that would occur in an integrated analysis.

Policies Represented Explicitly by End Use

This section describes the assumptions and modeling approaches of policies that were represented explicitly in NEMS by the specific energy end uses affected. The impacts were simulated to estimate the market response to the specific changes in costs and regulations called for in the policies, or with specified savings for the equipment or end use affected.

[9]In this context, energy intensity is defined as delivered energy consumption per real dollar of industrial output.

Table 1. Calculated Changes in Energy Consumption for Policies Based on Assumed Impacts Provided to EIA as Part of the Study Request
(Quadrillion Btu of Primary Energy)

Policy Assumption	2010	2015	2020	2025	Cumulative 2006-2025
Policies Included in Case 1					
Five-State EEPS, Electricity	-0.08	-0.27	-0.45	-0.63	-5.73
Five-State EEPS, Natural Gas	-0.03	-0.10	-0.16	-0.23	-2.10
Industrial Voluntary Agreements	-0.10	-0.26	-0.43	-0.50	-5.46
Total of Individual Policy Impacts	-0.21	-0.62	-1.04	-1.36	-13.29
Policies Included in Case 2					
National EEPS, Electricity	-0.53	-1.81	-3.04	-4.27	-38.94
National EEPS, Natural Gas	-0.19	-0.65	-1.12	-1.59	-14.28
Industrial Voluntary Agreements	-0.10	-0.26	-0.43	-0.50	-5.46
Electricity Voluntary Agreements	-0.36	-0.84	-0.94	-0.91	-13.40
Natural Gas Voluntary Agreements	-0.01	-0.02	-0.01	-0.02	-0.29
Total of Individual Policy Impacts	-1.18	-3.58	-5.55	-7.28	-72.38

Policy to Reform Corporate Average Fuel Economy Test Procedures

The policy examined in this analysis would require a revision in the current CAFE test procedures, with the procedures phased in from 2008 to 2012. By 2012, manufacturers would have to develop vehicles that provide a 20-percent increase in fuel economy to comply with the more stringent fuel economy test procedures. Initial revisions to the test procedure, to be implemented in 2008, would require a 4-percent increase in fuel economy. An additional 4-percent improvement in fuel economy would be required in each following year until 2012. The policy was included in both multi-policy cases considered in this analysis. The policy was modeled by increasing the fuel economy standards that manufacturers would have to meet, constraining the model's simulation of technology adoption by manufacturers and the vehicle choices available to consumers.

Upgraded Residential and Commercial Appliance Efficiency Standards

The policy calls for new and increased efficiency standards for three appliances in the residential sector and four in the commercial sector. The standards, included in both multi-policy cases in this analysis, were modeled by restricting the available appliances and equipment to those meeting the new standards beginning in the effective year of the policy, or by including the assumed energy savings as indicated. The changes and assumptions pertaining to the residential appliance standards are as follows:

- **Furnaces and Furnace Fans:** The current standard requires a 78 Annual Fuel Utilization Efficiency (AFUE) for furnaces. The proposed standard, effective in 2011, would require an 81 AFUE in southern climates, a 90 AFUE in northern climates,[10] and a 20-percent improvement in furnace fan efficiency.

[10]The southern climate standard is assumed to apply to four Census divisions: South Atlantic, East South Central, West South Central, and Pacific. The northern climate applies to the other five divisions: New England, Middle Atlantic, East North Central, West North Central, and Mountain.

Fuel Economy Measures

The EPA currently employs two tests in the calculation of new vehicle fuel economy for use in determining a manufacturer's compliance with CAFE standards. The tests, conducted in laboratories on chassis dynamometers, are designed to reflect a representative city driving schedule and highway driving schedule. The results are harmonically averaged, 55 percent city and 45 percent highway, to calculate a vehicle's fuel economy test value. After the end of a model year, vehicle manufacturers provide sales data to the Federal Government, and the manufacturer's CAFE is determined by harmonically averaging the tested vehicle fuel economies, weighted by their respective sales shares.

It is an accepted fact that tested fuel economy values used to determine CAFE compliance are seldom achieved during actual on-road driving conditions. The difference can be attributed to driver behavior, weather, traffic conditions, terrain, etc. As a result, the fuel economy values provided to consumers on vehicle window stickers and published in the Gas Mileage Guide are adjusted to represent more accurately the fuel economy consumers are likely to achieve during ownership. This adjustment reduces the tested city fuel economy by 10 percent and the tested highway fuel economy by 22 percent, which lowers the average tested fuel economy by about 15 percent. Studies have shown that continual increases in the share of highway travel, average highway travel speeds, and congestion result in on-road fuel economy values that are approximately 20 percent below the tested values.

- **Torchiere Lamps:** The proposed standard would be 190 watts per bulb, effective in 2007.
- **Ceiling Fan Light Kits:** The proposed standard would require light kits in ceiling fans to be sold with compact fluorescent bulbs, effective in 2009. The standard is assumed to save 123 kilowatthours per unit and apply to an assumed 14 million units sold per year.

The changes and assumptions for proposed commercial sector appliances and equipment standards are as follows:

- **Air Conditioners, Air-Cooled:** The current standard is an Energy Efficiency Ratio (EER) of 8.9 for systems with a capacity of 65 to 135 thousand Btu per hour (kBtu/hr). The proposed standard, effective in 2010, is dependent on the capacity and heating system type. An EER standard of 11.2 or 11.0 (11.2 applies to electric or no heat; 11.0 applies to all other heating types) is applicable to 65 to 135 kBtu/hr unitary air conditioners. An 11.0/10.8 EER standard applies to 65 to 135 kBtu/hr heat pumps. An 11.0 to 10.8 EER standard applies to 135 to 240 kBtu/hr unitary air conditioners. A 10.6 to 10.4 EER standard applies to 135 to 240 kBtu/hr heat pumps.
- **Reach-in Refrigerators:** The proposed standard, effective in 2010, calls for a 26-percent efficiency improvement for solid-door, reach-in refrigerators and a 39-percent improvement for glass/transparent door refrigerators, relative to 1999 models.
- **Pre-rinse Spray Valves:** The proposed standard would limit flow to 1.6 gallons per minute, effective in 2008, and is assumed to save 336 therms per year per unit.

- **Distribution Transformers:** The proposed standard, effective in 2010, is based on recommendations from the Appliance Standards Awareness Project. Low-voltage dry-type distribution transformers are assumed to save 22 kilowatthours per year, and medium-voltage dry-type distribution transformers are assumed to save 25 kilowatthours per year.

Tax Incentives

Several proposed tax incentive policies, included in both multi-policy cases considered in this analysis, were modeled by reducing costs to the owner or builder to reflect the tax credits over the applicable period. Generally, the tax policies evaluated are based on one of two recent legislative initiatives: H.R. 6, the House Conference Bill, or S.2311, the Efficient Energy through Certified Technologies and Electricity Reliability (EFFECTER) Act of 2004. The tax credit policies included are as follows:

- **New Homes, 2006-2008**: Based on EFFECTER, the builder receives a tax credit of $1,000 for homes that are 30 percent more energy efficient than the 2004 International Energy Conservation Code (IECC)[11] and $2,000 for homes 50 percent better than the IECC.
- **Existing Homes, 2006-2008**: Based on H.R. 6, the maximum homeowner tax credit is $2,000 to cover up to 20 percent of the cost of upgrades to building envelopes to meet the IECC.
- **Residential Equipment, 2006-2010**: Based on EFFECTER, homeowners receive tax credits of $50 for "Tier 1" appliances and $150 for "Tier 2" appliances.[12] The credits apply from 2006 to 2007 for Tier 1 appliances and from 2006 to 2010 for Tier 2 appliances.
- **Commercial Equipment, 2006-2010:** Based on EFFECTER, businesses receive a tax deduction of $150 or $450 for "Tier 1" equipment and $900 for "Tier 2" equipment.[12] The credits apply from 2006 to 2007 for Tier 1 appliances and from 2006 to 2010 for Tier 2 appliances.
- **Combined Heat and Power, 2006-2008**: Based on H.R. 6, a 10-percent tax credit is provided to businesses for systems with up to 15 megawatts of electric generating capacity and total system efficiency of 60 percent.

Building Codes

States were assumed to adopt several upgrades to building code policies for the residential and commercial sectors. The residential policies apply to either manufactured homes as regulated by the U.S. Department of Housing and Urban Development (HUD) or all other homes (non-HUD homes), based on future upgrades to the IECC. The commercial policies are

[11]In modeling the provision, the eligibility criteria were based on efficiency measures relative to the 2000 IECC, as these are the building codes on which the NEMS residential model is based. The detailed building simulations to reflect the 2004 IECC are not yet available to incorporate into NEMS. As a result, there may be some small differences in energy savings and costs with the provision as modeled in NEMS.

[12]Eligible equipment includes electric heat pump water heaters, electric heat pumps, geothermal heat pumps, central air conditioners, natural gas or propane or oil water heaters, furnaces and boilers, and air circulating fans in furnaces. EFFECTER defines two product classes for each appliance or equipment category. Tier 1 appliances tend to be the in the middle of the range of efficiency available for that product class. Tier 2 appliances tend to be near the upper limit of efficiency available.

based on improvements to shell components and lighting systems in future updates to Standard 90.1 issued by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). The HUD policies are included in both multi-policy cases, while the other residential and commercial building code policies are included in Case 2 only.

The specific assumptions about the policies are as follows:

- **HUD Homes**: Beginning in 2007, a savings in heating and cooling of 9 percent is assumed in the South Atlantic and West South Central Census divisions, 4 percent in the East South Central, Mountain, and Pacific divisions, and 6 percent in the New England, Middle Atlantic, East North Central, and West North Central divisions.
- **Non-HUD Homes**: States are assumed to adopt updates to the IECC in 2009, 2012, and 2015. The modeling assumes that the policy leads to savings in heating and cooling of 5 percent in 2009, an additional 7.5 percent in 2012, and an additional 7.5 percent in 2015.
- **Commercial Building Codes**: States are assumed to adopt updates to ASHRAE 90.1 in 2007, 2010, and 2013. The modeling assumes that the savings from the 2007 update are included in the reference case; assumes a maximum lighting power density (watts per square foot) that varies by building type in 2010, as specified by the ASE; and assumes additional savings in heating and cooling of 7.5 percent in 2010 and again in 2013.

Table 2 summarizes the policies considered in the analysis, indicating how they were combined in the multi-policy cases and whether they were modeled explicitly or represented with assumed impacts.

Methodology and Uncertainties

The projections in this report are model simulations. 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. Because many of the events that shape energy markets are random and cannot be anticipated (included severe weather, technological breakthroughs, and geopolitical developments), energy market projections are subject to uncertainty. Furthermore, 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, but often well enough to provide insights.

The projections in the reference case used in this report are from the *AEO2005*. The projections 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 within the 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.

Table 2. Summary of Policies and Modeling Treatment

Policy	Description	Multi-Policy Case	Modeling Treatment
Residential Appliance Standards			Specific assumptions by equipment or end use
Furnaces/Furnace Fans	An 81/90 AFUE standard and a 20-percent increase in furnace fan efficiency, in 2011.	1, 2	
Torchiere Lamps	190 watt standard in 2007.	1, 2	
Ceiling Fan Light Kits	123 kWh/year savings per unit in 2009.	1, 2	
Commercial Appliance Standards			Specific assumptions by equipment or end use
Air Conditioners, air-cooled	10.6-11.2 EER Standard in 2010.	1, 2	
Reach-in Refrigerators	26/39-percent efficiency improvement in 2010.	1, 2	
Pre-rinse Spray Valves	336 therms/year per unit savings in 2008.	1, 2	
Distribution Transformers	22/25 kilowatthours per year per unit savings in 2010.	1, 2	
Tax Credits			Cost-based equipment choice simulation
New Homes	Tax credits to builders, 2006-2008.	1, 2	
Existing Homes	Tax credits to homeowners, 2006-2008.	1, 2	
Residential Equipment	Tax credits to homeowners, 2006-2010.	1, 2	
Commercial Equipment	Tax deductions for businesses, 2006-2010.	1, 2	
Combined Heat and Power	10-percent tax credit for businesses, 2006-2008.	1, 2	
Building Codes			Specific assumptions by end use
HUD Homes	All States adopt new code in 2007.	1, 2	
Non-HUD Homes	Updates to IECC in 2009, 2012, 2015.	2	
Commercial Building Shell Components and Lighting Systems	Updates to ASHRAE 90.1 adopted by all States in 2007, 2010, and 2013.	2	
CAFE Reform Testing Procedures	Requires a 20-percent increase in fuel economy to comply with more stringent fuel economy test procedures, phased-in from 2008 to 2012. The revised test procedures eliminate the discrepancy with on-road fuel economy.	1, 2	Technology adoption simulation
Energy Efficiency Performance Standards			Assumed impacts across all end uses
5-State Program	Assumes 5 "average States" require electricity and natural gas suppliers to achieve an incremental 0.75-percent reduction in demand annually from 2009 through 2025.	1	
National Program	Assumes all States require electricity and natural gas suppliers to achieve an incremental 0.50-percent reduction in demand annually from 2009 to 2025.	2	
Voluntary Programs			Assumed impacts to meet aggregate targets
Industrial	Target based on goal to reduce energy intensity by 2.5 percent annually, 2007-2016, with 10 percent participation.	1,2	
Electricity Industry	Industry target to reduce energy intensity by 5 percent cumulatively (about 0.5 percent annually) from 2007 through 2016. Applies to fossil and biomass plants.	2	
Natural Gas Industry	Industry target to reduce energy intensity by 5 percent cumulatively (about 0.5 percent annually) from 2007 through 2016, with 25 percent participation. Applies to pipeline and lease and plant fuel.	2	

Finally, the costs of the policies and their impacts on expenditures are not fully represented in the modeling. EIA was not able to reliably estimate impacts of the policy cases on delivered retail energy prices and energy expenditures. As a result, the macroeconomic implications of these policies are not fully reflected in the analysis. While the macroeconomic impact on potential gross domestic product (GDP) can be modeled primarily on the basis of changes in energy consumption induced by the policies, the transitional impacts on actual GDP from unmeasured expenditures implied by these policies are not reflected.

2. Results

This chapter discusses the impacts of the policy assumptions on energy markets, carbon dioxide emissions, and the economy. The initial focus is on the multi-policy cases, Cases 1 and 2, as described in Chapter 1. The chapter begins with a discussion of the overall energy consumption impacts of the multi-policy cases, followed by a discussion of the impacts for each energy consumption sector (electric power, residential, commercial, industrial, and transportation). The impacts of individual policies are presented in the third section. Detailed tables displaying results of the multi-policy cases, compared with the *AEO2005* reference case, are provided in Appendix B.

Multi-Policy Case Aggregate Results

The combined effect of the energy efficiency policies is to reduce energy consumption, energy-related carbon dioxide emissions, and energy imports (Table 3). Compared to the reference case of the *AEO2005*, total projected energy consumption in 2025 is reduced by 3.9 quadrillion Btu (2.9 percent) in Case 1 and by 9.3 quadrillion Btu (7.0 percent) in Case 2. Over the entire projected period from 2006 to 2025, the policies save 39.8 quadrillion Btu cumulatively (1.7 percent) in Case 1 and 93.4 quadrillion Btu (3.9 percent) in Case 2.

Table 3. Projections in the *AEO2005* Reference and Multi-Policy Cases

		2015			2025		
Energy Indicator	**2003**	**Reference**	**Case 1**	**Case 2**	**Reference**	**Case 1**	**Case 2**
Energy Consumption (Quadrillion Btu)							
Petroleum Products	39.09	48.07	46.77	46.66	54.42	51.99	51.78
Natural Gas	22.54	28.69	28.28	26.90	31.47	30.96	28.99
Coal	22.71	25.71	25.47	24.62	30.48	29.46	26.60
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy	5.89	7.13	7.07	6.96	8.10	8.15	7.81
Other	0.02	0.07	0.07	0.05	0.04	0.04	0.04
Total	**98.22**	**118.29**	**116.29**	**113.78**	**133.18**	**129.26**	**123.84**
Purchased Electricity (Quadrillion Btu)	11.88	15.11	14.92	14.46	17.81	17.38	16.19
Net Imports (Quadrillion Btu)							
Petroleum	24.10	33.10	31.79	31.71	41.11	38.72	38.58
Natural Gas	3.32	7.19	6.89	5.86	8.87	8.88	7.57
Net Import Dependence: Share of Product Supplied (Percent)							
Petroleum	56.2	62.4	61.4	61.4	68.4	67.3	67.3
Natural Gas	14.7	25.1	24.4	21.8	28.2	28.7	26.1
Carbon Dioxide Emissions (Million Metric Tons)	5,789	7,052	6,923	6,760	8,062	7,781	7,392
Carbon Dioxide Intensity (Metric Tons per Million 2003 Dollars of GDP)	558	463	455	444	397	384	365

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

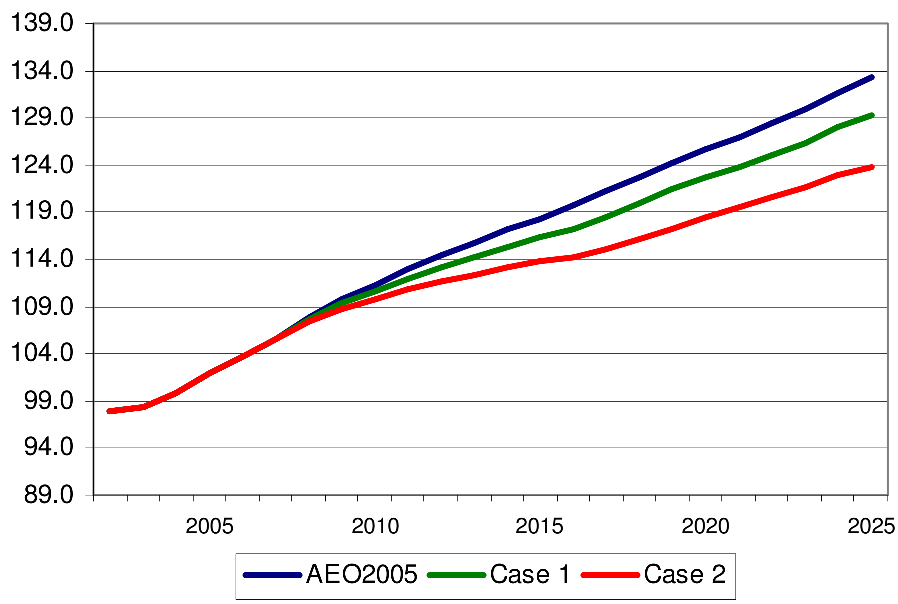
Most of the energy reduction in 2025 in Case 1 is for petroleum (2.4 quadrillion Btu, or a 4.5-percent reduction), followed by coal (1.0 quadrillion Btu, or 3.4 percent), and natural gas (0.5 quadrillion Btu, or 1.6 percent). The petroleum reductions in Case 1 occur primarily as a result of the more stringent CAFE testing policy, which requires manufacturers to increase the average fuel economy of new light-duty vehicles.

In Case 2, which includes the electricity and natural gas voluntary programs, upgraded building code policies, and the national-level EEPS, the reductions are targeted more heavily to the electricity sector. As a result, projected coal use in Case 2 is reduced by 12.7 percent compared to the reference case in 2025, natural gas by 7.9 percent, and oil by 4.8 percent. While some of this reduction occurs because of the voluntary efficiency policy, most of the reductions are from the 9.1-percent reduction in projected electricity demand in Case 2, much of which occurs because of the national-level EEPS. In Case 1, which assumes a five-State EEPS, the reduction in electricity demand in 2025 is 2.4 percent, compared to the reference case.

The impacts on carbon dioxide emissions are greater than for total energy consumption in percentage terms in both cases, because the policies tend to target fossil fuels and have relatively little impact on renewable and nuclear energy. Also, the Case 2 policies result in greater percentage reductions for coal, which has the highest carbon content. Overall carbon dioxide emissions in 2025 are reduced by 3.5 percent in Case 1, relative to the *AEO2005* reference case, and by 8.3 percent in Case 2.

The energy reductions under both policy cases grow over time (Figure 1). While most of the policies are specified to begin between 2006 and 2009, the policies are generally phased in

Figure 1. Projected Energy Consumption in Reference and Multi-Policy Cases
(Quadrillion Btu)



Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

over time or target a steady reduction in energy growth. Also, policies that call for improvements in the efficiency of new equipment will impact the market slowly because of gradual equipment turnover. As a result, projected policy impacts on total energy consumption in 2025 are more than six times as great as those in 2010 in both policy cases. The projected energy reductions through 2015 are roughly half of the 2025 reductions.

Because the Case 1 policies reduce oil consumption by 4.5 percent in 2025, primarily through the CAFE testing policy, they reduce dependence on imported oil. The net import share of oil consumption falls from 68.4 percent in the reference case to 67.3 percent in both multi-policy cases. The Case 2 polices, which result in a substantial reduction in natural gas use in 2025 (7.9 percent) compared to the reference case, also reduce dependence on imported natural gas. The projected net import share of natural gas in 2025 falls from 28.2 percent in the reference case to 26.1 percent in Case 2.

Macroeconomic Impacts

The relative importance of reductions in energy use that are attributable to program results provided to EIA as part of the study request, which were incorporated in the analysis without being explicitly modeled in NEMS, presents a significant challenge to the application and interpretation of EIA's standard macroeconomic analysis.

The reduced demand for natural gas and electricity in the policy cases places downward pressure on prices, because the energy is supplied from lower-cost sources at the margin. For example, the projected wellhead natural gas price in 2025 is 8.5 percent lower in Case 2 than in the reference case. However, given the absence of information regarding the implementation of key policies included in the two multi-policy cases, EIA was not able to reliably estimate impacts on retail energy prices and energy expenditures. For example, based on experience, it would be reasonable to expect that programs used to meet demand-reduction obligations placed on electricity and gas suppliers subject to an EEPS would be financed through surcharges on consumer bills; however, estimates of the cost of demand reduction in past programs vary widely, and there is no clear basis for using a particular estimate to represent the unspecified programs that might be pursued. The cost of programs used to reduce demand in these policy cases could partially, fully, or more than fully offset the effect of reduced demand on retail energy prices. Without information on changes in delivered prices, or information regarding the impact of these programs on investment, EIA was not in a position to develop reliable estimates of the impacts of the policy suites on actual GDP.

The NEMS macroeconomic model can, however, be used to capture the costs of the energy efficiency policies on the potential output (supply) side.[13] The energy efficiency policies would force the economy to substitute capital and labor resources for energy, causing a

[13]The aggregate supply potential of the economy is embodied in a concept identified as "potential GDP." Potential GDP is dependent on (in a production function framework) factor inputs and total factor productivity. Factor inputs include capital stock (business and public fixed capital stock), labor, and energy. The concept of potential GDP reflects the supply potential of the economy at full employment, whereas real GDP (sometimes referred to as actual GDP) reflects the actual economy, which may have unemployed or underutilized resources. Based on each factor's historical share of input costs, the elasticity of potential output with respect to labor is 0.64 (i.e., a 1-percent increase in the labor supply increases potential GDP by 0.64 percent); the business capital elasticity is 0.26; the infrastructure elasticity is 0.02; and the energy elasticity is 0.07.

relocation of these productive resources across economic sectors. The adjustment process would cause losses to the potential output of the economy, relative to baseline, due to losses in productivity.

To highlight the distinction between actual and potential GDP, consider an energy tax that induces the same changes in energy consumption as the energy efficiency policies. With such a tax policy, consumers and businesses would react to the higher energy prices that reflect the higher marginal cost. The economic adjustments toward more energy-efficient products would occur through a market mechanism and would be reflected in actual GDP as expenditures are switched, causing idling and dislocation of some resources in the short to medium term. Potential output, on the other hand, reflects full employment of resources. The losses incurred in potential output have more to do with losses in productivity of inputs due to their reallocation and do not include the idling, adjustment, and dislocation costs. Because there is no explicit accounting of the latter types of costs, this analysis focuses only on the impacts on potential GDP or losses in productivity.

Conceptually, it is possible to decompose the impact on potential GDP by looking at three distinct, and possibly opposing, effects:

- The implementation of policies to promote higher energy efficiency forces the economy toward a different mix of resources, using less energy. The adjustment to the new optimal mix entails losses to the potential output from a loss in productivity of capital and labor resources.
- Businesses and consumers lower their energy consumption. The lower level of energy demand itself tends to reduce energy prices, with positive impacts on the economy; however, the costs of implementing the EEPS and other such programs tends to raise delivered energy prices. Without modeling of these programs, the net effect on delivered energy prices is unclear.
- Businesses and consumers alter their investment behavior due to the policies, as discussed above. This affects not only actual GDP but potential GDP as well, through impacts on interest rates, corporate profits, and capital stock formation.

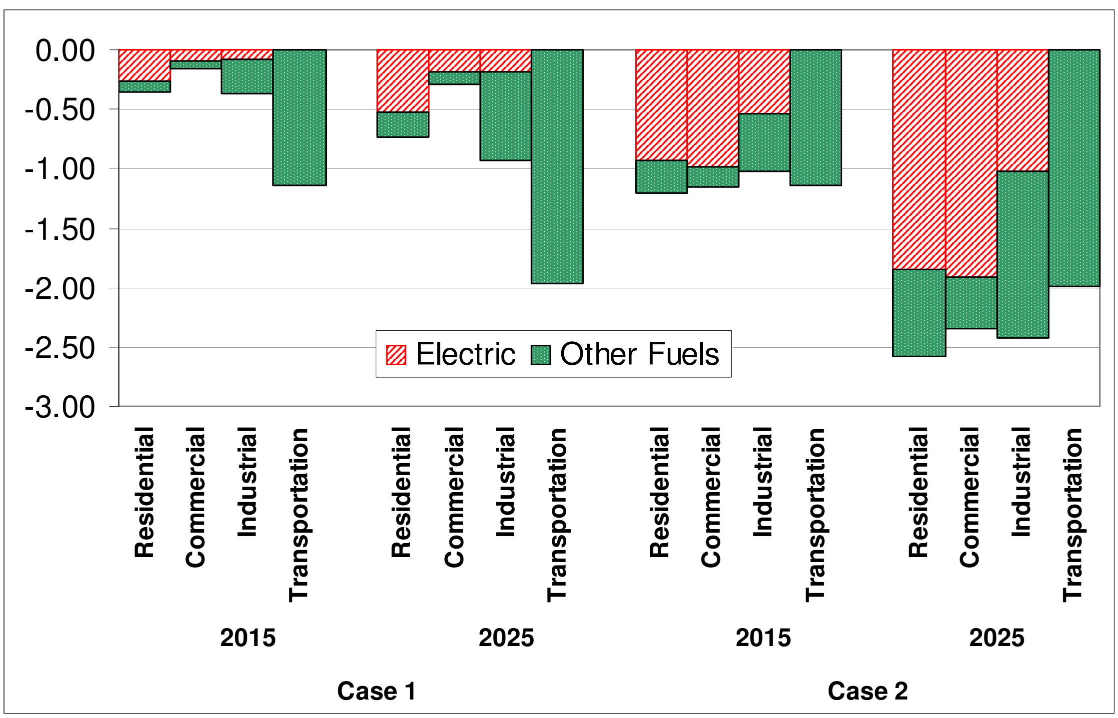
In the present study only the first of these effects, the impact of forced adjustments to factor inputs from the path of the reference case, could be addressed directly. This was done by estimating the cost to the economy of letting lower energy use feed into the potential GDP equation, but keeping energy prices and energy consumption at baseline levels for the demand side of the economy. For Cases 1 and 2, the cumulative losses in potential GDP from 2006 to 2025 due to the loss in productivity were $445 billion (a 0.14-percent reduction) and $864 million (a 0.27-percent reduction), respectively.

To illustrate the effect of possible changes in energy prices, EIA’s analysis also considered how reductions in energy prices, if they occurred, would positively impact potential output, assuming that the lower energy use would not alter the optimal input mix for potential GDP. For this sensitivity analysis, a bounding assumption was that implementation of the EEPS and other such programs does not impact delivered energy costs, which reflect only the effects of lower energy usage. In essence, this controls for the adjustment costs on the production side of the economy and ignores the price implications of implementing the policies. The cumulative positive impact on the economy from 2006 to 2025 from lower energy prices due to lower energy demand is $160 billion (a 0.05-percent increase) for Case 1 and $309 billion (a 0.10-percent increase) for Case 2. To the extent that actual delivered energy prices are affected by implementation costs, these results will overstate the gains in potential GDP due to price changes, which could lead to losses in potential GDP.

Impacts by Sector

The energy policies considered in this analysis reduce energy in all four end-use sectors relative to the reference case (Figure 2). In Case 1, about half of the reductions in energy use in 2025 occur in the transportation sector as a result of the policy to reform CAFE test procedures. In Case 2, the reductions are split more evenly across sectors, with the transportation sector accounting for the smallest amount of savings among the four sectors in 2025. The Case 2 savings in 2025 attributed to electricity generation account for just over half the total reductions. These savings occur primarily because of the national-level EEPS policy for electricity and the electricity sector voluntary agreement policy. The key impacts in each sector are summarized in the following sections.

Figure 2. Changes in Sectoral Energy Consumption in the Multi-Policy Cases Relative to the *AEO2005* Reference Case, 2015 and 2025
(Quadrillion Btu of Primary Energy)



Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Electricity Sector

The electric power sector is perhaps the most affected by the policies considered in this analysis. Many of the policies are directed at reducing electricity demand through standards, building codes, and tax incentives. The EEPS policies require the industry to achieve additional, verifiable reductions in electricity demand to achieve growth reduction targets. The voluntary agreements are directed at the power sector's own energy efficiency. In combination, the effect of these programs is significant. Table 4 compares the projections for the two multi-policy cases and the *AEO2005* reference case.

Table 4. Electric Power Sector Results in the *AEO2005* Reference and Multi-Policy Cases

		2015			2025		
Electric Power Indicator	**2003**	**Reference**	**Case 1**	**Case 2**	**Reference**	**Case 1**	**Case 2**
Energy Consumption (Quadrillion Btu)							
Petroleum	1.13	1.32	1.30	1.20	1.43	1.39	1.23
Natural Gas	5.06	8.56	8.43	7.55	9.61	9.74	9.24
Coal	20.49	23.65	23.43	22.56	28.54	27.53	24.65
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy/Other	3.62	4.46	4.41	4.29	5.14	5.19	4.86
Electricity Imports	0.02	0.07	0.07	0.05	0.04	0.04	0.04
Total	**38.28**	**46.68**	**46.25**	**44.24**	**53.43**	**52.56**	**48.65**
Purchased Electricity (Quadrillion Btu)	11.88	15.11	14.92	14.46	17.81	17.38	16.19
Carbon Dioxide Emissions (Million Metric Tons)	2,286	2,791	2,762	2,627	3,314	3,222	2,914
Generating Capacity (Megawatts)	920	967	957	933	1,145	1,122	1,056

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Case 1 impacts:

- Sales of electricity in 2025 are 2.4 percent less in Case 1 than in the *AEO2005* reference case, and power sector energy use falls by 1.6 percent. Because the reduced electricity demand also reduces the need for new, more efficient generating capacity, the average efficiency of the electricity generation is lower in Case 1. As a result, the reductions in energy use for generation are less than proportional to the reductions in electricity demand.
- The projected need for new generating capacity in 2025 is reduced by 19 gigawatts (7.2 percent) in Case 1 compared to the reference case. Cumulative power sector capacity additions from 2004 through 2025 in Case 1 are 244 gigawatts, compared with 263 gigawatts in the reference case. Most of the avoided capacity additions in Case 1 are coal-based (83 percent).
- Carbon dioxide emissions associated with electricity generation are reduced by 2.8 percent in 2025 in Case 1, a greater percentage change than for electricity demand (2.4 percent) or fuel use (1.6 percent). The coal-fired capacity additions avoided in Case 1 account for the higher percentage reduction in carbon dioxide emissions, because the carbon content of coal is greater than that of other fossil fuels.

Case 2 impacts:

- Sales of electricity in 2025 are 9.1 percent lower in Case 2 than in the reference case, and power sector energy use is lower by 9.0 percent. Unlike in Case 1, the percentage reductions for generation are about the same as for electricity demand. Case 2 includes the voluntary agreement policy calling for the industry to reduce energy intensity (or plant heat rates) by 5.0 percent cumulatively between 2006 and 2016. The effect of this policy is partially offset by a reduction in the need for new, more efficient capacity in Case 2.
- The need for new generating capacity through 2025 is reduced by 76 gigawatts (29 percent) in Case 2 compared to the reference case, and total capacity (existing and new additions) is reduced by 7.8 percent. Most of the avoided capacity additions in Case 2 are coal-based (69 percent), and about 5 percent are renewable.
- Projected carbon dioxide emissions associated with electricity generation are reduced by 12.1 percent in 2025 in Case 2, compared to the reference case.

Residential Sector

Table 5 compares the residential sector projections in the two multi-policy cases with those in the reference case.

Table 5. Residential Sector Projections in the *AEO2005* Reference and Multi-Policy Cases

Residential Indicator	2003	2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Energy Consumption (Quadrillion Btu)							
Petroleum	1.58	1.58	1.57	1.56	1.53	1.51	1.50
Natural Gas	5.25	5.90	5.83	5.66	6.17	5.97	5.47
Renewable/Other	0.41	0.40	0.40	0.40	0.39	0.39	0.38
Electricity	4.37	5.40	5.30	5.15	6.18	5.96	5.55
Delivered Energy	**11.61**	**13.29**	**13.10**	**12.77**	**14.26**	**13.83**	**12.91**
Electricity-Related Losses	9.71	11.29	11.13	10.61	12.35	12.05	11.13
Total Energy	**21.31**	**24.58**	**24.23**	**23.38**	**26.62**	**25.88**	**24.04**
Carbon Dioxide Emissions (Million Metric Tons)	1,225	1,419	1,397	1,343	1,580	1,524	1,391

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Case 1 impacts:

- In 2025, delivered energy consumption in the residential sector is reduced by 0.4 quadrillion Btu (3.0 percent) relative to the reference case, and primary energy consumption is reduced by 0.7 quadrillion (2.8 percent).
- Electricity savings account for more than half of the cumulative delivered energy savings in Case 1. When conversion losses are factored in, electricity reductions account for 72 percent of the cumulative primary energy savings.
- Residential carbon dioxide emissions, including the emissions associated with the generation of the electricity consumed in the sector, are reduced by 3.6 percent (56 million metric tons) in 2025, a greater percentage reduction than for total energy use, which is reduced by 2.8 percent in 2025.

Case 2 impacts:

- In 2025, delivered energy consumption in the residential sector is reduced by 1.4 quadrillion Btu (9.5 percent), and primary energy is reduced by 2.6 quadrillion (9.7 percent) relative to the reference case.
- Natural gas savings account for more than half of the cumulative delivered energy savings in Case 2, as the addition of building codes for non-HUD homes increases the savings in space heating fuels.
- Carbon dioxide emissions are reduced by 189 million metric tons (12 percent) in 2025, with unspecified EEPS programs contributing most to the decline.

Commercial Sector

Table 6 compares the commercial sector projections in the two multi-policy cases to those in the reference case.

Table 6. Commercial Sector Projections in the *AEO2005* Reference and Multi-Policy Cases

Commercial Indicator	2003	2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Energy Consumption (Quadrillion Btu)							
Petroleum	0.75	0.91	0.90	0.89	1.02	1.01	0.97
Natural Gas	3.22	3.69	3.62	3.53	4.17	4.06	3.79
Renewable/Other	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Electricity	4.13	5.63	5.58	5.37	7.12	7.01	6.48
Delivered Energy	**8.29**	**10.41**	**10.29**	**9.97**	**12.49**	**12.27**	**11.42**
Electricity-Related Losses	9.18	11.77	11.73	11.05	14.25	14.18	12.98
Total Energy	**17.46**	**22.18**	**22.02**	**21.02**	**26.74**	**26.45**	**24.40**
Carbon Dioxide Emissions (Million Metric Tons)	1,028	1,309	1,299	1,234	1,628	1,596	1,445

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Case 1 impacts:

- In 2025, delivered energy consumption in the commercial sector is reduced by 0.2 quadrillion Btu (1.8 percent) relative to the reference case, and primary energy consumption is reduced by 0.3 quadrillion (1.1 percent).
- Electricity savings account for 55 percent of the cumulative primary energy savings in Case 1 (including conversion losses).
- Commercial sector carbon dioxide emissions, including the emissions associated with the generation of electricity consumed in the sector, are reduced by 2.0 percent (32 million metric tons) in 2025—a greater percentage reduction than for total energy use, which is reduced by 1.1 percent in 2025.

Case 2 impacts:

- In 2025, delivered energy consumption in the commercial sector is reduced by 1.1 quadrillion Btu (8.6 percent), and primary energy consumption is reduced by 2.3 quadrillion Btu (8.7 percent).

- Cumulative energy savings in Case 2—23.3 quadrillion Btu through 2025—are 8 times the savings in Case 1, reflecting the combined energy savings from the policies to upgrade commercial building codes and the national-level EEPS policy.
- Carbon dioxide emissions are reduced by 183 million metric tons (11.3 percent) in 2025, with the assumed impacts of the EEPS policy contributing most to the decline.

Industrial Sector

Table 7 compares the industrial sector projections in the two multi-policy cases with those in the reference case.

Table 7. Industrial Sector Projections in the *AEO2005* Reference and Multi-Policy Cases

Industrial Indicator	2003	2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Energy Consumption (Quadrillion Btu)							
Petroleum	9.31	10.43	10.28	10.28	11.47	11.05	11.05
Natural Gas	7.19	8.5	8.38	8.19	9.26	8.98	8.36
Lease and Plant Fuel	1.15	1.23	1.22	1.2	1.31	1.28	1.23
Coal	2.11	1.95	1.94	1.95	1.83	1.82	1.84
Renewable Energy	1.79	2.19	2.19	2.19	2.5	2.49	2.48
Electricity	3.31	3.98	3.94	3.84	4.39	4.29	4.04
Delivered Electricity	**24.86**	**28.27**	**27.95**	**27.65**	**30.76**	**29.91**	**29.01**
Electricity-Related Losses	7.35	8.31	8.27	7.91	8.78	8.69	8.1
Total Energy	**32.21**	**36.58**	**36.22**	**35.57**	**39.53**	**38.6**	**37.11**
Carbon Dioxide Emissions (Million Metric Tons)	1,664	1,899	1,879	1,837	2,059	2,002	1,899
Combined Heat and Power Capacity (Gigawatts)	24.9	32.2	32.2	31.7	40.1	39.5	37.7

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Key findings:

- In Case 1, industrial petroleum consumption shows the largest reduction, 3.7 percent (0.4 quadrillion Btu) in 2025 relative to the reference case, primarily due to reduced consumption by refineries and oil and natural gas producers as a result of petroleum demand reductions brought about by the CAFE reform policy. Industrial natural gas consumption is reduced by 3.1 percent (0.3 quadrillion Btu) in 2025, due to the combined effects of the voluntary agreements and the five-State EEPS.
- The largest energy consumption impacts in Case 2 are for industrial natural gas and purchased electricity, as a result of the national EEPS policies for natural gas and electricity. In Case 2, the national EEPS policy is the most significant contributor to the 7.9-percent reduction in purchased electricity in 2025 compared with the reference case. Primary energy consumption in 2025 is projected to be 2.4 quadrillion (6.1 percent) lower in Case 2 than in the reference case.
- The net effect of the voluntary programs is to reduce projected combined heat and power (CHP) capacity in both cases, despite the availability of the investment tax credit. The voluntary agreement policy reduces both electricity requirements and steam requirements, thereby reducing the potential for CHP. In Case 2, industrial CHP capacity in 2025 is 2.4 gigawatts (5.9 percent) less than in the reference case.

- Industrial sector carbon dioxide emissions in the reference case increase from 1,664 million metric tons in 2003 to 2,059 million metric tons in 2025, including emissions associated with the generation of the electricity consumed in the sector. In Case 2, carbon dioxide emissions are 160 million metric tons (7.8 percent) lower in 2025 than in the reference case.

Transportation Sector

The policy to revise the CAFE test procedure was included in both multi-policy cases examined in this study. The impacts of the policy are virtually identical in the two cases, and this discussion therefore focuses on the results from Case 1. Results of the reference case and Case 1 are compared in Table 8.

Table 8. Transportation Sector Projections in the *AEO2005* Reference Case and Multi-Policy Case 1

Transportation Indicator	2003	2015		2025	
		Reference	Case 1	Reference	Case 1
Energy Consumption (Quadrillion Btu)					
Gasoline	16.64	20.81	19.76	24.04	22.29
Diesel	5.54	7.67	7.60	9.05	8.87
Total Petroleum	26.31	33.84	32.71	38.97	37.02
Natural Gas	0.67	0.81	0.80	0.95	0.93
Electricity	0.08	0.10	0.10	0.12	0.12
Delivered Energy	**27.07**	**34.75**	**33.61**	**40.04**	**38.09**
Electricity-Related Losses	0.17	0.21	0.21	0.24	0.24
Total Energy	**27.24**	**34.96**	**33.82**	**40.28**	**38.33**
Carbon Dioxide Emissions (Million Metric Tons)	1,872	2,425	2,347	2,796	2,660
Light-Duty Vehicle Travel (Trillion Miles)	2.67	3.44	3.48	4.16	4.25
Average New Light-Duty Vehicle Price (Thousand 2003 Dollars)					
Car	23.7	25.2	25.8	25.5	25.9
Light Truck	27.2	28.7	29.3	29.0	29.5
Average Light-Duty Vehicle	25.4	27.1	27.7	27.6	28.0
New Light-Duty Vehicle Sales (Millions)					
Cars	8.11	7.94	7.76	8.33	8.19
Light Trucks	8.40	10.46	10.17	12.66	12.36
Total	**16.51**	**18.40**	**17.93**	**20.99**	**20.54**
Light-Duty Vehicle Fuel Economy (Miles per Gallon)					
New Car	29.5	30.3	28.0	31.0	28.2
New Car, Adjusted Case 1[1]			33.6		33.9
New Light Truck	21.8	23.4	22.6	24.6	23.1
New Light Truck, Adjusted Case 1[1]			27.1		27.7
Average Stock On-Road	20.0	20.4	21.8	21.0	23.3

[1]Adjusted fuel economy is the new fuel car economy in Case 1 measured under the current test procedure for comparability to the *AEO2005* reference case.

Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A and DORG_V1.D031105A.

The CAFE reform policy would require a revision in current fuel economy test procedures, with the new procedures phased in from 2008 to 2012. By 2012, manufacturers would have to develop vehicles that provide a 20-percent increase in fuel economy to comply with the more stringent fuel economy test procedures. Initial revisions to the test procedure, to be implemented in 2008, would require a 4-percent increase in fuel economy. An additional 4-percent improvement in fuel economy would be required in each following year until 2012.

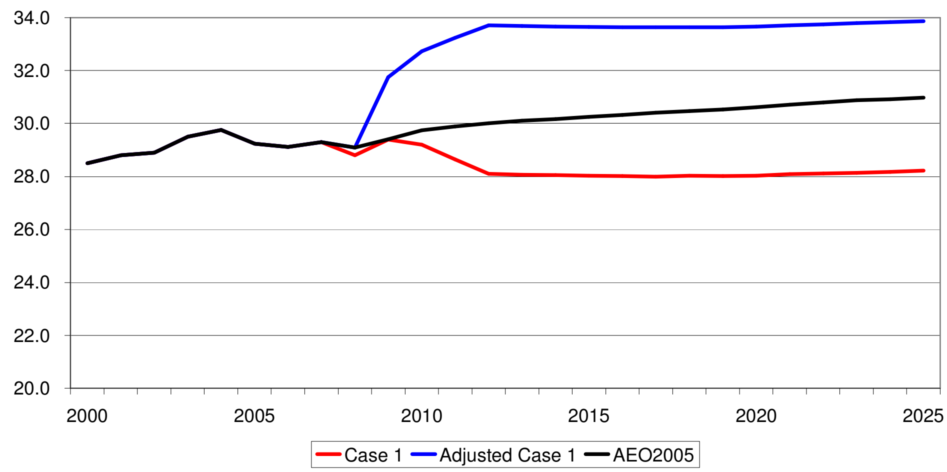
Key impacts of the CAFE policy:

- Compared with the *AEO2005* reference case, the increase in fuel economy for light-duty vehicles projected in Case 1 results in a 3.3-percent reduction (1.1 quadrillion Btu) in petroleum demand in 2015 and a 5.0-percent reduction (1.9 quadrillion Btu) in 2025.
- In 2025, light-duty vehicle travel in Case 1 increases by 2.2 percent (91 billion miles annually) compared to the *AEO2005* reference case, because increased vehicle fuel economy reduces the cost of driving.
- The increased penetration of advanced technologies required to meet the more stringent CAFE test procedures increases the average price of a new vehicle in Case 1 compared to the *AEO2005* reference case. In 2015, the average price of a new car increases by $530 and the average price of a new light truck increases by $620 (2003 dollars). In 2025, the average incremental price increases are $400 for cars and $480 for light trucks.
- As a result of increased new vehicle prices, projected sales of new light-duty vehicles are lower than in the *AEO2005* reference case. In 2015, new light-duty vehicle sales are lower by 2.5 percent (470,000 vehicles), with 61 percent of that reduction attributed to a decrease in light truck sales. In 2025, new light vehicle sales are lower by 2.2 percent (460,000 vehicles), with the decrease in new light truck sales accounting for 67 percent of the total reduction.

The fuel economy projections for new light-duty vehicles in the policy cases are not directly comparable with those in the *AEO2005* reference case because the fuel economy projected in the policy case reflects a revised CAFE test procedure, not an increase in the CAFE standard. The projected new car and light truck fuel economy in Case 1 can be adjusted to reflect the tested fuel economy that would have been achieved under the current CAFE test procedure. In Figure 3, "adjusted Case 1" miles per gallon is the new car fuel economy measured under the current test procedure for comparability to the *AEO2005* reference case. For example, the tested new car fuel economy in 2015 decreases from 30.3 miles per gallon as reported in the *AEO2005* reference case to 28.0 miles per gallon in Case 1; however, with adjustments for fuel economy improvements required under the new CAFE test procedure, new car fuel economy in 2015 in Case 1 is equivalent to 33.6 miles per gallon measured under the current test procedure.

Once the new test procedures have been phased in, there is little additional change in new car fuel economy in Case 1, unlike in the reference case. With the new test procedures, manufacturers implement technology earlier than they would have otherwise to meet the redefined CAFE standard. After 2012, new car fuel economy remains relatively constant through the remainder of forecast period in Case 1, as many of the low-cost, advanced technologies have saturated the market. In the reference case, these technologies penetrate

Figure 3. New Car Fuel Economy in the *AEO2005* Reference Case, Case 1, and Adjusted Case 1
(Miles per Gallon)

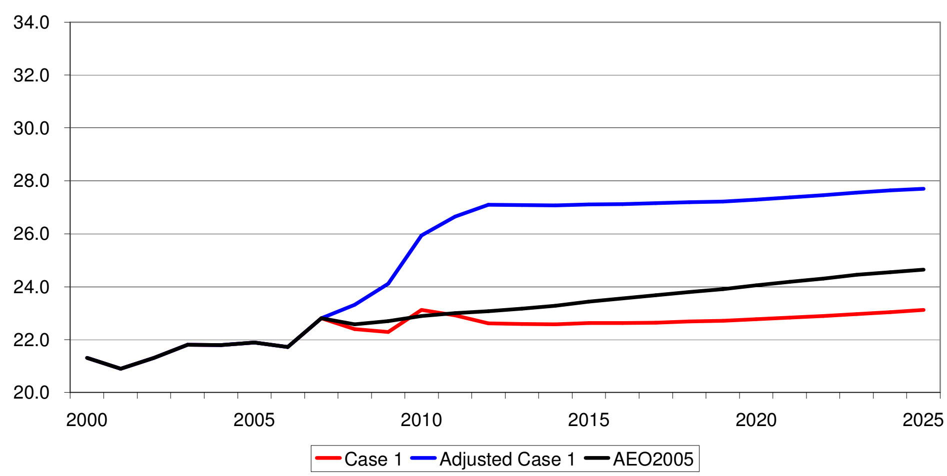


Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A and DORG_V1.D031105A.

more gradually over time, leading to an upward trend in new car fuel economy over the entire projection period.

Similar to the fuel economy projections for new cars, the direct comparison of the unadjusted fuel economy for new light trucks between Case 1 and the *AEO2005* reference case is misleading. For example, in 2015, the unadjusted new light truck fuel economy is projected to be 22.6 miles per gallon in Case 1, compared to 23.4 miles per gallon in the reference case. However, with adjustments for fuel economy improvements required under the new CAFE test procedure, new light truck fuel economy in 2015 is equivalent to 27.1 miles per gallon as measured under the existing CAFE test procedure (Figure 4).

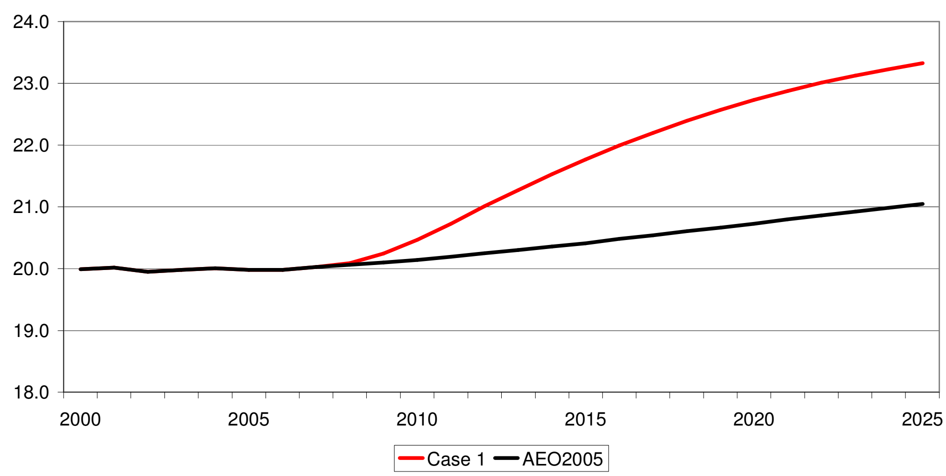
Figure 4. New Light Truck Fuel Economy in the *AEO2005* Reference Case, Case 1, and Adjusted Case 1
(Miles per Gallon)



Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A and DORG_V1.D031105A.

Although there was no increase in the CAFE standards and projections of new light-duty vehicle fuel economy in Case 1 are lower than those projected in the *AEO2005* reference case due to the revision of the test procedure, the elimination of the shortfall between tested and on-road fuel economy results in an increase in the average fuel economy of the stock of light-duty vehicles (Figure 5). Compared to the *AEO2005* reference case, stock average fuel economy increases by 6.6 percent (1.5 miles per gallon) to 21.8 miles per gallon in 2015 and by 10.8 percent (2.3 miles per gallon) to 23.3 miles per gallon in 2025. Although Case 1 projections of new light-duty vehicle fuel economy remain relatively flat as new vehicles continue to displace the old vehicle stock, average stock fuel economy would continue to increase beyond 2025.

Figure 5. Light-Duty Vehicle On-Road Fuel Economy in the *AEO2005* Reference Case and Case 1
(Miles per Gallon)



Source: Energy Information Administration, National Energy Modeling System, runs AEO2005.D102004A and DORG_V1.D031105A.

Impacts of Individual Policies

The approximate energy savings from individual policies that were specifically modeled in NEMS are presented in Table 9, with a comparison to the energy consumption projections of the *AEO2005* reference case.[14] The individual policies with the greatest cumulative impacts on projected energy consumption are the CAFE reform policy and the national-level EEPS for natural gas and for electricity. Together, these three policies account for about 79 percent of the total cumulative energy reduction from 2006 to 2025 of 93.4 quadrillion Btu in Case 2 (a combined energy savings of 3.9 percent of the 20-year total of 2,379 quadrillion Btu). The CAFE reform policy, included in both multi-policy cases, accounts for 50 percent of the

[14]The individual policy impacts in Table 9 were estimated from model runs with the policies considered individually. For simplicity, the estimates are based mostly on standalone, sectoral model runs of NEMS representing the sector affected by the policy. These standalone runs do not include all the feedbacks and joint effects that occur when the policies are simulated in complete, integrated NEMS runs. In most cases, the combined effects of the policies are somewhat less than the sum of the individual policy impacts; however, the estimates provide an indication of the relative contributions of individual policies.

annual energy savings projected for Case 1 in 2025 and 21 percent of the Case 2 savings in 2025.

The policies with the smallest cumulative impacts on energy consumption are the tax incentives (tax credits for new and existing homes, residential and commercial tax credits for efficient equipment and building shells, and an investment tax credit for small CHP plants). Together, these policies, which have a greater impact early in the projection when the incentives are in effect, reduce projected energy consumption in 2010 by 0.04 quadrillion Btu (less than 0.1 percent) compared to the reference case. The impacts of the tax incentive policies are mitigated by the limited duration of the tax credits and the slow turnover rates of the targeted building stock and related equipment. In addition, the credits tend to be small relative to the marginal cost of adopting the more efficient technology.

The impact of the investment tax credit for CHP is small due to the policy's limitation of 15 megawatts, as well as its 3-year duration from 2006 to 2008. In the commercial sector, the tax credit results in between 5 and 6 megawatts of additional commercial CHP capacity in the two multi-policy cases. In the industrial sector, an additional 52 megawatts of eligible CHP capacity is added by 2008 compared to the *AEO2005* reference case when the policy is analyzed by itself. When the policy is combined with the other policies, however, the overall additions of CHP are reduced. The reduction in electricity and steam demand under the voluntary agreements reduce the potential market for CHP, outweighing the positive effect of the tax incentive.

Of the incentives targeted at the residential sector, the new home tax credits are projected to save the smallest amount of energy cumulatively through 2025, because new construction accounts for a small amount of total residential housing in a given year, and the tax credit is in effect for only 3 years.

Appliance standards are more effective than tax incentives in reducing energy demand, because they limit consumers' choices to the more efficient technology, thus ensuring the technology adoption and the associated reductions in energy demand. When promulgated, the standards remain in effect over the entire projection period, allowing the impacts to grow over time as more appliances are purchased and/or replaced.

The scope of a particular efficiency standard and its effective date affect the projected energy impact and the efficiency improvement required by the standard. The distribution transformer standard and the reach-in refrigerator efficiency standard both are targeted at very specific segments of commercial energy use. Although these standards save a significant share of energy use per unit, their narrow scope limits their potential effects on total commercial energy use.

The building code policies produce relatively large energy savings, compared to some of the other policies. In the residential sector, building codes achieve an energy savings of 1 percent (0.3 quadrillion Btu) in 2025. In the commercial sector, the building code policy saves 2 percent (0.5 quadrillion Btu) in 2025. However, more than 80 percent of the reduction with the commercial building codes is due to the stipulation of a limit on the watts per square foot allowed for lighting. The proposed code may result in a change in the level of lighting service

Table 9. Policy Impacts Relative to the *AEO2005* Reference Case
(Quadrillion Btu)

	2010	2015	2020	2025	Cumulative 2006-2025
Primary Energy Use by Sector in the *AEO2005* Reference Case					
Residential	23.47	24.58	25.56	26.62	491.5
Commercial	20.29	22.18	24.24	26.74	449.6
Industrial	35.47	36.58	38.19	39.53	737.4
Transportation	32.04	34.96	37.61	40.28	700.9
Total	**111.27**	**118.29**	**125.60**	**133.18**	**2,379.4**
Change in Energy Use from the Reference Case by Sector and Policy					
Residential					
Ceiling Fan Efficiency Standard	-0.055	-0.127	-0.214	-0.300	-2.736
Furnace/Furnace Fan Standard	-0.012	-0.076	-0.119	-0.153	-1.551
Torchiere Lamp Standard	-0.044	-0.086	-0.088	-0.092	-1.371
Building Codes (HUD Type)	-0.005	-0.009	-0.013	-0.016	-0.184
Building Codes (Non-HUD Type)	-0.020	-0.097	-0.186	-0.264	-2.253
New Home Tax Credits	-0.001	-0.001	-0.001	-0.001	-0.024
Existing Home Tax Credits	-0.024	-0.021	-0.020	-0.018	-0.406
Equipment Tax Credits	-0.011	-0.011	-0.008	-0.005	-0.166
Commercial					
Air Conditioner Efficiency Standard	-0.011	-0.052	-0.078	-0.097	-0.986
Refrigerator Efficiency Standard	-0.001	-0.003	-0.005	-0.006	-0.059
Pre-rinse Spray Valve Standard	-0.045	-0.077	-0.077	-0.078	-1.235
Distribution Transformer Standard	0.000	0.000	0.000	0.000	-0.001
Equipment Tax Deductions	-0.005	-0.003	-0.002	-0.001	-0.053
Building Codes	-0.085	-0.238	-0.379	-0.529	-5.047
Other Policies Modeled Using NEMS					
CAFE Reform, Fuel Economy Testing	-0.258	-1.125	-1.582	-1.942	-20.581
CHP Tax Credits[1]	NA	NA	NA	NA	NA
Multi-Policy Cases, Including EEPS and Voluntary Policies					
Case 1	-0.603	-2.005	-2.868	-3.914	-39.759
Case 1 Subset[2]	-0.399	-1.493	-2.022	-2.663	-27.346
Case 2	-1.530	-4.517	-7.258	-9.335	-93.443

CHP: Combined heat and power. HUD Type: Manufactured homes regulated by the U.S. Department of Housing and Urban Development. NA: not applicable.

[1]The induced increase in CHP capacity increases commercial and industrial energy consumption while decreasing electric power sector consumption. The overall effect is a reduction in primary energy use of less than 0.005 quadrillion Btu per year, the amount dependent on the type of power plants displaced. With the relatively small change in CHP capacity, a precise estimate of the differences in energy use is unavailable, given the solution tolerances in NEMS.

[2]This case includes all the policies in Case 1 except for the five-State EEPS and the industrial voluntary agreements case.

Source: Energy Information Administration, National Energy Modeling System. *AEO2005*, run AEO2005.D102004A; Case 1, run DORG_V1.D031105A; Case 2, run DORG_V2.D031105A; Case 1 Subset, run DORG_V1E.D041305A. Other results from individual sector model test runs derived from the reference case and multi-policy runs.

provided, because the maximum power requirement may be met by reducing the number of lights used in addition to installing lights that use less power.

The impacts of the voluntary agreement and EEPS policies are high relative to the impacts of the numerous policies targeted at specific end uses. Given the inherent uncertainty associated with the outcome of such programs, a variation on the multi-policy Case 1 was examined, and the results are presented in Table 9. In the Case 1 Subset, the effects of the industrial voluntary program and the State-level EEPS policies were removed. This variation on Case 1 provides an estimate of the combined impacts of the “hard” policies targeted at specific end uses, with the exception of the residential and commercial building code policies already omitted from Case 1. The energy savings in the Case 1 Subset are 68 percent of the Case 1 savings in 2025. The Case 1 Subset achieves a 2-percent reduction in total energy consumption in 2025 (2.7 quadrillion Btu). Of these savings, 73 percent (1.9 quadrillion) occur as a result of the CAFE reform policy.

Appendix A
Letter from Senator Dorgan Requesting the Analysis

BYRON L. DORGAN
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COMMERCE, SCIENCE & TRANSPORTATION
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MINOT, ND 58701
701–852–0703

September 29, 2004

Guy Caruso
Administrator
Energy Information Administration
EI-1/Forrestal Building
100 Independence Avenue SW
Washington, DC 20585

Dear Mr. Caruso:

I am writing to request that you conduct a quantitative analysis of the energy consumption and oil savings that would result from a range of energy efficiency policies that have evolved from staff work with the Alliance to Save Energy. Increasing concern about national security, trade deficits, economic growth, air quality and climate change will concern Congress for many years.

Your *Annual Energy Outlook* is a widely used baseline for many types of policy analysis. Comparing future action in an evaluation of an ambitious package of energy efficiency policies is timely, and could improve debate as well as the eventual agreements on future energy legislation.

I would like EIA to undertake a broad review of the expected energy and economic impacts of a detailed group of energy policies, highlighting those key differences that could significantly reduce America's dependence on imported energy, and reduce emissions. I suggest that an early meeting between respective staffs would provide the details of the specific policies most worth analyzing. Important assumptions about the appropriate level of detail, the timing of the analysis and planning horizons could be resolved in discussions with my staff. Please contact Jerome Hinkle, at (202) 224-3700, with any questions.

The Energy Information Administration has often made key contributions to debate and understanding. I appreciate the contributions your energy analysis has made on policy debates, especially in the 108th Congress. I expect that the analysis I have described here will greatly help Congress in its pursuit of future actions.

Sincerely,

Byron L. Dorgan
U.S. Senator

cc: Rick A. Dearborn, CI-1, Assistant Secretary for Congressional and Intergovernmental Affairs
Kateri Callahan, President, Alliance to Save Energy

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Appendix B: Forecast Comparison Tables

Table B1. Total Energy Supply and Disposition Summary
(Quadrillion Btu per Year, Unless Otherwise Noted)

Supply, Disposition, and Prices	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Production							
Crude Oil and Lease Condensate	12.03	11.63	11.63	11.63	10.01	10.00	9.98
Natural Gas Plant Liquids	2.34	2.67	2.66	2.63	2.81	2.75	2.68
Dry Natural Gas	19.58	21.33	21.23	20.87	22.42	21.89	21.24
Coal	22.66	25.56	25.33	24.47	29.90	28.87	26.00
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy**1**	5.89	7.13	7.07	6.96	8.10	8.15	7.81
Other**2**	0.93	0.78	0.76	0.76	0.82	0.79	0.82
Total	**71.42**	**77.73**	**77.31**	**75.90**	**82.73**	**81.12**	**77.16**
Imports							
Crude Oil**3**	21.08	28.98	28.58	28.55	35.16	33.80	33.72
Petroleum Products**4**	5.16	6.32	5.39	5.32	8.27	7.19	7.11
Natural Gas	4.02	8.00	7.70	6.75	9.70	9.74	8.51
Other Imports**5**	0.69	1.07	1.07	1.06	1.23	1.23	1.24
Total	**30.95**	**44.37**	**42.74**	**41.68**	**54.36**	**51.96**	**50.59**
Exports							
Petroleum**6**	2.13	2.21	2.18	2.16	2.32	2.27	2.25
Natural Gas	0.70	0.81	0.82	0.89	0.83	0.85	0.95
Coal	1.12	0.88	0.88	0.88	0.65	0.65	0.65
Total	**3.95**	**3.90**	**3.88**	**3.93**	**3.80**	**3.77**	**3.85**
Discrepancy7	**0.18**	**-0.09**	**-0.12**	**-0.12**	**0.10**	**0.05**	**0.06**
Consumption							
Petroleum Products**8**	39.09	48.07	46.77	46.66	54.42	51.99	51.78
Natural Gas	22.54	28.69	28.28	26.90	31.47	30.96	28.99
Coal	22.71	25.71	25.47	24.62	30.48	29.46	26.60
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy**1**	5.89	7.13	7.07	6.96	8.10	8.15	7.81
Other**9**	0.02	0.07	0.07	0.05	0.04	0.04	0.04
Total	**98.22**	**118.29**	**116.29**	**113.78**	**133.18**	**129.26**	**123.84**
Net Imports - Petroleum	**24.10**	**33.10**	**31.79**	**31.71**	**41.11**	**38.72**	**38.58**
Prices (2003 dollars per unit)							
World Oil Price (dollars per barrel)**10**	27.73	26.75	26.75	26.75	30.31	30.31	30.31
Natural Gas Wellhead Price (dollars per thousand cubic feet)**11**	4.98	4.16	4.05	3.74	4.79	4.73	4.38
Coal Minemouth Price (dollars per ton)	17.93	16.89	16.75	16.48	18.26	17.77	16.74

[1]Includes grid-connected electricity from conventional hydroelectric; wood and wood waste; landfill gas; municipal solid waste; other biomass; wind; photovoltaic and solar thermal sources; non-electric energy from renewable sources, such as active and passive solar systems, and wood; and both the ethanol and gasoline components of E85, but not the ethanol components of blends less than 85 percent. Excludes electricity imports using renewable sources and nonmarketed renewable energy.
[2]Includes liquid hydrogen, methanol, supplemental natural gas, and some domestic inputs to refineries.
[3]Includes imports of crude oil for the Strategic Petroleum Reserve.
[4]Includes imports of finished petroleum products, unfinished oils, alcohols, ethers, and blending components.
[5]Includes coal, coal coke (net), and electricity (net).
[6]Includes crude oil and petroleum products.
[7]Balancing item. Includes unaccounted for supply, losses, gains, net storage withdrawals, heat loss when natural gas is converted to liquid fuel, and heat loss when coal is converted to liquid fuel.
[8]Includes natural gas plant liquids, crude oil consumed as a fuel, and nonpetroleum-based liquids for blending, such as ethanol.
[9]Includes net electricity imports, methanol, and liquid hydrogen.
[10]Average refiner acquisition cost for imported crude oil.
[11]Represents lower 48 onshore and offshore supplies.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 natural gas supply values and natural gas wellhead price: Energy Information Administration (EIA), *Natural Gas Monthly*, DOE/EIA-0130(2004/07) (Washington, DC, July 2004). 2003 petroleum supply values: EIA, *Petroleum Supply Annual 2003,* DOE/EIA-0340(2003)/1 (Washington, DC, July 2004). Other 2003 values: EIA, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004) and EIA, *Quarterly Coal Report, October-December 2003*, DOE/EIA-0121(2003/4Q) (Washington, DC, March 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B2. Energy Consumption by Sector and Source
(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Energy Consumption							
Residential							
Distillate Fuel	0.96	0.88	0.87	0.87	0.77	0.78	0.77
Kerosene	0.07	0.09	0.09	0.09	0.09	0.09	0.09
Liquefied Petroleum Gas	0.54	0.61	0.60	0.60	0.67	0.65	0.64
Petroleum Subtotal	1.58	1.58	1.57	1.56	1.53	1.51	1.50
Natural Gas	5.25	5.90	5.83	5.66	6.17	5.97	5.47
Coal	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Renewable Energy**1**	0.40	0.39	0.39	0.39	0.38	0.38	0.37
Electricity	4.37	5.40	5.30	5.15	6.18	5.96	5.55
Delivered Energy	**11.61**	**13.29**	**13.10**	**12.77**	**14.26**	**13.83**	**12.91**
Electricity Related Losses	9.71	11.29	11.13	10.61	12.35	12.05	11.13
Total	**21.31**	**24.58**	**24.23**	**23.38**	**26.62**	**25.88**	**24.04**
Commercial							
Distillate Fuel	0.52	0.66	0.66	0.64	0.77	0.76	0.72
Residual Fuel	0.07	0.07	0.07	0.07	0.08	0.08	0.08
Kerosene	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Liquefied Petroleum Gas	0.10	0.10	0.10	0.10	0.11	0.11	0.11
Motor Gasoline**2**	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Petroleum Subtotal	0.75	0.91	0.90	0.89	1.02	1.01	0.97
Natural Gas	3.22	3.69	3.62	3.53	4.17	4.06	3.79
Coal	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Renewable Energy**3**	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Electricity	4.13	5.63	5.58	5.37	7.12	7.01	6.48
Delivered Energy	**8.29**	**10.41**	**10.29**	**9.97**	**12.49**	**12.27**	**11.42**
Electricity Related Losses	9.18	11.77	11.73	11.05	14.25	14.18	12.98
Total	**17.46**	**22.18**	**22.02**	**21.02**	**26.74**	**26.45**	**24.40**
Industrial4							
Distillate Fuel	1.03	1.08	1.06	1.05	1.19	1.16	1.15
Liquefied Petroleum Gas	2.09	2.44	2.42	2.42	2.74	2.69	2.69
Petrochemical Feedstock	1.32	1.52	1.51	1.52	1.57	1.54	1.56
Residual Fuel	0.28	0.38	0.39	0.38	0.38	0.39	0.38
Motor Gasoline**2**	0.31	0.33	0.33	0.33	0.37	0.36	0.36
Other Petroleum**5**	4.30	4.69	4.59	4.57	5.23	4.91	4.92
Petroleum Subtotal	9.31	10.43	10.28	10.28	11.47	11.05	11.05
Natural Gas	7.19	8.50	8.38	8.19	9.26	8.98	8.36
Lease and Plant Fuel**6**	1.15	1.23	1.22	1.20	1.31	1.28	1.23
Natural Gas Subtotal	8.34	9.73	9.60	9.39	10.57	10.26	9.59
Metallurgical Coal	0.67	0.48	0.48	0.48	0.37	0.36	0.36
Steam Coal	1.39	1.42	1.41	1.41	1.42	1.41	1.42
Net Coal Coke Imports	0.05	0.05	0.05	0.06	0.05	0.05	0.06
Coal Subtotal	2.11	1.95	1.94	1.95	1.83	1.82	1.84
Renewable Energy**7**	1.79	2.19	2.19	2.19	2.50	2.49	2.48
Electricity	3.31	3.98	3.94	3.84	4.39	4.29	4.04
Delivered Energy	**24.86**	**28.27**	**27.95**	**27.65**	**30.76**	**29.91**	**29.01**
Electricity Related Losses	7.35	8.31	8.27	7.91	8.78	8.69	8.10
Total	**32.21**	**36.58**	**36.22**	**35.57**	**39.53**	**38.60**	**37.11**

Table B2. Energy Consumption by Sector and Source (Continued)
(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Transportation							
Distillate Fuel8	5.54	7.67	7.60	7.62	9.05	8.87	8.86
Jet Fuel9	3.26	4.45	4.45	4.45	4.89	4.89	4.89
Motor Gasoline2	16.64	20.81	19.76	19.77	24.04	22.29	22.32
Residual Fuel	0.62	0.57	0.57	0.57	0.58	0.58	0.58
Liquefied Petroleum Gas	0.02	0.07	0.06	0.06	0.09	0.08	0.08
Other Petroleum10	0.24	0.27	0.27	0.27	0.31	0.31	0.31
Petroleum Subtotal	26.31	33.84	32.71	32.74	38.97	37.02	37.04
Pipeline Fuel Natural Gas	0.65	0.73	0.72	0.69	0.84	0.83	0.78
Compressed Natural Gas	0.02	0.08	0.08	0.08	0.11	0.10	0.10
Renewable Energy (E85)11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.08	0.10	0.10	0.10	0.12	0.12	0.12
Delivered Energy	**27.07**	**34.75**	**33.61**	**33.61**	**40.04**	**38.09**	**38.05**
Electricity Related Losses	0.17	0.21	0.21	0.20	0.24	0.24	0.24
Total	**27.24**	**34.96**	**33.82**	**33.81**	**40.28**	**38.33**	**38.29**
Delivered Energy Consumption for All Sectors							
Distillate Fuel	8.04	10.28	10.19	10.18	11.78	11.57	11.49
Kerosene	0.11	0.14	0.14	0.14	0.13	0.13	0.13
Jet Fuel9	3.26	4.45	4.45	4.45	4.89	4.89	4.89
Liquefied Petroleum Gas	2.75	3.22	3.19	3.19	3.60	3.53	3.52
Motor Gasoline2	16.98	21.18	20.13	20.14	24.45	22.69	22.72
Petrochemical Feedstock	1.32	1.52	1.51	1.52	1.57	1.54	1.56
Residual Fuel	0.97	1.02	1.03	1.02	1.03	1.04	1.03
Other Petroleum12	4.52	4.94	4.84	4.82	5.53	5.20	5.21
Petroleum Subtotal	37.96	46.75	45.47	45.46	52.98	50.60	50.56
Natural Gas	15.68	18.17	17.91	17.46	19.70	19.11	17.73
Lease and Plant Fuel Plant6	1.15	1.23	1.22	1.20	1.31	1.28	1.23
Pipeline Natural Gas	0.65	0.73	0.72	0.69	0.84	0.83	0.78
Natural Gas Subtotal	17.48	20.13	19.85	19.34	21.85	21.22	19.74
Metallurgical Coal	0.67	0.48	0.48	0.48	0.37	0.36	0.36
Steam Coal	1.50	1.52	1.52	1.52	1.52	1.51	1.52
Net Coal Coke Imports	0.05	0.05	0.05	0.06	0.05	0.05	0.06
Coal Subtotal	2.22	2.06	2.05	2.06	1.94	1.93	1.95
Renewable Energy13	2.28	2.67	2.67	2.67	2.97	2.96	2.95
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	11.88	15.11	14.92	14.46	17.81	17.38	16.19
Delivered Energy	**71.82**	**86.73**	**84.96**	**84.00**	**97.56**	**94.09**	**91.39**
Electricity Related Losses	26.40	31.57	31.33	29.78	35.62	35.17	32.45
Total	**98.22**	**118.29**	**116.29**	**113.78**	**133.18**	**129.26**	**123.84**
Electric Power14							
Distillate Fuel	0.33	0.40	0.39	0.36	0.45	0.42	0.39
Residual Fuel	0.80	0.92	0.91	0.84	0.98	0.97	0.84
Petroleum Subtotal	1.13	1.32	1.30	1.20	1.43	1.39	1.23
Natural Gas	5.06	8.56	8.43	7.55	9.61	9.74	9.24
Steam Coal	20.49	23.65	23.43	22.56	28.54	27.53	24.65
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy15	3.62	4.46	4.41	4.29	5.14	5.19	4.86
Electricity Imports	0.02	0.07	0.07	0.05	0.04	0.04	0.04
Total	**38.28**	**46.68**	**46.25**	**44.24**	**53.43**	**52.56**	**48.65**

Table B2. Energy Consumption by Sector and Source (Continued)
(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Total Energy Consumption							
Distillate Fuel	8.37	10.68	10.58	10.54	12.23	11.99	11.88
Kerosene	0.11	0.14	0.14	0.14	0.13	0.13	0.13
Jet Fuel[9]	3.26	4.45	4.45	4.45	4.89	4.89	4.89
Liquefied Petroleum Gas	2.75	3.22	3.19	3.19	3.60	3.53	3.52
Motor Gasoline[2]	16.98	21.18	20.13	20.14	24.45	22.69	22.72
Petrochemical Feedstock	1.32	1.52	1.51	1.52	1.57	1.54	1.56
Residual Fuel	1.77	1.94	1.94	1.86	2.02	2.01	1.88
Other Petroleum[12]	4.52	4.94	4.84	4.82	5.53	5.20	5.21
Petroleum Subtotal	39.09	48.07	46.77	46.66	54.42	51.99	51.78
Natural Gas	20.74	26.73	26.33	25.01	29.32	28.85	26.98
Lease and Plant Fuel[6]	1.15	1.23	1.22	1.20	1.31	1.28	1.23
Pipeline Natural Gas	0.65	0.73	0.72	0.69	0.84	0.83	0.78
Natural Gas Subtotal	22.54	28.69	28.28	26.90	31.47	30.96	28.99
Metallurgical Coal	0.67	0.48	0.48	0.48	0.37	0.36	0.36
Steam Coal	21.99	25.17	24.94	24.09	30.07	29.04	26.17
Net Coal Coke Imports	0.05	0.05	0.05	0.06	0.05	0.05	0.06
Coal Subtotal	22.71	25.71	25.47	24.62	30.48	29.46	26.60
Nuclear Power	7.97	8.62	8.62	8.58	8.67	8.67	8.63
Renewable Energy[16]	5.89	7.13	7.07	6.96	8.10	8.15	7.81
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity Imports	0.02	0.07	0.07	0.05	0.04	0.04	0.04
Total	**98.22**	**118.29**	**116.29**	**113.78**	**133.18**	**129.26**	**123.84**
Energy Use and Related Statistics							
Delivered Energy Use	71.82	86.73	84.96	84.00	97.56	94.09	91.39
Total Energy Use	98.22	118.29	116.29	113.78	133.18	129.26	123.84
Population (millions)	291.39	323.55	323.55	323.55	350.64	350.64	350.64
Carbon Dioxide Emissions (million metric tons)	5788.7	7052.4	6922.7	6760.2	8062.3	7780.5	7391.5

[1]Includes wood used for residential heating. See Table B15 for estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal hot water heating, and solar photovoltaic electricity generation.
[2]Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.
[3]Includes commercial sector consumption of wood and wood waste, landfill gas, municipal solid waste, and other biomass for combined heat and power. See Table B15 for estimates of nonmarketed renewable energy consumption for solar thermal hot water heating and solar photovoltaic electricity generation.
[4]Includes energy for combined heat and power plants, except those whose primary business is to sell electricity, or electricity and heat, to the public.
[5]Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.
[6]Represents natural gas used in the field gathering and processing plant machinery.
[7]Includes consumption of energy from hydroelectric, wood and wood waste, municipal solid waste, and other biomass.
[8]Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur.
[9]Includes only kerosene type.
[10]Includes aviation gasoline and lubricants.
[11]E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol actually varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.
[12]Includes unfinished oils, natural gasoline, motor gasoline blending components, aviation gasoline, lubricants, still gas, asphalt, road oil, petroleum coke, and miscellaneous petroleum products.
[13]Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
[14]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
[15]Includes conventional hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes net electricity imports.
[16]Includes hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, wind, photovoltaic and solar thermal sources. Includes ethanol components of E85; excludes ethanol blends (10 percent or less) in motor gasoline. Excludes net electricity imports and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports. Consumption values of 0.00 are values that round to 0.00, because they are less than 0.005.
Sources: 2003 consumption based on: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). 2003 population and gross domestic product: Global Insight macroeconomic model CTL0804, modified by EIA. 2003 carbon dioxide emissions: EIA, *Emissions of Greenhouse Gases in the United States 2003,* DOE/EIA-0573(2003) (Washington, DC, December 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B3. Residential Sector Key Indicators and End-Use Consumption
(Quadrillion Btu per Year, Unless Otherwise Noted)

Key Indicators and Consumption	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Key Indicators							
Households (millions)							
Single-Family	76.15	89.62	89.62	89.63	99.50	99.49	99.49
Multifamily	29.51	32.34	32.34	32.35	35.08	35.08	35.09
Mobile Homes	6.35	7.15	7.15	7.15	7.90	7.90	7.89
Total	**112.01**	**129.11**	**129.11**	**129.12**	**142.48**	**142.46**	**142.47**
Average House Square Footage	**1742**	**1871**	**1871**	**1871**	**1950**	**1950**	**1950**
Energy Intensity							
(million Btu per household)							
Delivered Energy Consumption	103.6	102.9	101.8	99.2	100.1	97.8	91.3
Total Energy Consumption	190.3	190.4	188.0	181.4	186.8	182.4	169.4
(thousand Btu per square foot)							
Delivered Energy Consumption	59.5	55.0	54.4	53.0	51.3	50.1	46.8
Total Energy Consumption	109.2	101.8	100.5	97.0	95.8	93.5	86.9
Delivered Energy Consumption by Fuel							
Electricity							
Space Heating	0.40	0.45	0.45	0.45	0.47	0.47	0.46
Space Cooling	0.65	0.73	0.73	0.73	0.80	0.80	0.78
Water Heating	0.37	0.38	0.38	0.39	0.37	0.38	0.38
Refrigeration	0.40	0.35	0.35	0.35	0.36	0.36	0.36
Cooking	0.10	0.12	0.12	0.12	0.13	0.13	0.13
Clothes Dryers	0.24	0.26	0.27	0.27	0.29	0.29	0.29
Freezers	0.13	0.12	0.12	0.12	0.13	0.13	0.13
Lighting	0.78	0.99	0.97	0.98	1.13	1.10	1.11
Clothes Washers**1**	0.03	0.05	0.05	0.05	0.06	0.06	0.06
Dishwashers**1**	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Color Televisions	0.13	0.23	0.23	0.23	0.28	0.28	0.29
Personal Computers	0.07	0.12	0.12	0.12	0.15	0.15	0.15
Furnace Fans	0.08	0.10	0.10	0.10	0.12	0.10	0.10
Other Uses**2**	0.95	1.46	1.43	1.27	1.85	1.78	1.37
Delivered Energy	**4.37**	**5.40**	**5.30**	**5.15**	**6.18**	**5.96**	**5.55**
Natural Gas							
Space Heating	3.70	4.17	4.09	3.91	4.36	4.16	3.65
Space Cooling	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Heating	1.17	1.29	1.29	1.30	1.32	1.32	1.33
Cooking	0.21	0.25	0.25	0.25	0.27	0.27	0.27
Clothes Dryers	0.07	0.10	0.10	0.10	0.12	0.12	0.12
Other Uses**3**	0.10	0.10	0.10	0.10	0.09	0.09	0.09
Delivered Energy	**5.25**	**5.90**	**5.83**	**5.66**	**6.17**	**5.97**	**5.47**
Distillate							
Space Heating	0.84	0.77	0.76	0.76	0.68	0.68	0.67
Water Heating	0.12	0.11	0.11	0.11	0.10	0.10	0.10
Other Uses**4**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delivered Energy	**0.96**	**0.88**	**0.87**	**0.87**	**0.77**	**0.78**	**0.77**
Liquefied Petroleum Gas							
Space Heating	0.30	0.30	0.29	0.29	0.30	0.29	0.28
Water Heating	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cooking	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Other Uses**3**	0.17	0.23	0.23	0.23	0.28	0.28	0.28
Delivered Energy	**0.54**	**0.61**	**0.60**	**0.60**	**0.67**	**0.65**	**0.64**
Marketed Renewables (wood)**5**	0.40	0.39	0.39	0.39	0.38	0.38	0.37
Other Fuels**6**	0.08	0.10	0.10	0.10	0.10	0.10	0.10

Table B3. Residential Sector Key Indicators and End-Use Consumption (Continued)
(Quadrillion Btu per Year, Unless Otherwise Noted)

Key Indicators and Consumption	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Delivered Energy Consumption by End Use							
Space Heating	5.72	6.19	6.10	5.90	6.29	6.07	5.53
Space Cooling	0.65	0.73	0.73	0.73	0.80	0.80	0.78
Water Heating	1.71	1.83	1.84	1.85	1.85	1.85	1.86
Refrigeration	0.40	0.35	0.35	0.35	0.36	0.36	0.36
Cooking	0.34	0.39	0.39	0.39	0.44	0.44	0.44
Clothes Dryers	0.31	0.37	0.37	0.37	0.40	0.40	0.41
Freezers	0.13	0.12	0.12	0.12	0.13	0.13	0.13
Lighting	0.78	0.99	0.97	0.98	1.13	1.10	1.11
Clothes Washers	0.03	0.05	0.05	0.05	0.06	0.06	0.06
Dishwashers	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Color Televisions	0.13	0.23	0.23	0.23	0.28	0.28	0.29
Personal Computers	0.07	0.12	0.12	0.12	0.15	0.15	0.15
Furnace Fans	0.08	0.10	0.10	0.10	0.12	0.10	0.10
Other Uses**7**	1.22	1.79	1.76	1.60	2.23	2.15	1.75
Delivered Energy	**11.61**	**13.29**	**13.14**	**12.81**	**14.26**	**13.93**	**13.01**
Electricity Related Losses	**9.71**	**11.29**	**11.13**	**10.61**	**12.35**	**12.05**	**11.13**
Total Energy Consumption by End Use							
Space Heating	6.61	7.13	7.04	6.83	7.22	7.02	6.45
Space Cooling	2.11	2.27	2.27	2.24	2.41	2.42	2.36
Water Heating	2.53	2.63	2.64	2.65	2.60	2.61	2.63
Refrigeration	1.30	1.08	1.09	1.07	1.08	1.09	1.08
Cooking	0.57	0.64	0.64	0.64	0.70	0.70	0.70
Clothes Dryers	0.85	0.92	0.92	0.92	0.97	0.98	0.98
Freezers	0.42	0.37	0.37	0.36	0.38	0.38	0.38
Lighting	2.51	3.07	3.00	2.99	3.39	3.32	3.34
Clothes Washers	0.10	0.15	0.15	0.15	0.19	0.20	0.19
Dishwashers	0.08	0.09	0.09	0.09	0.09	0.09	0.09
Color Televisions	0.43	0.70	0.71	0.70	0.85	0.85	0.86
Personal Computers	0.23	0.37	0.37	0.36	0.45	0.45	0.45
Furnace Fans	0.27	0.32	0.30	0.30	0.35	0.31	0.31
Other Uses**7**	3.32	4.83	4.76	4.21	5.93	5.75	4.50
Total	**21.31**	**24.58**	**24.27**	**23.42**	**26.62**	**25.98**	**24.14**
Non-Marketed Renewables							
Geothermal**8**	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Solar**9**	0.02	0.03	0.03	0.03	0.04	0.04	0.04
Total	**0.02**	**0.04**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**

[1]Does not include electric water heating portion of load.
[2]Includes small electric devices, heating elements, and motors not listed above.
[3]Includes such appliances as swimming pool heaters, outdoor grills, and outdoor lighting (natural gas).
[4]Includes such appliances as swimming pool and spa heaters.
[5]Includes wood used for primary and secondary heating in wood stoves or fireplaces as reported in the *Residential Energy Consumption Survey 2001*.
[6]Includes kerosene and coal.
[7]Includes all other uses listed above.
[8]Includes primary energy displaced by geothermal heat pumps in space heating and cooling applications.
[9]Includes primary energy displaced by solar thermal water heaters and electricity generated using photovoltaics.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 based on: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004).
Projections: EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B4. Commercial Sector Key Indicators and Consumption
(Quadrillion Btu per Year, Unless Otherwise Noted)

Key Indicators and Consumption	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Key Indicators							
Total Floorspace (billion square							
Surviving	70.1	85.9	85.9	85.9	101.8	101.8	101.9
New Additions	2.1	2.5	2.5	2.5	3.0	3.0	3.0
Total	**72.1**	**88.4**	**88.4**	**88.4**	**104.8**	**104.8**	**104.9**
Energy Consumption Intensity (thousand Btu per square foot)							
Delivered Energy Consumption	114.8	117.7	116.4	112.7	119.2	117.1	108.9
Electricity Related Losses	127.2	133.1	132.7	125.0	136.0	135.3	123.8
Total Energy Consumption	242.0	250.8	249.1	237.7	255.2	252.4	232.7
Delivered Energy Consumption by Fuel							
Purchased Electricity							
Space Heating1	0.15	0.16	0.16	0.16	0.16	0.16	0.16
Space Cooling1	0.42	0.48	0.46	0.47	0.54	0.51	0.52
Water Heating1	0.14	0.15	0.15	0.15	0.16	0.16	0.16
Ventilation	0.16	0.18	0.18	0.18	0.20	0.20	0.20
Cooking	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lighting	1.10	1.37	1.38	1.34	1.52	1.53	1.44
Refrigeration	0.20	0.24	0.24	0.24	0.28	0.28	0.28
Office Equipment (PC)	0.14	0.29	0.29	0.29	0.36	0.36	0.36
Office Equipment (non-PC)	0.31	0.57	0.57	0.57	0.87	0.87	0.87
Other Uses2	1.48	2.17	2.13	1.94	3.00	2.92	2.44
Delivered Energy	**4.13**	**5.63**	**5.58**	**5.37**	**7.12**	**7.01**	**6.48**
Natural Gas							
Space Heating1	1.36	1.47	1.45	1.34	1.56	1.52	1.22
Space Cooling1	0.01	0.02	0.02	0.02	0.03	0.03	0.03
Water Heating1	0.57	0.72	0.66	0.67	0.85	0.79	0.80
Cooking	0.26	0.34	0.34	0.34	0.40	0.40	0.41
Other Uses3	1.02	1.15	1.15	1.16	1.33	1.33	1.34
Delivered Energy	**3.22**	**3.69**	**3.62**	**3.53**	**4.17**	**4.06**	**3.79**
Distillate							
Space Heating1	0.22	0.37	0.37	0.35	0.47	0.47	0.43
Water Heating1	0.07	0.07	0.07	0.07	0.08	0.07	0.07
Other Uses4	0.23	0.22	0.22	0.22	0.21	0.21	0.21
Delivered Energy	**0.52**	**0.66**	**0.66**	**0.64**	**0.77**	**0.76**	**0.72**
Marketed Renewables (biomass)	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Other Fuels5	0.33	0.34	0.34	0.34	0.35	0.35	0.35
Delivered Energy Consumption by End							
Space Heating1	1.73	2.00	1.98	1.85	2.20	2.15	1.81
Space Cooling1	0.43	0.49	0.48	0.48	0.57	0.54	0.55
Water Heating1	0.78	0.94	0.88	0.89	1.09	1.02	1.04
Ventilation	0.16	0.18	0.18	0.18	0.20	0.20	0.20
Cooking	0.29	0.37	0.37	0.37	0.43	0.43	0.44
Lighting	1.10	1.37	1.38	1.34	1.52	1.53	1.44
Refrigeration	0.20	0.24	0.24	0.24	0.28	0.28	0.28
Office Equipment (PC)	0.14	0.29	0.29	0.29	0.36	0.36	0.36
Office Equipment (non-PC)	0.31	0.57	0.57	0.57	0.87	0.87	0.87
Other Uses6	3.15	3.96	3.93	3.75	4.98	4.89	4.43
Delivered Energy	8.29	10.41	10.29	9.97	12.49	12.27	11.42

Table B4. Commercial Sector Key Indicators and Consumption (Continued)
(Quadrillion Btu per Year, Unless Otherwise Noted)

Key Indicators and Consumption	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Electricity Related Losses	**9.18**	**11.77**	**11.73**	**11.05**	**14.25**	**14.18**	**12.98**
Total Energy Consumption by End Use							
Space Heating1	2.06	2.32	2.31	2.17	2.52	2.48	2.13
Space Cooling1	1.37	1.49	1.45	1.45	1.66	1.58	1.60
Water Heating1	1.08	1.26	1.19	1.20	1.41	1.33	1.36
Ventilation	0.52	0.55	0.55	0.56	0.59	0.60	0.61
Cooking	0.36	0.43	0.43	0.44	0.49	0.49	0.50
Lighting	3.55	4.23	4.27	4.09	4.56	4.61	4.33
Refrigeration	0.65	0.75	0.75	0.75	0.85	0.85	0.85
Office Equipment (PC)	0.44	0.90	0.90	0.89	1.08	1.09	1.08
Office Equipment (non-PC)	1.00	1.75	1.75	1.74	2.61	2.63	2.63
Other Uses6	6.44	8.49	8.41	7.74	10.98	10.79	9.32
Total	**17.46**	**22.18**	**22.02**	**21.02**	**26.74**	**26.45**	**24.40**
Non-Marketed Renewable Fuels							
Solar7	0.02	0.03	0.03	0.03	0.04	0.04	0.04

[1]Includes fuel consumption for district services.
[2]Includes miscellaneous uses, such as service station equipment, automated teller machines, telecommunications equipment, and medical equipment.
[3]Includes miscellaneous uses, such as pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings.
[4]Includes miscellaneous uses, such as cooking, emergency electric generators, and combined heat and power in commercial buildings.
[5]Includes residual fuel oil, liquefied petroleum gas, coal, motor gasoline, and kerosene.
[6]Includes miscellaneous uses, such as service station equipment, automated teller machines, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, liquefied petroleum gas, coal, motor gasoline, and kerosene.
[7]Includes primary energy displaced by solar thermal space heating and water heating, and electricity generation by solar photovoltaic systems.
Btu = British thermal unit.
PC = Personal computer.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 based on: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004).
Projections: EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B5. Industrial Sector Key Indicators and Consumption

Key Indicators and Consumption	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Key Indicators							
Value of Shipments (billion 1996 dollars)							
Manufacturing	3851	5392	5388	5408	6733	6702	6696
Nonmanufacturing	1254	1458	1455	1451	1736	1729	1718
Total	**5105**	**6850**	**6843**	**6860**	**8469**	**8431**	**8415**
Energy Consumption (quadrillion Btu)1							
Distillate	1.03	1.08	1.06	1.05	1.19	1.16	1.15
Liquefied Petroleum Gas	2.09	2.44	2.42	2.42	2.74	2.69	2.69
Petrochemical Feedstocks	1.32	1.52	1.51	1.52	1.57	1.54	1.56
Residual Fuel	0.28	0.38	0.39	0.38	0.38	0.39	0.38
Motor Gasoline	0.31	0.33	0.33	0.33	0.37	0.36	0.36
Petroleum Coke	1.00	1.17	1.14	1.14	1.38	1.27	1.27
Still Gas	1.48	1.57	1.55	1.54	1.68	1.59	1.59
Asphalt and Road Oil	1.22	1.21	1.18	1.18	1.43	1.35	1.35
Miscellaneous Petroleum**2**	0.61	0.73	0.71	0.71	0.75	0.70	0.71
Petroleum Subtotal	9.31	10.43	10.28	10.28	11.47	11.05	11.05
Natural Gas	7.19	8.50	8.38	8.19	9.26	8.98	8.36
Lease and Plant Fuel**3**	1.15	1.23	1.22	1.20	1.31	1.28	1.23
Natural Gas Subtotal	8.34	9.73	9.60	9.39	10.57	10.26	9.59
Metallurgical Coal and Coke**4**	0.72	0.53	0.53	0.54	0.42	0.41	0.43
Steam Coal	1.39	1.42	1.41	1.41	1.42	1.41	1.42
Coal Subtotal	2.11	1.95	1.94	1.95	1.83	1.82	1.84
Renewables**5**	1.79	2.19	2.19	2.19	2.50	2.49	2.48
Purchased Electricity	3.31	3.98	3.94	3.84	4.39	4.29	4.04
Delivered Energy	**24.86**	**28.27**	**27.95**	**27.65**	**30.76**	**29.91**	**29.01**
Electricity Related Losses	7.35	8.31	8.27	7.91	8.78	8.69	8.10
Total	**32.21**	**36.58**	**36.22**	**35.57**	**39.53**	**38.60**	**37.11**
Energy Consumption per dollar of Shipments1 (thousand Btu per 1996 dollars)							
Distillate	0.20	0.16	0.15	0.15	0.14	0.14	0.14
Liquefied Petroleum Gas	0.41	0.36	0.35	0.35	0.32	0.32	0.32
Petrochemical Feedstocks	0.26	0.22	0.22	0.22	0.19	0.18	0.19
Residual Fuel	0.05	0.06	0.06	0.06	0.04	0.05	0.04
Motor Gasoline	0.06	0.05	0.05	0.05	0.04	0.04	0.04
Petroleum Coke	0.20	0.17	0.17	0.17	0.16	0.15	0.15
Still Gas	0.29	0.23	0.23	0.22	0.20	0.19	0.19
Asphalt and Road Oil	0.24	0.18	0.17	0.17	0.17	0.16	0.16
Miscellaneous Petroleum**2**	0.12	0.11	0.10	0.10	0.09	0.08	0.08
Petroleum Subtotal	1.82	1.52	1.50	1.50	1.35	1.31	1.31
Natural Gas	1.41	1.24	1.22	1.19	1.09	1.06	0.99
Lease and Plant Fuel**3**	0.23	0.18	0.18	0.17	0.15	0.15	0.15
Natural Gas Subtotal	1.63	1.42	1.40	1.37	1.25	1.22	1.14
Metallurgical Coal and Coke**4**	0.14	0.08	0.08	0.08	0.05	0.05	0.05
Steam Coal	0.27	0.21	0.21	0.21	0.17	0.17	0.17
Coal Subtotal	0.41	0.28	0.28	0.28	0.22	0.22	0.22
Renewables**5**	0.35	0.32	0.32	0.32	0.29	0.30	0.30
Purchased Electricity	0.65	0.58	0.58	0.56	0.52	0.51	0.48
Delivered Energy	**4.87**	**4.13**	**4.08**	**4.03**	**3.63**	**3.55**	**3.45**
Electricity Related Losses	1.44	1.21	1.21	1.15	1.04	1.03	0.96
Total	**6.31**	**5.34**	**5.29**	**5.18**	**4.67**	**4.58**	**4.41**
Industrial Combined Heat and Power							
Capacity (gigawatts)	24.87	32.23	32.20	31.67	40.09	39.50	37.72
Generation (billion kilowatthours)	139.59	192.47	192.32	187.96	250.10	245.57	232.27

[1]Fuel consumption includes energy for combined heat and power plants, except those whose primary business is to sell electricity, or electricity and heat, to the public.
[2]Includes lubricants and miscellaneous petroleum products.
[3]Represents natural gas used in the field gathering and processing plant machinery.
[4]Includes net coal coke imports.
[5]Includes consumption of energy from hydroelectric, wood and wood waste, municipal solid waste, and other biomass.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 consumption values based on: EIA, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). 2003 shipments: Global Insight industry model, August 2004. **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B6. Transportation Sector Key Indicators and Delivered Energy Consumption

Supply, Disposition, and Prices	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Key Indicators							
Level of Travel							
(billion vehicle miles traveled)							
Light-Duty Vehicles less than 8,500 pounds	2602	3354	3392	3393	4053	4143	4149
Commercial Light Trucks[1]	65	87	87	87	107	107	107
Freight Trucks greater than 10,000 pounds	214	300	300	302	373	372	373
(billion seat miles available)							
Air	932	1327	1327	1327	1520	1520	1520
(billion ton miles traveled)							
Rail	1352	1690	1685	1661	2001	1970	1892
Domestic Shipping	592	669	669	667	733	724	712
Energy Efficiency Indicators							
(miles per gallon)							
New Light-Duty Vehicle[2]	25.1	26.1	24.8	24.8	26.9	25.0	25.0
New Car[2]	29.5	30.3	28.0	28.0	31.0	28.2	28.2
New Light Truck[2]	21.8	23.4	22.6	22.6	24.6	23.1	23.1
Light-Duty Stock[3]	20.0	20.4	21.8	21.8	21.0	23.3	23.3
New Commercial Light Truck[1]	14.6	15.6	18.1	18.1	16.4	18.5	18.5
Stock Commercial Light Truck[1]	14.0	15.1	16.4	16.4	15.9	18.1	18.1
Freight Truck	6.0	6.2	6.1	6.1	6.6	6.6	6.6
(seat miles per gallon)							
Aircraft	55.3	62.1	62.0	62.0	68.5	68.5	68.5
(ton miles per thousand Btu)							
Rail	2.9	3.3	3.3	3.3	3.6	3.6	3.6
Domestic Shipping	2.3	2.4	2.4	2.4	2.4	2.4	2.4
Energy Use by Mode							
(quadrillion Btu)							
Light-Duty Vehicles	15.78	20.24	19.16	19.17	23.69	21.86	21.89
Commercial Light Trucks[1]	0.58	0.72	0.67	0.67	0.84	0.74	0.74
Bus Transportation	0.25	0.27	0.27	0.27	0.27	0.27	0.27
Freight Trucks	4.46	6.11	6.11	6.14	7.10	7.09	7.10
Rail, Passenger	0.12	0.15	0.15	0.15	0.17	0.17	0.17
Rail, Freight	0.47	0.52	0.52	0.51	0.56	0.55	0.53
Shipping, Domestic	0.26	0.29	0.29	0.29	0.31	0.30	0.30
Shipping, International	0.56	0.52	0.52	0.52	0.52	0.52	0.52
Recreational Boats	0.31	0.35	0.35	0.35	0.39	0.39	0.39
Air	2.74	3.83	3.83	3.83	4.25	4.25	4.25
Military Use	0.69	0.81	0.81	0.81	0.83	0.83	0.83
Lubricants	0.20	0.23	0.23	0.23	0.27	0.27	0.27
Pipeline Fuel	0.65	0.73	0.72	0.69	0.84	0.83	0.78
Total	**27.07**	**34.75**	**33.61**	**33.61**	**40.04**	**38.09**	**38.05**
(million barrels per day oil equivalent)							
Light-Duty Vehicles	8.29	10.65	10.09	10.09	12.45	11.49	11.51
Commercial Light Trucks[1]	0.30	0.38	0.35	0.35	0.44	0.39	0.39
Bus Transportation	0.12	0.13	0.13	0.13	0.13	0.13	0.13
Freight Trucks	2.13	2.92	2.93	2.94	3.40	3.40	3.40
Rail, Passenger	0.06	0.07	0.07	0.07	0.08	0.08	0.08
Rail, Freight	0.22	0.25	0.25	0.24	0.26	0.26	0.25
Shipping, Domestic	0.12	0.13	0.13	0.13	0.14	0.14	0.14
Shipping, International	0.25	0.23	0.23	0.23	0.23	0.23	0.23
Recreational Boats	0.16	0.19	0.19	0.19	0.20	0.20	0.20
Air	1.33	1.85	1.85	1.85	2.06	2.06	2.06
Military Use	0.33	0.39	0.39	0.39	0.40	0.40	0.40
Lubricants	0.09	0.11	0.11	0.11	0.13	0.13	0.13
Pipeline Fuel	0.33	0.37	0.37	0.35	0.43	0.42	0.39
Total	**13.73**	**17.67**	**17.07**	**17.06**	**20.36**	**19.33**	**19.32**

[1]Commercial trucks 8,500 to 10,000 pounds.
[2]Environmental Protection Agency rated miles per gallon.
[3]Combined car and light truck "on-the-road" estimate.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003: Energy Information Administration (EIA), *Natural Gas Annual 2002*, DOE/EIA-0131(2002) (Washington, DC, January 2004); Federal Highway Administration, *Highway Statistics 2001* (Washington, DC, November 2002); Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 22 and Annual* (Oak Ridge, TN, September 2002); National Highway Traffic and Safety Administration, *Summary of Fuel Economy Performance* (Washington, DC, February 2000); EIA, *Household Vehicle Energy Consumption 1994*, DOE/EIA-0464(94) (Washington, DC, August 1997); U.S. Department of Commerce, Bureau of the Census, "Vehicle Inventory and Use Survey," EC97TV (Washington, DC, October 1999); EIA, *Describing Current and Potential Markets for Alternative-Fuel Vehicles*, DOE/EIA-0604(96) (Washington, DC, March 1996); EIA, *Alternatives to Traditional Transportation Fuels 1998*, http://www.eia.doe.gov/cneaf/alt_trans98/table1.html; EIA, *State Energy Data Report 2001*, DOE/EIA-0214(2001) (Washington, DC, November 2004) U.S. Department of Transportation, Research and Special Programs Administration, *Air Carrier Statistics Monthly, December 2003/2002* (Washington, DC, 2003); EIA, *Fuel Oil and Kerosene Sales 2002*, DOE/EIA-0535(2002) (Washington, DC, November 2003); and United States Department of Defense, Defense Fuel Supply Center. **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B7. Electricity Supply, Disposition, and Emissions
(Billion Kilowatthours, Unless Otherwise Noted)

Supply, Disposition, and Emissions	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Generation by Fuel Type							
Electric Power Sector[1]							
Power Only[2]							
Coal	1916	2251	2228	2205	2836	2719	2452
Petroleum	106	118	116	109	128	124	112
Natural Gas[3]	407	854	836	748	1048	1069	1003
Nuclear Power	764	826	826	822	830	830	826
Pumped Storage/Other	-9	-9	-9	-9	-9	-9	-9
Renewable Sources[4]	318	398	395	388	430	432	411
Distributed Generation (Natural Gas)	0	0	0	0	3	2	1
Total	**3501**	**4438**	**4393**	**4264**	**5267**	**5167**	**4797**
Combined Heat and Power[5]							
Coal	34	34	33	33	33	33	33
Petroleum	7	7	6	6	7	7	6
Natural Gas	149	200	200	195	186	187	197
Renewable Sources	6	4	4	4	4	4	4
Total	**197**	**244**	**243**	**237**	**230**	**231**	**240**
Total Net Generation	**3699**	**4683**	**4636**	**4501**	**5497**	**5399**	**5037**
Less Direct Use	50	65	65	65	65	65	65
Net Available to the Grid	**3649**	**4617**	**4570**	**4436**	**5432**	**5334**	**4972**
Commercial and Industrial Generation[6]							
Coal	21	21	21	21	21	21	21
Petroleum	6	10	10	9	13	11	11
Natural Gas	76	117	117	113	169	166	152
Other Gaseous Fuels[7]	6	5	5	5	5	5	5
Renewable Sources[4]	35	45	45	45	55	55	54
Other[8]	10	10	10	10	10	10	10
Total	**153**	**208**	**208**	**203**	**273**	**268**	**253**
Less Direct Use	126	149	149	147	182	181	173
Total Sales to the Grid	**28**	**59**	**59**	**57**	**91**	**87**	**80**
Total Electricity Generation	**3852**	**4890**	**4843**	**4704**	**5770**	**5667**	**5290**
Total Net Generation to the Grid	**3677**	**4676**	**4629**	**4493**	**5522**	**5421**	**5052**
Net Imports	**5**	**21**	**20**	**15**	**11**	**12**	**11**
Electricity Sales by Sector							
Residential	1280	1584	1553	1510	1810	1746	1628
Commercial	1210	1651	1637	1573	2088	2055	1898
Industrial	969	1166	1154	1126	1286	1259	1184
Transportation	23	29	29	29	35	35	35
Total	**3481**	**4430**	**4372**	**4239**	**5220**	**5095**	**4746**
Direct Use	175	214	214	212	248	246	238
Total Electricity Use	**3657**	**4644**	**4586**	**4450**	**5467**	**5341**	**4984**
Electric Power Sector Emissions[1]							
Sulfur Dioxide (million tons)	10.59	8.97	8.93	8.95	8.95	8.95	8.95
Nitrogen Oxide (million tons)	4.12	4.09	4.07	3.93	4.29	4.24	4.05
Mercury (tons)	49.70	55.12	54.27	53.17	55.97	55.11	54.58

[1]Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.
[2]Includes plants that only produce electricity.
[3]Includes electricity generation from fuel cells.
[4]Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power.
[5]Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report NAICS code 22).
[6]Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.
[7]Other gaseous fuels include refinery and still gas.
[8]Other includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur and miscellaneous technologies.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 power only and combined heat and power generation, sales to utilities, net imports, residential, industrial, and total electricity sales, and emissions: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004), and supporting databases. 2003 commercial and transportation electricity sales: EIA estimates based on Oak Ridge National Laboratory, *Transportation Energy Data Book 21* (Oak Ridge, TN, September 2001). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B8. Electricity Generating Capacity
(Gigawatts)

Net Summer Capacity[1]	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Electric PowerSector[2]							
Power Only[3]							
Coal Steam	305.2	310.6	308.0	305.6	389.2	373.0	336.3
Other Fossil Steam[4]	128.6	101.1	97.9	90.5	99.4	96.3	88.9
Combined Cycle	106.9	147.9	145.7	139.8	189.4	192.4	171.5
Combustion Turbine/Diesel	124.8	141.8	140.6	134.4	188.6	183.5	189.1
Nuclear Power[5]	99.2	102.2	102.2	101.7	102.7	102.7	102.2
Pumped Storage	20.8	20.9	20.9	20.9	20.9	20.9	20.9
Fuel Cells	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewable Sources[6]	92.0	96.3	95.8	95.1	102.9	102.7	99.0
Distributed Generation[7]	0.0	1.1	1.0	0.7	6.9	5.6	3.3
Total	**877.5**	**921.9**	**912.1**	**888.7**	**1100.0**	**1076.9**	**1011.0**
Combined Heat and Power[8]							
Coal Steam	5.1	5.0	4.9	4.7	5.0	4.9	4.7
Other Fossil Steam[4]	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Combined Cycle	31.3	33.5	33.5	33.5	33.5	33.5	33.5
Combustion Turbine/Diesel	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Renewable Sources[6]	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	**42.8**	**45.0**	**44.8**	**44.6**	**45.0**	**44.8**	**44.6**
Cumulative Planned Additions[9]							
Coal Steam	0.0	1.8	1.8	1.8	1.8	1.8	1.8
Other Fossil Steam[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Combined Cycle	0.0	28.3	28.3	28.3	28.3	28.3	28.3
Combustion Turbine/Diesel	0.0	3.9	3.9	3.9	3.9	3.9	3.9
Nuclear Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewable Sources[6]	0.0	2.8	2.8	2.8	3.0	3.0	3.0
Distributed Generation[7]	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**36.8**	**36.8**	**36.8**	**37.0**	**37.0**	**37.0**
Cumulative Unplanned Additions[9]							
Coal Steam	0.0	6.5	4.5	2.4	85.1	69.4	33.1
Other Fossil Steam[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Combined Cycle	0.0	15.3	13.4	7.8	56.8	60.1	39.5
Combustion Turbine/Diesel	0.0	19.7	18.7	15.2	69.9	64.8	71.0
Nuclear Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewable Sources[6]	0.0	1.3	0.8	0.2	7.7	7.5	3.8
Distributed Generation[7]	0.0	1.1	1.0	0.7	6.9	5.6	3.3
Total	**0.0**	**44.0**	**38.4**	**26.3**	**226.4**	**207.5**	**150.6**
Cumulative Electric Power Sector Additions	**0.0**	**80.8**	**75.2**	**63.0**	**263.4**	**244.4**	**187.6**
Cumulative Retirements[10]							
Coal Steam	0.0	3.0	3.6	4.2	3.0	3.6	4.2
Other Fossil Steam[4]	0.0	27.5	30.7	38.1	29.2	32.4	39.7
Combined Cycle	0.0	0.4	0.7	1.0	0.4	0.7	1.0
Combustion Turbine/Diesel	0.0	6.6	6.8	9.5	9.9	10.1	10.6
Nuclear Power	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Pumped Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewable Sources[6]	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total	**0.0**	**37.6**	**41.9**	**53.4**	**42.6**	**46.8**	**56.1**
Total Electric Power Sector Capacity	**920.3**	**966.9**	**956.9**	**933.3**	**1145.0**	**1121.8**	**1055.6**

Table B8. Electricity Generating Capacity (Continued)
(Gigawatts)

Net Summer Capacity[1]	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Commercial and Industrial Generators[11]							
Coal	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Petroleum	0.7	1.5	1.5	1.5	1.7	1.6	1.5
Natural Gas	14.4	19.7	19.6	19.1	26.7	26.3	24.4
Other Gaseous Fuels	1.8	1.6	1.6	1.6	1.7	1.7	1.6
Renewable Sources[6]	5.4	7.3	7.3	7.3	9.9	9.8	9.4
Other	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Total	**27.1**	**34.9**	**34.9**	**34.3**	**44.8**	**44.1**	**41.9**
Cumulative Capacity Additions[9]	**0.0**	**7.8**	**7.8**	**7.2**	**17.7**	**17.0**	**14.8**

[1]Net summer capacity is the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power), as demonstrated by tests during summer peak demand.
[2]Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.
[3]Includes plants that only produce electricity. Includes capacity increases (uprates) at existing units.
[4]Includes oil-, gas-, and dual-fired capacity.
[5]Nuclear capacity reflects operating capacity of existing units, including 3.5 gigawatts of uprates through 2025.
[6]Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power. Facilities co-firing biomass and coal are classified as coal.
[7]Primarily peak-load capacity fueled by natural gas.
[8]Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report NAICS code 22).
[9]Cumulative additions after December 31, 2003.
[10]Cumulative total retirements after December 31, 2003.
[11]Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model estimates and may differ slightly from official EIA data reports.
Sources: 2003 electric generating capacity and projected planned additions: Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report" (preliminary). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B9. Electricity Trade
(Billion Kilowatthours, Unless Otherwise Noted)

Electricity Trade	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Interregional Electricity Trade							
Gross Domestic Firm Power Trade	136.7	82.4	82.4	82.4	37.9	37.9	37.9
Gross Domestic Economy Trade	198.5	178.8	183.9	198.4	101.6	108.1	147.5
Gross Domestic Trade	**335.2**	**261.2**	**266.3**	**280.8**	**139.5**	**146.0**	**185.4**
Gross Domestic Firm Power Sales (million 2003 dollars)	6926.5	4176.6	4176.6	4176.6	1919.7	1919.7	1919.7
Gross Domestic Economy Sales (million 2003 dollars)	7959.8	7408.5	7500.6	7193.9	4682.6	4983.0	6112.0
Gross Domestic Sales (million 2003 dollars)	**14886.3**	**11585.1**	**11677.2**	**11370.5**	**6602.3**	**6902.8**	**8031.7**
International Electricity Trade							
Firm Power Imports From Canada and Mexico	11.3	1.5	1.5	1.5	0.0	0.0	0.0
Economy Imports From Canada and Mexico	18.2	38.7	37.6	32.7	25.1	25.6	25.0
Gross Imports From Canada and Mexico	**29.5**	**40.2**	**39.1**	**34.2**	**25.2**	**25.7**	**25.0**
Firm Power Exports To Canada and Mexico	5.5	0.7	0.7	0.7	0.0	0.0	0.0
Economy Exports To Canada and Mexico	19.5	18.3	18.3	18.3	14.0	14.0	14.0
Gross Exports To Canada and Mexico	**24.9**	**18.9**	**18.9**	**18.9**	**14.0**	**14.0**	**14.0**

Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports. Firm Power Sales are capacity sales, meaning the delivery of the power is scheduled as part of the normal operating conditions of the affected electric systems. Economy Sales are subject to curtailment or cessation of delivery by the supplier in accordance with prior agreements or under specified conditions.

Sources: 2003 interregional firm electricity trade data: North American Electric Reliability Council (NERC), Electricity Sales and Demand Database 1999. 2003 Mexican electricity trade data: DOE Form FE-718R, “Annual Report of International Electrical Export/Import Data.” 2003 Canadian electricity trade data: National Energy Board, *Annual Report 2002*. **Projections:** Energy Information Administration, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B10. Petroleum Supply and Disposition Balance
(Million Barrels per Day, Unless Otherwise Noted)

Supply and Disposition	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Crude Oil							
Domestic Crude Production[1]	5.68	5.49	5.49	5.50	4.73	4.72	4.71
Alaska	0.97	0.88	0.88	0.88	0.61	0.61	0.61
Lower 48 States	4.71	4.61	4.61	4.61	4.12	4.12	4.10
Net Imports	9.65	13.28	13.10	13.08	16.11	15.49	15.45
Gross Imports	9.66	13.29	13.11	13.09	16.12	15.50	15.46
Exports	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Other Crude Supply[2]	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Total Crude Supply	**15.31**	**18.77**	**18.59**	**18.58**	**20.84**	**20.21**	**20.17**
Other Petroleum Supply							
Natural Gas Plant Liquids	1.72	1.96	1.96	1.93	2.04	2.00	1.95
Net Product Imports	1.58	2.12	1.64	1.63	3.00	2.47	2.45
Gross Refined Product Imports[3]	1.85	1.87	1.42	1.40	2.47	2.04	2.02
Unfinished Oil Imports	0.34	0.76	0.74	0.74	1.02	0.93	0.93
Blending Components	0.41	0.52	0.49	0.49	0.60	0.55	0.55
Exports	1.01	1.03	1.01	1.00	1.08	1.06	1.05
Refinery Processing Gain[4]	1.00	1.36	1.36	1.36	1.56	1.52	1.53
Other Supply[5]	0.69	0.46	0.44	0.44	0.50	0.47	0.49
Total Primary Supply[6]	**20.30**	**24.67**	**23.98**	**23.94**	**27.93**	**26.68**	**26.59**
Refined Petroleum Products Supplied							
Motor Gasoline[7]	8.93	11.17	10.61	10.62	12.89	11.96	11.98
Jet Fuel[8]	1.57	2.15	2.15	2.15	2.36	2.36	2.36
Distillate Fuel[9]	3.95	5.07	5.03	5.01	5.81	5.70	5.64
Residual Fuel	0.77	0.85	0.85	0.81	0.88	0.88	0.82
Other[10]	4.77	5.42	5.35	5.35	5.98	5.77	5.78
Total	**20.00**	**24.67**	**23.98**	**23.94**	**27.93**	**26.68**	**26.58**
Refined Petroleum Products Supplied							
Residential and Commercial	1.28	1.38	1.37	1.36	1.42	1.41	1.38
Industrial[11]	4.87	5.49	5.42	5.42	6.05	5.85	5.85
Transportation	13.35	17.21	16.61	16.63	19.82	18.80	18.81
Electric Power[12]	0.50	0.59	0.58	0.53	0.64	0.62	0.55
Total	**20.00**	**24.67**	**23.98**	**23.94**	**27.93**	**26.68**	**26.58**
Discrepancy[13]	**0.29**	**0.00**	**0.00**	**0.00**	**-0.00**	**-0.00**	**0.00**
World Oil Price (2003 dollars per barrel)[14]	27.73	26.75	26.75	26.75	30.31	30.31	30.31
Import Share of Product Supplied	0.56	0.62	0.61	0.61	0.68	0.67	0.67
Net Expenditures for Imported Crude Oil and Petroleum Products (billion 2003 dollars)	113.78	153.97	145.01	144.71	215.89	200.57	199.98
Domestic Refinery Distillation Capacity[15]	16.8	20.2	20.0	20.0	22.3	21.6	21.6
Capacity Utilization Rate (percent)	93.0	94.2	94.2	94.2	94.9	94.8	94.8

[1]Includes lease condensate.
[2]Strategic petroleum reserve stock additions plus unaccounted for crude oil and crude stock withdrawals minus crude products supplied.
[3]Includes other hydrocarbons and alcohols.
[4]Represents volumetric gain in refinery distillation and cracking processes.
[5]Includes petroleum product stock withdrawals; domestic sources of blending components, other hydrocarbons, alcohols, and ethers; natural gas converted to liquid fuel; and coal converted to liquid fuel.
[6]Total crude supply plus natural gas plant liquids, other inputs, refinery processing gain, and net product imports.
[7]Includes ethanol and ethers blended into gasoline.
[8]Includes only kerosene type.
[9]Includes distillate and kerosene.
[10]Includes aviation gasoline, liquefied petroleum gas, petrochemical feedstocks, lubricants, waxes, asphalt, road oil, still gas, special naphthas, petroleum coke, crude oil product supplied, and miscellaneous petroleum products.
[11]Includes energy for combined heat and power (CHP) plants, except those whose primary business is to sell electricity, or electricity and heat, to the public.
[12]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
[13]Balancing item. Includes unaccounted for supply, losses, and gains.
[14]Average refiner acquisition cost for imported crude oil.
[15]End-of-year operable capacity.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 product supplied based on: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). Other 2003 data: EIA, *Petroleum Supply Annual 2003,* DOE/EIA-0340(2003)/1 (Washington, DC, July 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B11. Natural Gas Supply and Disposition
(Trillion Cubic Feet per Year)

Supply, Disposition, and Prices	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Production							
Dry Gas Production1	19.07	20.77	20.67	20.32	21.83	21.31	20.68
Supplemental Natural Gas2	0.06	0.08	0.08	0.08	0.08	0.08	0.08
Net Imports	**3.24**	**7.02**	**6.72**	**5.72**	**8.66**	**8.67**	**7.38**
Canada	3.13	2.98	2.90	2.53	2.55	2.50	2.09
Mexico	-0.33	-0.29	-0.30	-0.33	-0.25	-0.34	-0.43
Liquefied Natural Gas3	0.44	4.33	4.12	3.51	6.37	6.51	5.72
Total Supply	**22.37**	**27.86**	**27.47**	**26.11**	**30.56**	**30.06**	**28.14**
Consumption by Sector							
Residential	5.10	5.74	5.66	5.50	5.99	5.80	5.32
Commercial	3.13	3.58	3.52	3.43	4.05	3.95	3.69
Industrial4	6.99	8.26	8.14	7.96	9.00	8.72	8.12
Electric Power5	4.96	8.39	8.26	7.41	9.43	9.54	9.06
Transportation6	0.02	0.08	0.08	0.08	0.11	0.10	0.11
Pipeline Fuel	0.64	0.71	0.70	0.67	0.82	0.81	0.76
Lease and Plant Fuel7	1.12	1.20	1.19	1.17	1.27	1.25	1.20
Total	**21.95**	**27.96**	**27.56**	**26.21**	**30.67**	**30.17**	**28.25**
Natural Gas to Liquids	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Discrepancy8	**0.42**	**-0.09**	**-0.09**	**-0.09**	**-0.11**	**-0.11**	**-0.11**
Lower 48 Average Wellhead Price9 (2003 dollars per thousand cubic feet)	**4.98**	**4.16**	**4.05**	**3.74**	**4.79**	**4.73**	**4.38**

[1]Marketed production (wet) minus extraction losses.
[2]Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.
[3]Includes any natural gas regasified in the Bahamas and transported via pipeline to Florida.
[4]Includes energy for combined heat and power (CHP) plants, except those whose primary business is to sell electricity, or electricity and heat, to the public.
[5]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
[6]Compressed natural gas used as vehicle fuel.
[7]Represents natural gas used in the field gathering and processing plant machinery.
[8]Balancing item. Natural gas lost as a result of converting flow data measured at varying temperatures and pressures to a standard temperature and pressure and the merger of different data reporting systems which vary in scope, format, definition, and respondent type. In addition, 2003 values include net storage injections.
[9]Represents lower 48 onshore and offshore supplies.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 supply values; and lease, plant, and pipeline fuel consumption; and residential and commercial delivered prices: Energy Information Administration (EIA), *Natural Gas Monthly*, DOE/EIA-0130(2004/07) (Washington, DC, July 2004). Other 2003 consumption based on: EIA, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). 2003 wellhead prices from the *Natural Gas Annual 2002*, DOE/EIA-0131(2002) (Washington, DC, January 2004) and the *Natural Gas Monthly*, DOE/EIA-0130(2004/07) (Washington, DC, July 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B12. Oil and Gas Supply

Production and Supply	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Crude Oil							
Lower 48 Average Wellhead Price1 (2003 dollars per barrel)	**28.60**	**26.27**	**26.26**	**26.29**	**30.00**	**29.88**	**29.85**
Production (million barrels per day)2							
U.S. Total	5.68	5.49	5.49	5.50	4.73	4.72	4.71
Lower 48 Onshore	2.99	2.42	2.42	2.42	2.09	2.09	2.09
Lower 48 Offshore	1.72	2.19	2.19	2.19	2.03	2.03	2.01
Alaska	0.97	0.88	0.88	0.88	0.61	0.61	0.61
Lower 48 End of Year Reserves (billion barrels)2	**18.94**	**18.89**	**18.89**	**18.90**	**16.47**	**16.37**	**16.27**
Natural Gas							
Lower 48 Average Wellhead Price1 (2003 dollars per thousand cubic feet)	**4.98**	**4.16**	**4.05**	**3.74**	**4.79**	**4.73**	**4.38**
Dry Production (trillion cubic feet)3							
U.S. Total	19.07	20.77	20.67	20.32	21.83	21.31	20.68
Lower 48 Onshore	13.89	15.38	15.29	14.96	14.71	14.22	14.15
Associated-Dissolved**4**	1.54	1.22	1.22	1.22	1.08	1.08	1.08
Non-Associated	12.36	14.16	14.06	13.74	13.63	13.14	13.07
Conventional	5.77	5.62	5.60	5.54	5.02	4.86	4.92
Unconventional	6.59	8.54	8.46	8.19	8.61	8.27	8.15
Lower 48 Offshore	4.73	5.12	5.12	5.10	4.89	4.87	4.66
Associated-Dissolved**4**	0.99	1.48	1.48	1.48	1.34	1.33	1.29
Non-Associated	3.74	3.64	3.64	3.62	3.56	3.54	3.37
Alaska	0.44	0.27	0.27	0.26	2.23	2.23	1.87
Lower 48 End of Year Dry Reserves3 (trillion cubic feet)	**180.77**	**194.93**	**194.14**	**191.09**	**178.29**	**176.50**	**171.07**
Supplemental Gas Supplies (trillion cubic	**0.06**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
Total Lower 48 Wells Drilled (thousands)	**30.08**	**29.33**	**28.71**	**25.64**	**26.96**	**26.08**	**27.68**

[1]Represents lower 48 onshore and offshore supplies.
[2]Includes lease condensate.
[3]Marketed production (wet) minus extraction losses.
[4]Gas which occurs in crude oil reserves either as free gas (associated) or as gas in solution with crude oil (dissolved).
[5]Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 lower 48 onshore, lower 48 offshore, and Alaska crude oil production: Energy Information Administration (EIA), *Petroleum Supply Annual 2003,* DOE/EIA-0340(2003)/1 (Washington, DC, July 2004). 2003 natural gas lower 48 average wellhead price, Alaska and total natural gas production, and supplemental gas supplies: EIA, *Natural Gas Monthly*, DOE/EIA-0130(2004/07) (Washington, DC, July 2004). 2003 crude oil lower 48 average wellhead price: EIA, *Petroleum Marketing Annual 2003*, DOE/EIA-0487(2003) (Washington, DC, August 2004). Other 2003 values: EIA, Office of Integrated Analysis and Forecasting. **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B13. Coal Supply, Disposition, and Prices
(Million Short Tons per Year, Unless Otherwise Noted)

Supply, Disposition, and Prices	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Production1							
Appalachia	388	385	381	377	406	394	356
Interior	146	157	157	157	182	175	160
West	549	727	722	680	900	868	781
East of the Mississippi	481	493	487	485	538	519	468
West of the Mississippi	603	777	772	729	950	918	829
Total	**1083**	**1270**	**1259**	**1213**	**1488**	**1437**	**1297**
Net Imports							
Imports	25	38	38	38	46	46	46
Exports	43	35	35	35	26	26	26
Total	**-18**	**3**	**3**	**3**	**20**	**20**	**20**
Total Supply2	**1065**	**1273**	**1262**	**1216**	**1507**	**1457**	**1316**
Consumption by Sector							
Residential and Commercial	4	5	5	5	5	5	5
Industrial**3**	62	66	65	66	66	65	66
Coke Plants	24	18	17	17	13	13	13
Electric Power**4**	1004	1185	1175	1129	1425	1375	1234
Total Sectoral Consumption	**1095**	**1273**	**1263**	**1217**	**1508**	**1458**	**1317**
Coal to Liquids							
Heat and Power (included in Industrial)	0	0	0	0	0	0	0
Liquids Production	0	0	0	0	0	0	0
Total Coal Use	**1095**	**1273**	**1263**	**1217**	**1508**	**1458**	**1317**
Discrepancy and Stock Change5	**-29**	**-0**	**-0**	**-0**	**-1**	**-1**	**-1**
Average Minemouth Price							
(2003 dollars per short ton)	17.93	16.89	16.75	16.48	18.26	17.77	16.74
(2003 dollars per million Btu)	0.86	0.84	0.83	0.82	0.91	0.88	0.83

[1]Includes anthracite, bituminous coal, lignite, and waste coal delivered to independent power producers. Waste coal deliveries totaled 11.1 million tons in 2002 and 11.6 million tons in 2003.
[2]Production plus net imports plus net storage withdrawals.
[3]Includes consumption for combined heat and power (CHP) plants, except those plants whose primary business is to sell electricity, or electricity and heat, to the public.
[4]Includes all electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public.
[5]Balancing item: the sum of production, net imports, and net storage withdrawals minus total consumption.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 data based on: Energy Information Administration (EIA), *Annual Coal Report 2003*, DOE/EIA-0584(2003) (Washington, DC, September 2004); EIA, *Quarterly Coal Report, October-December 2003*, DOE/EIA-0121(2003/4Q) (Washington, DC, March 2004); and EIA, AEO2005 National Energy Modeling System run AEO2005.D102004A. **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B14. Renewable Energy Generating Capacity and Generation
(Gigawatts, Unless Otherwise Noted)

Capacity and Generation	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Electric Power Sector1							
Net Summer Capacity							
Conventional Hydropower	77.93	78.18	78.18	78.18	78.18	78.18	78.18
Geothermal**2**	2.18	2.66	2.51	2.26	4.62	4.86	4.17
Municipal Solid Waste**3**	3.34	3.63	3.58	3.57	3.67	3.67	3.63
Wood and Other Biomass**4,5**	1.77	2.06	1.88	1.78	4.50	4.22	2.64
Solar Thermal	0.39	0.47	0.47	0.47	0.51	0.51	0.51
Solar Photovoltaic**5**	0.04	0.23	0.23	0.23	0.40	0.40	0.40
Wind	6.56	9.29	9.17	8.91	11.25	11.10	9.66
Total	**92.21**	**96.50**	**96.02**	**95.39**	**103.13**	**102.94**	**99.20**
Generation (billion kilowatthours)							
Conventional Hydropower	269.29	300.55	300.51	300.43	301.09	301.02	300.81
Geothermal**2**	13.15	16.09	14.84	12.75	32.78	34.85	29.03
Municipal Solid Waste**3**	20.28	26.07	25.68	25.63	26.49	26.48	26.18
Wood and Other Biomass**5**	9.40	30.01	29.07	26.02	37.35	37.51	28.02
Dedicated Plants	5.73	11.67	10.62	10.08	27.29	25.82	15.99
Cofiring	3.66	18.34	18.45	15.94	10.06	11.69	12.03
Solar Thermal	0.53	0.86	0.86	0.86	0.99	0.99	0.99
Solar Photovoltaic**6**	0.00	0.52	0.52	0.52	0.96	0.96	0.96
Wind	10.73	27.34	26.94	25.98	34.52	34.02	28.74
Total	**323.38**	**401.44**	**398.42**	**392.19**	**434.19**	**435.82**	**414.75**
Commercial and Industrial Generators7							
Net Summer Capacity							
Conventional Hydropower**8**	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Geothermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Biomass	4.08	5.55	5.55	5.56	6.75	6.73	6.70
Solar Photovoltaic**6**	0.06	0.44	0.44	0.42	1.80	1.78	1.46
Total	**5.43**	**7.30**	**7.29**	**7.29**	**9.85**	**9.81**	**9.45**
Generation (billion kilowatthours)							
Conventional Hydropower**8**	5.82	5.82	5.82	5.82	5.82	5.82	5.82
Geothermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste	1.86	2.24	2.24	2.24	2.24	2.24	2.24
Biomass	27.59	36.19	36.20	36.25	43.21	43.04	42.87
Solar Photovoltaic**6**	0.12	0.95	0.94	0.91	3.74	3.71	3.05
Total	**35.39**	**45.20**	**45.19**	**45.22**	**55.00**	**54.81**	**53.97**

[1]Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.
[2]Includes hydrothermal resources only (hot water and steam).
[3]Includes landfill gas.
[4]Facilities co-firing biomass and coal are classified as coal.
[5]Includes projections for energy crops after 2010.
[6]Does not include off-grid photovoltaics (PV). Based on annual PV shipments from 1989 through 2002, EIA estimates that as much as 134 megawatts of remote electricity generation PV applications (i.e., off-grid power systems) were in service in 2002, plus an additional 362 megawatts in communications, transportation, and assorted other non-grid-connected, specialized applications. See *Annual Energy Review 2003*, Table 10.6 (annual PV shipments, 1989-2002). The approach used to develop the estimate, based on shipment data, provides an upper estimate of the size of the PV stock, including both grid-based and off-grid PV. It will overestimate the size of the stock, because shipments include a substantial number of units that are exported, and each year some of the PV units installed earlier will be retired from service or abandoned.
[7]Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.
[8]Represents own-use industrial hydroelectric power.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 capacity: Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report" (preliminary). 2003 generation: EIA, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B15. Renewable Energy Consumption by Sector and Source[1]
(Quadrillion Btu per Year)

Sector and Source	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
Marketed Renewable Energy2							
Residential (wood)	**0.40**	**0.39**	**0.39**	**0.39**	**0.38**	**0.38**	**0.37**
Commercial (biomass)	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**
Industrial3	**1.79**	**2.19**	**2.19**	**2.19**	**2.50**	**2.49**	**2.48**
Conventional Hydroelectric	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Municipal Solid Waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Biomass	1.72	2.12	2.12	2.12	2.42	2.42	2.41
Transportation	**0.24**	**0.33**	**0.32**	**0.32**	**0.38**	**0.36**	**0.36**
Ethanol used in E85**4**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethanol used in Gasoline Blending	0.24	0.33	0.31	0.31	0.38	0.35	0.36
Electric Power5	**3.62**	**4.46**	**4.41**	**4.29**	**5.14**	**5.19**	**4.86**
Conventional Hydroelectric	2.72	3.08	3.08	3.08	3.08	3.08	3.08
Geothermal	0.28	0.39	0.35	0.28	0.92	0.99	0.80
Municipal Solid Waste**6**	0.32	0.35	0.34	0.34	0.35	0.35	0.35
Biomass	0.18	0.35	0.34	0.30	0.40	0.40	0.31
Dedicated Plants	0.09	0.12	0.11	0.10	0.28	0.27	0.17
Cofiring	0.09	0.23	0.23	0.20	0.11	0.13	0.14
Solar Thermal	0.01	0.01	0.01	0.01	0.02	0.02	0.02
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wind	0.11	0.28	0.28	0.27	0.36	0.35	0.30
Total Marketed Renewable Energy	**6.13**	**7.46**	**7.39**	**7.27**	**8.48**	**8.51**	**8.17**
Sources of Ethanol							
From Corn	0.24	0.33	0.31	0.32	0.34	0.32	0.32
From Cellulose	0.00	0.01	0.00	0.00	0.04	0.03	0.04
Total	**0.24**	**0.33**	**0.32**	**0.32**	**0.38**	**0.36**	**0.36**
Non-Marketed Renewable Energy7							
Selected Consumption							
Residential	**0.02**	**0.04**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**
Solar Hot Water Heating	0.02	0.03	0.03	0.03	0.04	0.04	0.04
Geothermal Heat Pumps	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	**0.02**	**0.03**	**0.03**	**0.03**	**0.04**	**0.04**	**0.04**
Solar Thermal	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.01	0.01	0.01

[1]Actual heat rates used to determine fuel consumption for all renewable fuels except hydropower, solar, and wind. Consumption at hydroelectric, solar, and wind facilities determined by using the fossil fuel equivalent of 10,280 Btu per kilowatthour.
[2]Includes nonelectric renewable energy groups for which the energy source is bought and sold in the marketplace, although all transactions may not necessarily be marketed, and marketed renewable energy inputs for electricity entering the marketplace on the electric power grid. Excludes electricity imports.
[3]Includes all electricity production by industrial and other combined heat and power (CHP) for the grid and for own use.
[4]Excludes motor gasoline component of E85.
[5]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
[6]Includes landfill gas.
[7]Includes selected renewable energy consumption data for which the energy is not bought or sold, either directly or indirectly as an input to marketed energy. The Energy Information Administration does not estimate or project total consumption of nonmarketed renewable energy.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 ethanol: Energy Information Administration (EIA), *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004). 2003 electric power sector: EIA, Form EIA-860, "Annual Electric Generator Report" (preliminary). Other 2003 values: EIA, Office of Integrated Analysis and Forecasting.
Projections: EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B16. Carbon Dioxide Emissions by Sector and Source
(Million Metric Tons)

Sector and Source	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Residential							
Petroleum	106	108	108	107	104	103	102
Natural Gas	277	312	308	299	326	315	289
Coal	1	1	1	1	1	1	1
Electricity	840	998	981	936	1149	1104	1000
Total	**1225**	**1419**	**1397**	**1343**	**1580**	**1524**	**1391**
Commercial							
Petroleum	54	65	65	63	73	73	70
Natural Gas	171	195	191	186	220	214	200
Coal	9	9	9	9	9	9	9
Electricity	794	1040	1034	975	1326	1299	1166
Total	**1028**	**1309**	**1299**	**1234**	**1628**	**1596**	**1445**
Industrial1							
Petroleum	422	476	470	468	521	501	501
Natural Gas**2**	420	506	499	488	550	534	499
Coal	186	182	181	182	171	170	172
Electricity	636	735	729	698	817	796	727
Total	**1664**	**1899**	**1879**	**1837**	**2059**	**2002**	**1899**
Transportation							
Petroleum**3**	1822	2364	2286	2288	2723	2588	2588
Natural Gas**4**	35	43	42	41	50	50	47
Electricity	15	18	18	18	22	22	22
Total	**1872**	**2425**	**2347**	**2347**	**2796**	**2660**	**2657**
Electric Power5							
Petroleum	96	101	99	91	109	106	94
Natural Gas	267	451	444	398	507	513	487
Coal	1906	2219	2198	2117	2677	2582	2312
Other**6**	17	21	21	20	22	22	21
Total	**2286**	**2791**	**2762**	**2627**	**3314**	**3222**	**2914**
Total Carbon Dioxide Emissions by Primary Fuel7							
Petroleum**3**	2499	3115	3028	3019	3530	3371	3354
Natural Gas	1170	1506	1485	1412	1653	1626	1522
Coal	2103	2411	2389	2309	2858	2762	2494
Other	17	21	21	20	22	22	21
Total	**5789**	**7052**	**6923**	**6760**	**8062**	**7781**	**7392**
Carbon Dioxide Emissions (tons per person)	**19.9**	**21.8**	**21.4**	**20.9**	**23.0**	**22.2**	**21.1**

[1]Fuel consumption includes energy for combined heat and power (CHP) plants, except those plants whose primary business is to sell electricity, or electricity and heat, to the public.
[2]Includes lease and plant fuel.
[3]This includes international bunker fuel, which by convention are excluded from the international accounting of carbon dioxide emissions. In the years from 1990 through 2002, international bunker fuels accounted for 82 to 100 million metric tons of carbon dioxide annually.
[4]Includes pipeline fuel natural gas and compressed natural gas used as vehicle fuel.
[5]Includes electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public.
[6]Includes emissions from geothermal power and nonbiogenic emissions from municipal solid waste.
[7]Emissions from the electric power sector are distributed to the primary fuels.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: 2003 emissions and emission factors: Energy Information Administration (EIA), *Emissions of Greenhouse Gases in the United States 2003,* DOE/EIA-0573(2003) (Washington, DC, December 2004). **Projections:** EIA, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.

Table B17. International Petroleum Supply and Disposition Summary
(Million Barrels per Day, Unless Otherwise Noted)

Supply and Disposition	2003	Projections					
		2015			2025		
		Reference	Case 1	Case 2	Reference	Case 1	Case 2
World Oil Price (2003 dollars per	**27.73**	**26.75**	**26.75**	**26.75**	**30.31**	**30.31**	**30.31**
Production (Conventional)2							
Mature Market Economies							
United States (50 states)	9.09	9.27	9.25	9.23	8.82	8.72	8.68
Canada	2.25	1.64	1.64	1.64	1.57	1.57	1.57
Mexico	3.80	4.55	4.55	4.55	4.85	4.85	4.85
Western Europe3	6.69	5.89	5.89	5.89	5.00	5.00	5.00
Japan	0.13	0.07	0.07	0.07	0.06	0.06	0.06
Australia and New Zealand	0.66	0.91	0.91	0.91	0.86	0.86	0.86
Total Mature Market Economies .	**22.62**	**22.33**	**22.31**	**22.29**	**21.16**	**21.06**	**21.02**
Transitional Economies							
Former Soviet Union							
Russia	8.34	10.62	10.62	10.62	11.11	11.11	11.11
Caspian Area4	1.87	4.46	4.46	4.46	6.22	6.22	6.22
Eastern Europe5	0.22	0.38	0.38	0.38	0.45	0.45	0.45
Total Transitional Economies ..	**10.44**	**15.46**	**15.46**	**15.46**	**17.78**	**17.78**	**17.78**
Emerging Economies							
OPEC6							
Asia	1.38	1.47	1.44	1.44	1.56	1.53	1.52
Middle East	20.95	26.87	26.40	26.38	38.47	37.64	37.61
North Africa	2.99	3.71	3.65	3.65	4.78	4.68	4.68
West Africa	1.98	2.64	2.59	2.59	3.74	3.66	3.66
South America	2.85	3.81	3.74	3.74	5.20	5.09	5.08
Non-OPEC							
China	3.10	3.50	3.50	3.50	3.41	3.41	3.41
Other Asia	2.59	2.76	2.76	2.76	2.64	2.64	2.64
Middle East7	1.81	2.47	2.47	2.47	2.78	2.78	2.78
Africa	2.94	4.75	4.75	4.75	6.56	6.56	6.56
South and Central America	3.93	5.38	5.38	5.38	6.42	6.42	6.42
Total Emerging Economies	**44.52**	**57.35**	**56.69**	**56.66**	**75.57**	**74.42**	**74.37**
Total Production (Conventional)	**77.58**	**95.14**	**94.46**	**94.41**	**114.51**	**113.26**	**113.17**
Production6 (Nonconventional)							
United States (50 states)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other North America	0.93	3.09	3.09	3.09	3.46	3.46	3.46
Western Europe	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Asia	0.03	0.04	0.04	0.04	0.07	0.07	0.07
Middle East7	0.03	0.16	0.16	0.16	0.25	0.25	0.25
Africa	0.21	0.25	0.25	0.25	0.32	0.32	0.32
South and Central America	0.57	1.36	1.36	1.36	1.50	1.50	1.50
Total Production	**1.79**	**4.94**	**4.94**	**4.94**	**5.65**	**5.65**	**5.65**
Total Production	**79.37**	**100.08**	**99.40**	**99.35**	**120.17**	**118.91**	**118.82**

Table B17. International Petroleum Supply and Disposition Summary (Continued)
(Million Barrels per Day, Unless Otherwise Noted)

Supply and Disposition	2003	Projections 2015 Reference	2015 Case 1	2015 Case 2	2025 Reference	2025 Case 1	2025 Case 2
Consumption8							
Mature Market Economies							
United States (50 states)	20.00	24.67	23.98	23.94	27.93	26.68	26.58
U.S. Territories	0.36	0.40	0.40	0.40	0.47	0.47	0.47
Canada	2.17	2.46	2.46	2.46	2.80	2.80	2.80
Mexico	2.02	2.63	2.63	2.63	3.48	3.48	3.48
Western Europe**3**	14.22	15.08	15.08	15.08	15.71	15.71	15.71
Japan	5.58	5.72	5.72	5.72	5.84	5.84	5.84
Australia and New Zealand	1.04	1.40	1.40	1.40	1.69	1.69	1.69
Total Mature Market Economies	**45.38**	**52.36**	**51.68**	**51.63**	**57.92**	**56.67**	**56.57**
Transitional Economies							
Former Soviet Union	4.18	5.02	5.02	5.02	6.45	6.45	6.45
Eastern Europe**5**	1.42	1.68	1.68	1.68	2.09	2.09	2.09
Total Transitional Economies	**5.59**	**6.70**	**6.70**	**6.70**	**8.54**	**8.54**	**8.54**
Emerging Economies							
China	5.54	9.20	9.20	9.20	12.79	12.79	12.79
India	2.19	3.48	3.48	3.48	5.29	5.29	5.29
South Korea	2.17	2.65	2.65	2.65	2.93	2.93	2.93
Other Asia	5.74	8.36	8.36	8.36	10.66	10.66	10.66
Middle East**7**	5.58	7.53	7.53	7.53	9.08	9.08	9.08
Africa	2.72	3.57	3.57	3.57	4.66	4.66	4.66
South and Central America	4.69	6.53	6.53	6.53	8.61	8.61	8.61
Total Emerging Economies	**28.64**	**41.31**	**41.31**	**41.31**	**54.01**	**54.01**	**54.01**
Total Consumption	**79.60**	**100.38**	**99.70**	**99.65**	**120.47**	**119.21**	**119.12**
OPEC Production**10**	30.60	39.67	39.00	38.97	55.13	53.97	53.92
Non-OPEC Production**10**	48.77	60.41	60.39	60.38	65.04	64.94	64.90
Net Exports, Transitional Economies	4.84	8.75	8.75	8.75	9.25	9.25	9.25
OPEC Market Share	0.39	0.40	0.39	0.39	0.46	0.45	0.45

[1]Average refiner acquisition cost of imported crude oil.
[2]Includes production of crude oil (including lease condensates, natural gas plant liquids, other hydrogen and hydrocarbons for refinery feedstocks, alcohol and other sources, and refinery gains.
[3]Western Europe = Austria, Belgium, Bosnia and Herzegovina, Croatia, Denmark, Finland, France, the unified Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Macedonia, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and Yugoslavia.
[4]Caspian area includes Other Former Soviet Union.
[5]Eastern Europe = Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia.
[6]OPEC = Organization of Petroleum Exporting Countries - Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.
[7]Non-OPEC Middle East includes Turkey.
[8]Includes liquids produced from energy crops, natural gas, coal, oil sands, and shale. Includes both OPEC and non-OPEC producers in the regional breakdown.
[9]Includes both OPEC and non-OPEC consumers in the regional breakdown.
[10]Includes both conventional and nonconventional liquids production.
Note: Totals may not equal sum of components due to independent rounding. Data for 2003 are model results and may differ slightly from official EIA data reports.
Sources: Energy Information Administration, AEO2005 National Energy Modeling System runs AEO2005.D102004A, DORG_V1.D031105A, and DORG_V2.D031105A.