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# Analysis of the Impacts of an Early Start for Compliance with the Kyoto Protocol

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**Energy Information Administration**
Office of Integrated Analysis and Forecasting
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Washington, DC 20585

# Preface

The analysis in this report was undertaken at the request of the Committee on Science of the U.S. House of Representatives, subsequent to the report *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, published by the Energy Information Administration (EIA) in October 1998. In its request, the Committee asked EIA to "evaluate an earlier start date than 2005, which was the first year that the price signal was passed to consumers in your study of the Kyoto Protocol," as noted in the letter in Appendix B.

In its 1998 study, EIA analyzed the impacts of the Kyoto Protocol, assuming that a price was imposed on the consumption of fossil fuels relative to their carbon content in order to reduce projected carbon emissions in the United States to the level specified in the Kyoto Protocol for the period 2008 through 2012. The carbon price was phased in beginning in 2005, in order to allow energy markets time for adjustment before 2008. The present study assumes that the United States reaches the same level of carbon emissions in the period 2008 through 2012 but begins a gradual phase-in of the carbon price in 2000, in order to analyze whether a longer, more gradual adjustment would be beneficial. The projections in this report were produced using the National Energy Modeling System (NEMS), an energy-economy model of U.S. energy markets designed, developed, and maintained by EIA, which is used each year to provide the projections in EIA's *Annual Energy Outlook*. The detailed energy market results are provided in Appendix A.

The legislation that established EIA in 1977 vested the organization with an element of statutory independence. EIA does not take position on policy questions. It is the responsibility of EIA to provide timely, high quality information and to perform objective, credible analyses in support of the deliberations of both public and private decisionmakers. This report does not purport to represent the official position of the U.S. Department of Energy or the Administration.

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Within its Independent Expert Review Program, EIA arranged for leading experts in the field of energy and economic analysis to review an earlier version of this report. The assistance of the following reviewers is gratefully acknowledged: Joseph Boyer, Yale University; William Hogan, Harvard University; Michael Toman, Resources for the Future; and John Weyant, Stanford University Energy Modeling Forum.

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# Executive Summary

This analysis was undertaken at the request of the U.S. House of Representatives Committee on Science, following the earlier study by the Energy Information Administration (EIA)—*Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*,[1] published in October 1998. The committee requested that EIA analyze the impacts of an earlier phased-in start date for carbon emissions reductions to comply with the Kyoto Protocol, based on the same assumptions and cases of the earlier study.

## Background

Representatives of more than 160 nations met in Kyoto, Japan, from December 1 through 11, 1997, to negotiate binding limits for greenhouse gas emissions for the developed countries. The 1992 Framework Convention on Climate Change called for efforts by these countries, the Annex I countries,[2] to undertake actions to reduce greenhouse gas emissions by 2000 to 1990 levels. In the Kyoto Protocol to the Framework Convention, binding targets for greenhouse gas emissions were established for each of the Annex I countries, relative to its emissions level in 1990. On average, the overall emissions reduction target for the Annex I countries is 5.2 percent below 1990 levels; however, the targets are differentiated by country. The target for the United States is 7 percent below 1990 levels. In each case, the target is to be achieved, on average, from 2008 through 2012, the first commitment period in the Protocol.

In 1990, total greenhouse gas emissions in the United States were 1,633 million metric tons carbon equivalent, and carbon emissions from energy comprised 1,346 million metric tons, or 82 percent of the total.[3] Thus, carbon emissions from the combustion of energy are the major source of greenhouse gas emissions. The targets established in the Protocol, however, include five other greenhouse gases, each weighted by its global warming potential. Net changes in emissions from forests, other vegetation, and soils will also be used in meeting the targets. The Protocol also includes a variety of international activities that allow a country to meet its target by taking actions with or within other countries. A number of implementation issues remain to be resolved.

Because of the uncertainties concerning the Protocol, the earlier EIA analysis included a range of six cases, each with a different level of reductions for domestic carbon emissions from energy. The cases ranged from 24 percent above 1990 levels (1990+24%) to 7 percent below 1990 levels (1990-7%), with the targets achieved on average in the period 2008 to 2012. In the reference case, carbon emissions were projected to reach 1,791 million metric tons in 2010—33 percent above 1990 levels. The cases implicitly assumed different levels of offsets from carbon-absorbing sinks, other greenhouse gases, and international activities. Because the Protocol indicates that countries must show demonstrable progress by 2005, the carbon reduction targets were phased in beginning in 2005, in order to allow a gradual adjustment of energy markets.

EIA's analysis assumed that a carbon price would be applied to each of the energy fuels at its point of consumption relative to its carbon content. The carbon price was not applied directly to electricity but was applied to the fossil fuels used for electricity generation and, thus, was reflected in the delivered price of electricity. The carbon price represents the marginal cost of reducing domestic carbon emissions, reflecting the price the United States would be willing to pay to purchase carbon permits from other countries or to induce carbon reductions in other countries.

## Impacts on Energy Markets

In order to analyze the impacts of an earlier start date for carbon emissions reductions, the present analysis assumes that carbon reductions will be phased in beginning in 2000, instead of 2005, reaching the emissions target during the commitment period 2008 through 2012.

[1]Energy Information Administration, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, SR/OIAF/98-03 (Washington, DC, October 1998).

[2]Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Turkey and Belarus are Annex I nations that have not ratified the Framework Convention and did not commit to quantifiable emissions targets.

[3]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998).

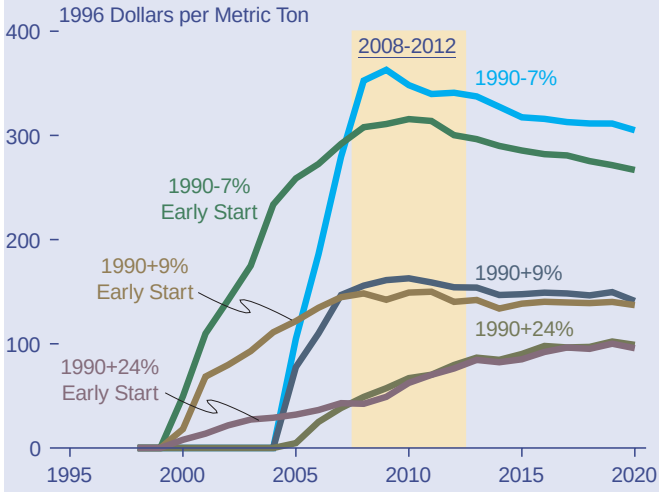
This analysis does not imply any changes in the timing or level of the U.S. commitments under the Kyoto Protocol but rather investigates whether binding limits on carbon emissions, imposed through a carbon price, would be less costly in terms of overall economic impacts if the limits began in 2000 rather than in 2005. The analysis does not assume additional impacts on consumer behavior as a result of further information programs, voluntary early reduction programs, partnerships, or regulations.

The introduction of carbon prices prior to 2005 lowers the demand for energy services in that period due to both the direct effect of higher energy prices on energy markets and the indirect effect of higher energy prices on the economy. The efficiency and carbon intensity of the stock of energy-using equipment also improves as a result of increased investment in more efficient equipment, accelerated retirements, such as retirements of less efficient industrial equipment and oil- and coal-fired generating capacity, and the acceleration of technology improvements before 2005. Consequently, energy consumption and carbon emissions are reduced prior to 2005, and the marginal cost of compliance is reduced in the commitment period. However, a carbon price is introduced earlier, and the earlier emissions reductions do not count toward the commitment targets.

The early start date reduces the carbon price in 2010 for each of the carbon reduction cases: from $67 (1996 dollars) to $62 per metric ton in the 1990+24% case; from $163 to $149 per metric ton in the 1990+9% case; and from $348 to $316 per metric ton in the 1990-7% case (Figure ES1). Average carbon prices over the first commitment period, 2008 through 2012, are also lowered: from $65 to $60 per metric ton in the 1990+24% case; from $159 to $146 per metric ton in the 1990+9% case; and from $349 to $310 per metric ton in the 1990-7% case. Because carbon prices are incurred earlier, average carbon prices over the entire projection period, 2000 through 2020, increase with the early start date: from $55 to $59 per metric ton in the 1990+24% case; from $110 to $124 per metric ton in the 1990+9% case; and from $231 to $254 per metric ton in the 1990-7% case.

For the 1990+9% and 1990-7% cases, which require larger shares of the total carbon emissions reductions to come from domestic energy sources than in the 1990+24% case, cumulative investments in more energy-efficient and lower carbon equipment, particularly for electricity generation, reduce the cost of compliance in the later years in both the early start and 2005 start cases. In all cases there is reduced demand for energy services, more rapid adoption of more efficient equipment, and increased use of either noncarbon or less carbon-intensive fuels as a result of the carbon price and the increase in fossil fuel prices. U.S. coal consumption is significantly lower in the carbon reduction cases, and consumption of petroleum is also lower. Consumption of natural gas, nuclear power, and renewable energy increases, primarily for electricity generation.

**Figure ES1. Projected Carbon Prices in the 1990+24%, 1990+9%, and 1990-7% Early Start and 2005 Start Cases, 1998-2020**



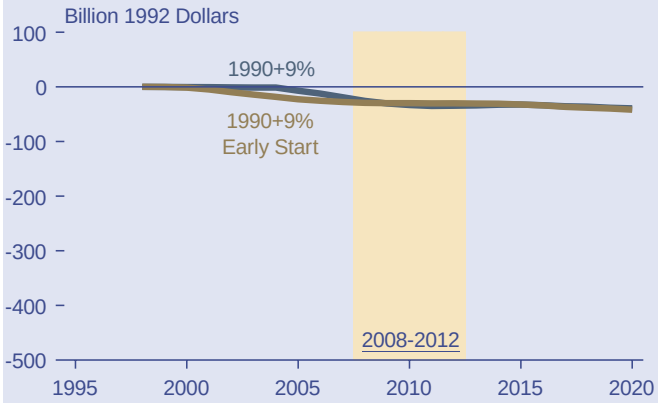

Sources: National Energy Modeling System runs FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Impacts on the Economy

With an earlier start date, the economy experiences a loss in gross domestic product (GDP) beginning in 2000 as higher prices increase the prices of goods and services throughout the economy; however, the early start date smooths the transition of the economy to the longer run target. The early start cases alter both the time profile and magnitude of the carbon price and the payments for carbon permits, which in turn affect the economy. Both potential and actual GDP are used to measure the economic impacts. The loss in potential GDP measures the loss in productive capacity of the economy attributable to the reduction in energy resources available to the economy. The loss in actual GDP incorporates the adjustment cost to the economy and reflects short-term economic dislocations that result from higher energy prices.

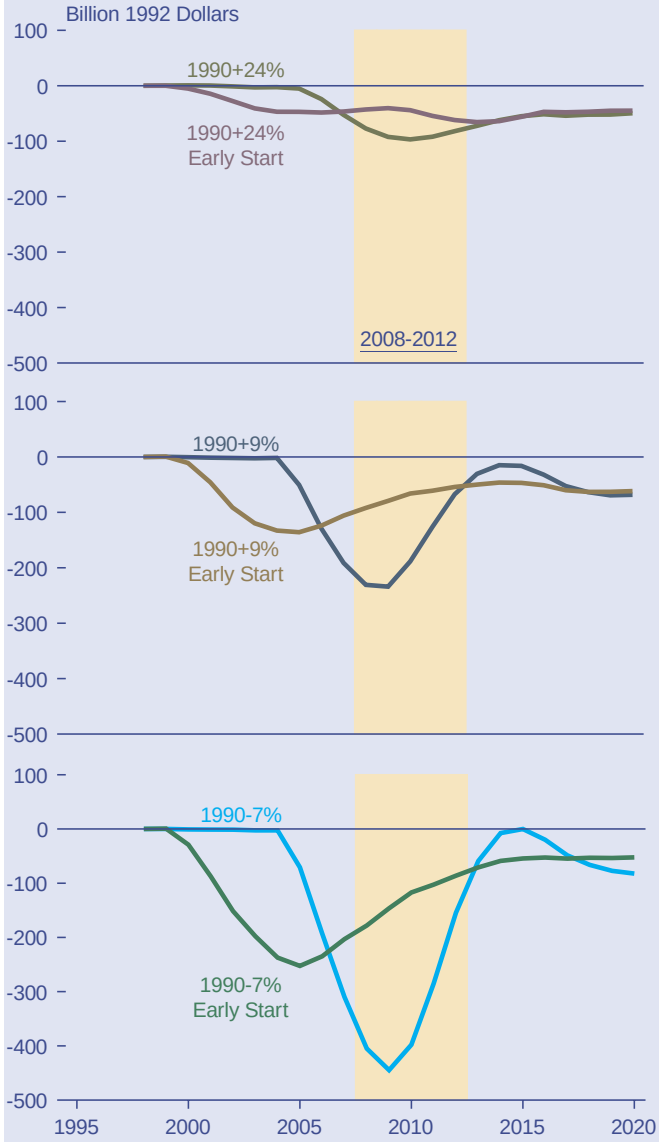
In the 1990+9% early start case, potential GDP losses begin in 2000 and progress slowly through 2010 (Figure ES2). In the 1990+9% case with the 2005 start date, the movement in potential GDP is more rapid. Once the carbon emissions target has been reached, however, the early start and 2005 start cases merge, and the projected rates of decline in both carbon emissions and energy use are similar in the two cases. Potential GDP then takes on the same path in both cases. By 2010, potential GDP declines by $33 billion (1992 dollars) in the 2005 start case and $30 billion in the early start case. By 2020, the loss in potential GDP is $39 billion with the 2005 start

**Figure ES2. Projected Dollar Losses in Potential Gross Domestic Product in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Figure ES3. Projected Dollar Losses in Actual Gross Domestic Product in the 1990+24%, 1990+9%, and 1990-7% Early Start and 2005 Start Cases, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

date and $42 billion with the 2000 start date. A similar pattern of results occurs in the 1990+24% and the 1990-7% cases (Table ES1).

The largest portion of the adjustment loss occurs in roughly the first 5 years of the imposition of the carbon price whether the start date is 2000 or 2005 (Figure ES3). In general, the loss in actual GDP in the early start cases between 2000 and 2005 is between one-half and nearly three-quarters of the loss in the cases with the 2005 start date between 2005 and 2010. In the early start cases, actual GDP begins to rebound back toward its level in the reference case sooner, and the recovery is smoother than in the cases with a 2005 start. By 2010, the GDP impacts in the 1990+24% early start case are about half those in the 1990+24% case with the 2005 start date. In the 1990+9% and 1990-7% cases, the impacts on GDP with the early start date are about one-third of the impacts with the 2005 start date. Ultimately, in all cases, the economy transitions into a long-run path, and the losses in actual and potential GDP become very close by 2020.

For each of the three carbon reduction targets, the early start and 2005 start cases project approximately the same undiscounted values for the cumulative impact on GDP from 2000 through 2020 (Table ES2). Although the cumulative impacts on GDP are similar, the early start cases involve a tradeoff. The peak impacts are less severe in the early start cases, but they occur earlier. A net present value calculation takes into consideration the time value of money. Using a discount rate of 7 percent beginning in 2000, the cumulative discounted impacts are larger in the early start cases.

**Table ES1. Projected Impacts on Potential and Actual GDP, 2010 and 2020**
(Billion 1992 Dollars)

| Projection | 2010 | | 2020 | |
|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start |
| **1990+24% Case** | | | | |
| Potential GDP | 12 | 14 | 26 | 28 |
| Actual GDP | 97 | 44 | 50 | 45 |
| **1990+9% Case** | | | | |
| Potential GDP | 33 | 30 | 39 | 42 |
| Actual GDP | 189 | 66 | 68 | 62 |
| **1990-7% Case** | | | | |
| Potential GDP | 72 | 64 | 68 | 68 |
| Actual GDP | 398 | 117 | 82 | 52 |

Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Table ES2. Projected Cumulative Impacts on Actual GDP, 2000-2020**
(Billion 1992 Dollars)

| Analysis Case | Undiscounted Value | | Net Present Value at 7-Percent Discount Rate | |
|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start |
| 1990+24% | 975 | 937 | 404 | 439 |
| 1990+9% | 1,573 | 1,560 | 750 | 846 |
| 1990-7% | 2,631 | 2,475 | 1,285 | 1,430 |

Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

# 1. Introduction

## Background

This analysis was undertaken at the request of the U.S. House of Representatives Committee on Science, following the earlier study by the Energy Information Administration (EIA), *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*.[1] That report, also responding to a request from the Committee on Science, was published in October 1998. The committee subsequently requested that EIA analyze the impacts of an earlier phased-in start date for U.S. carbon emissions reductions to comply with the Kyoto Protocol, based on the same assumptions and cases of the earlier study.

The Kyoto Protocol calls for binding limits on greenhouse gas emissions by the developed nations during the period 2008 through 2012. Some analysts suggest that an earlier start date could allow for a more gradual, and therefore easier and less expensive, transition in energy markets to achieve specific reduction targets. Earlier carbon reductions could lead to the purchase of more efficient or less carbon-intensive equipment at an earlier date, making it easier to meet greenhouse gas emissions targets. This report describes EIA's analysis of the impacts of an early start, using the same methodology as in the previous study, with only those changes in assumptions caused by the early start date. The analysis results are summarized in Chapter 2, and Appendix A provides detailed tables of the projections. The remainder of this chapter summarizes the provisions of the Kyoto Protocol and the results of EIA's 1998 study.

## The Kyoto Protocol and Its Status

From December 1 through 11, 1997, representatives from more than 160 countries met in Kyoto, Japan, at the third session of the Conference of the Parties to the 1992 Framework Convention on Climate Change. The goal of the Conference was the negotiation of binding limits for greenhouse gas emissions for developed nations. In the resulting Kyoto Protocol to the Framework Convention, targets for greenhouse gas emissions were established for these nations, the Annex I countries,[2] relative to their emissions levels in 1990. The targets are to be achieved, on average, from 2008 through 2012, the first commitment period in the Protocol.

The overall emissions reduction target for the Annex I countries is 5.2 percent below 1990 levels. Relative to 1990, the individual targets range from an 8-percent reduction for the European Union (EU) to a 10-percent increase for Iceland. Australia and Norway are also allowed increases of 8 and 1 percent above 1990 levels, respectively, while New Zealand, the Russian Federation, and the Ukraine are held to their 1990 levels. Other Eastern European countries undergoing transition to a market economy have reduction targets of between 5 and 8 percent below 1990 levels. The reduction targets for Canada and Japan are 6 percent and, for the United States, 7 percent, compared to 1990. Non-Annex I countries have no targets under the Protocol, although the Protocol reaffirms the commitments of the Framework Convention by all parties to formulate and implement climate change mitigation and adaptation programs.

The Protocol was opened for signature on March 16, 1998, for a 1-year period. It will enter into force 90 days after 55 Parties, including Annex I countries accounting for at least 55 percent of the 1990 carbon dioxide emissions from Annex I nations, have deposited their instruments of ratification, acceptance, approval, or accession. By March 15, 1999, 84 countries had signed the Protocol, including all but two of the Annex I countries, Hungary and Iceland. To date, only 10 countries have ratified or acceded to the Protocol—Panama, El Salvador, Trinidad and Tobago, Antigua and Barbuda, the Maldives, Tuvalu, Fiji, Bahamas, Niue, and Georgia—none of which is an Annex I country.

Although the Protocol does not prescribe specific steps to be taken, a number of potential actions are enumerated. They include energy efficiency improvements, enhancement of carbon-absorbing sinks, research and

[1]Energy Information Administration, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, SR/OIAF/98-03 (Washington, DC, October 1998).

[2]Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Turkey and Belarus are Annex I nations that have not ratified the Framework Convention and did not commit to quantifiable emissions targets.

development of sequestration technologies, phasing out of fiscal incentives and subsidies that may inhibit the goal of emissions reductions, and reduction of methane emissions in waste management and in energy production, distribution, and transportation. Sources of emissions include energy combustion, fugitive emissions from fuels, industrial processes, solvents, agriculture, and waste management and disposal.

The Kyoto Protocol includes a number of flexibility measures for compliance—often referred to as *what*, *where*, and *when* flexibility. *What* flexibility refers to the source of the emissions. Although carbon dioxide is the major greenhouse gas in terms of the level of emissions, the Protocol includes methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride,[3] in addition to carbon dioxide. The aggregate target is established using the carbon dioxide equivalent of each of the greenhouse gases, based on the global warming potential of each gas. Carbon-absorbing sinks—forests, other vegetation, and soils—are also included in *what* flexibility. Net changes in emissions by direct anthropogenic land-use changes and forestry activities will be used in meeting the commitment, limited to afforestation, reforestation, and deforestation since 1990. Specific guidelines and rules for the accounting of land-use and forestry activities must be resolved by the Conference of the Parties.

*Where* flexibility includes a variety of international activities, which would allow a country to meet its emissions target by taking action with or within other countries. Emissions trading among the Annex I countries is permitted. Groups of Annex I countries, such as the EU, may also jointly meet the total commitment of all the member nations either by allocating a share of the total reduction to each member or by trading emissions rights. Joint implementation projects are also allowed among the Annex I countries, allowing a nation to take emissions credits for projects that reduce emissions or enhance emissions-absorbing sinks in other Annex I countries. It is specifically indicated in the Protocol that trading and joint implementation are supplemental to domestic actions.

The Protocol also establishes a Clean Development Mechanism (CDM), a program under which Annex I countries can earn credits for projects that reduce emissions in non-Annex I countries. Such projects must lead to measurable, long-term benefits. Reductions from projects occurring from 2000 up to the beginning of the first commitment period can be used to assist in compliance in the commitment period. An executive board will be established to supervise the CDM, and an unspecified share of the proceeds from certified project activities will be used to cover administrative expenses and to assist developing country Parties that are particularly vulnerable to adverse effects of climate change to meet the costs of adaptation.

At the fourth session of the Conference of the Parties in Buenos Aires, in November 1998, a plan of action was adopted to finalize a number of the implementation issues at the sixth Conference of the Parties, which is likely to be held late in 2000 or early in 2001. Also at issue is the possibility of limiting credits for international actions that may be used to meet a country's target.

Under *when* flexibility, the targets can be achieved on average over the first commitment period of 2008 to 2012 rather than in each individual year. Averaging emissions over the 5-year period smooths out short-term fluctuations that might result from economic cycles or weather conditions. No targets are established for periods after 2012, although the Conference of the Parties will initiate consideration of future commitments at least 7 years before the end of the first commitment period. Banking—carrying over emissions reductions that go beyond the target from one commitment period to a subsequent commitment period—is allowed. The Protocol indicates that each Annex I country must have made demonstrable progress in achieving its commitments by 2005.

## Summary of EIA's 1998 Analysis of the Kyoto Protocol

At the request of the U.S. House of Representatives Committee on Science, EIA analyzed the likely impacts of the Kyoto Protocol on U.S. energy prices, energy use, and the economy in the 2008 to 2012 period. The analysis was published in *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, with an accompanying briefing report, *What Does the Kyoto Protocol Mean to U.S. Energy Markets and the U.S. Economy?*[4]

The request specified that the 1998 analysis use the same methodologies and assumptions as the *Annual Energy Outlook 1998* (*AEO98*),[5] which was the latest *AEO* at the time, using the National Energy Modeling System with no changes in assumptions regarding policy, regulatory actions, or funding for energy and environmental programs. The Committee also specified that the

[3]Hydrofluorocarbons are a non-ozone-depleting substitute for CFCs; perfluorocarbons are byproducts of aluminum production and are also used in semiconductor manufacturing; and sulfur hexafluoride is used as an insulator in electrical equipment and in semiconductor manufacturing.

[4]Energy Information Administration, *What Does the Kyoto Protocol Mean to U.S. Energy Markets and the U.S. Economy?*, SR/OIAF/98-03(S) (Washington, DC, October 1998).

[5]Energy Information Administration, *Annual Energy Outlook 1998*, DOE/EIA-0383(98) (Washington, DC, December 1997).

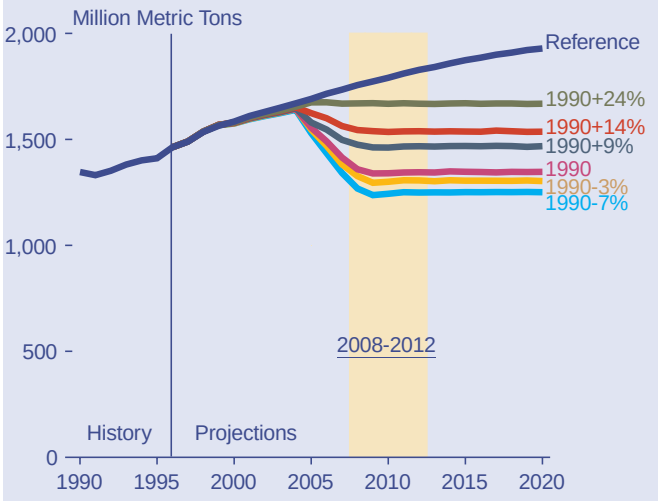
construction of new nuclear plants should not be assumed but that economic life extensions of nuclear plants should be permitted.

Energy use is naturally a focus of greenhouse gas reductions. In 1990, total greenhouse gas emissions in the United States were 1,633 million metric tons carbon equivalent, of which carbon emissions from the combustion of energy comprised 1,346 million metric tons, or 82 percent. By 1997, total greenhouse gas emissions had risen to 1,791 million metric tons carbon equivalent, with 1,480 million metric tons (83 percent) from energy combustion.[6] Because energy-related carbon emissions constitute such a large percentage of total greenhouse gas emissions, any action or policy to reduce emissions will impact U.S. energy markets.

## Carbon Targets

Because of the uncertainties surrounding the final implementation of the Kyoto Protocol, EIA's analysis included a range of six cases with different levels of reductions for domestic energy-related carbon emissions (Figure 1).

**Figure 1. Projected Carbon Emissions, 1990-2020**




Sources: **History:** Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1996*, DOE/EIA-0573(96) (Washington, DC, October 1997). **Projections:** Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, FD1998.D080398B, FD09ABV.D080398B, FD1990.D080398B, FD03BLW.D080398B, and FD07BLW.D080398B.

- **Reference Case.** Carbon emissions from energy increase to 33 percent above 1990 levels in 2010, reaching 1,791 million metric tons compared to 1,346 million metric tons in 1990. Between 2008 and 2012, annual carbon emissions average 1,792 million metric tons.
- **24 Percent Above 1990 Levels (1990+24%).** Carbon emissions increase to an annual average of 1,670 million metric tons between 2008 and 2012, 24 percent above the 1990 levels.
- **14 Percent Above 1990 Levels (1990+14%).** Carbon emissions average 1,539 million metric tons annually between 2008 and 2012, approximately at the level estimated for 1998 in *AEO98*, 1,533 million metric tons.
- **9 Percent Above 1990 Levels (1990+9%).** Carbon emissions increase to an annual average of 1,467 million metric tons between 2008 and 2012, 9 percent above 1990 levels.
- **Stabilization at 1990 Levels (1990).** Carbon emissions reach an annual average of 1,345 million metric tons during the commitment period of 2008 through 2012, stabilizing approximately at the 1990 level of 1,346 million metric tons.
- **3 Percent Below 1990 Levels (1990-3%).** Carbon emissions are reduced to an annual average of 1,307 million metric tons between 2008 and 2012.
- **7 Percent Below 1990 Levels (1990-7%).** Carbon emissions are reduced to an annual average of 1,250 million metric tons in the period 2008 to 2012. This case essentially assumes that the 7-percent target in the Kyoto Protocol for reducing emissions below 1990 levels must be met by energy-related carbon emissions with no net offsets from sinks, other greenhouse gases, or international activities.

EIA assumed that the United States would reach its goal of a 7-percent reduction in net greenhouse gas emissions in each of the carbon reduction cases, but each case implicitly assumed different levels of forestry and agricultural sinks, reductions from other greenhouse gases, international trading, and other international activities, which may offset the domestic reductions required from carbon. EIA's 1990-3% case was based on a fact sheet issued by the U.S. Department of State on January 15, 1998, which estimated that the method of accounting for sinks and the flexibility of using 1995 as the base year for the synthetic greenhouse gases could change the U.S. target for energy-related carbon emissions to a level analogous to 3 percent below 1990 levels, before accounting for sinks, reductions in other greenhouse gases, or international activities. Each of the cases with higher carbon targets (smaller reductions) assumed more contribution from sinks, other gases, and international activities to offset carbon reductions. In the 1990+24% case, for example, sinks, reductions in other greenhouse gases, and international activities account

[6]Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1997*, DOE/EIA-0573(97) (Washington, DC, October 1998).

for nearly 80 percent of the total net greenhouse gas reduction.

In each of the carbon reduction cases, the target is achieved on average for each of the years in the first commitment period, 2008 through 2012. The target is assumed to be constant from 2013 through 2020, the end of the forecast horizon, because the Protocol does not specify any targets beyond the first commitment period (although consideration of commitments for subsequent periods will be initiated at least 7 years before the end of the first commitment period). In the 1998 study, the target was assumed to be phased in over a 3-year period beginning in 2005, because the Protocol indicates that demonstrable progress toward reducing emissions must be shown by 2005. The 2005 start date for compliance activities would allow energy markets to begin adjustments to meet the reduction targets prior to 2008.

## Carbon Prices

In its 1998 analysis of the Kyoto Protocol, EIA assumed that a carbon price would be applied to each of the energy fuels at its point of consumption, relative to its carbon content. The carbon price would not be applied directly to electricity but would be applied to the fossil fuels used for electricity generation and reflected in the delivered price of electricity. The analysis assumed that a carbon permit trading system would function as a Federal Government auction, and that the revenues collected by the Government would be recycled to the economy through either a lump sum rebate in personal income taxes or a reduction in social security tax rates.

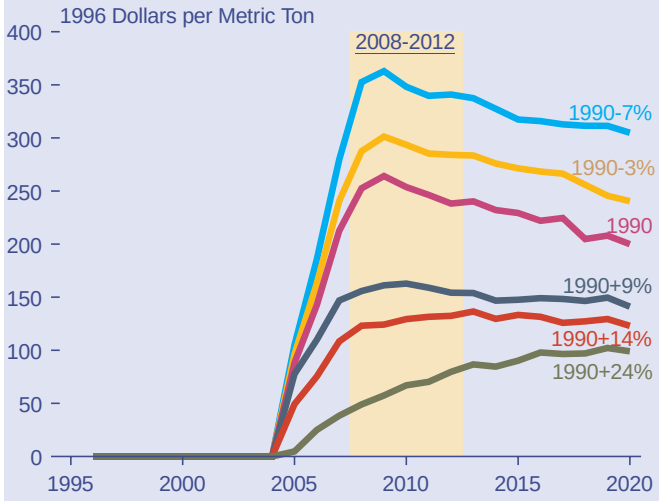
In 2010, the carbon price necessary to achieve the targets ranges from $67 per metric ton (1996 dollars) in the 1990+24% case to $348 per metric ton in the 1990-7% case. In the more restrictive cases, the carbon price escalates rapidly to achieve the more stringent reductions but then declines over the next 10 years of the forecast horizon. Cumulative investments in more energy-efficient and lower-carbon equipment, particularly for electricity generation, reduce the cost of compliance in the later years (Figure 2).

The carbon prices represent the marginal cost of reducing domestic carbon emissions, reflecting the price the United States would be willing to pay to purchase carbon permits from other countries or to induce carbon reductions in other countries. They do not represent the international market-clearing price of carbon permits or the price at which other countries would be willing to offer permits.

## Energy Prices

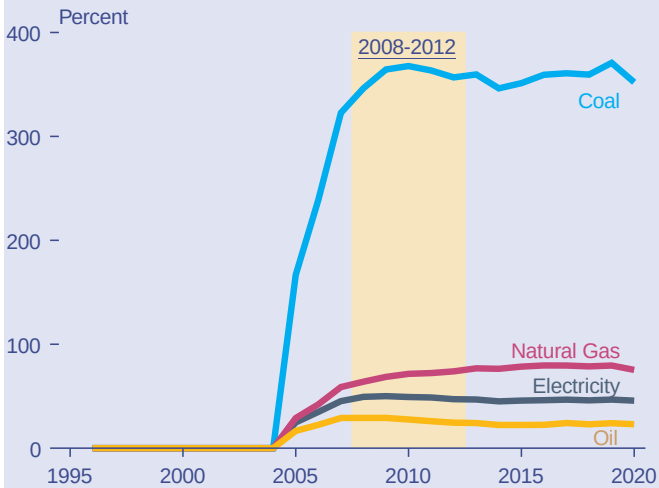
Because coal has the highest carbon content per thermal output of all the fossil fuels, a carbon price would have the largest impact on coal prices (Figure 3). Across all the EIA carbon reduction cases, the average delivered price of coal in 2010 is higher by between 152 and nearly 800 percent relative to the reference case. Average electricity prices in 2010 are higher by between 20 and 86 percent compared to the reference case, and average delivered natural gas prices are between 25 and 148 percent higher. On average, the price of petroleum products is higher by between 12 and 62 percent, and the price of gasoline is higher by between 11 and 53 percent in 2010, reaching $1.91 a gallon in the most stringent reduction case compared to $1.25 a gallon in the reference case.

**Figure 2. Projected Carbon Prices, 1996-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, FD1998.D080398B, FD09ABV.D080398B, FD1990.D080398B, FD03BLW.D080398B, and FD07BLW.D080398B.

**Figure 3. Projected Changes in Average Delivered Prices for Energy Fuels in the 1990+9% Case Relative to the Reference Case, 1996-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A and FD09ABV.D080398B.

## Energy Consumption and Fuel Mix

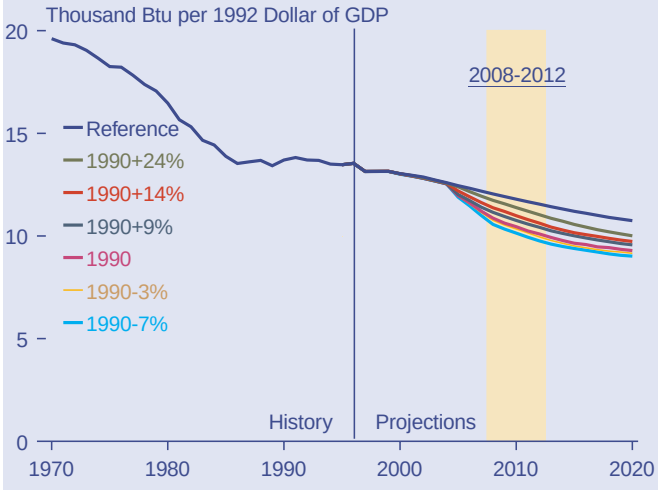
The imposition of carbon prices and the resulting increase in fossil fuel prices would lead to reduced demand for energy services, more rapid adoption of higher-efficiency equipment, and increased use of either noncarbon or less carbon-intensive fuels. As carbon prices raised the delivered price of energy, the overall intensity of energy use would decline. In the reference case, energy intensity, measured as primary energy consumed per dollar of gross domestic product (GDP), declines at an average annual rate of about 1 percent between 2005 and 2010. Across the carbon reduction cases, the rate of the intensity decline in the same period ranges from 1.6 percent a year in the 1990+24% case to 3.0 percent a year in the 1990-7% case (Figure 4).

Carbon emissions would be reduced in each of the end-use sectors—residential, commercial, industrial, and transportation. Higher energy prices would encourage investments in more efficient equipment, building shells, and vehicles and reduce the demand for energy services. The impact of higher energy prices on the economy would also lower industrial output and overall travel requirements. Finally, relative changes in the prices of energy fuels as a result of the carbon prices would encourage a shift to less carbon-intensive fuels and renewable energy.

Across the carbon reduction cases, electricity generation accounts for between 68 and 75 percent of the total carbon reductions in 2010. As energy prices increase, electricity consumption is reduced and more efficient, less carbon-intensive technologies are used for electricity generation. Fuel switching accounts for most of the carbon reductions from electricity (Figure 5) as generators shift from coal to new natural-gas-fired generating plants, extend the operating lives of existing nuclear plants, and increase the use of renewable energy—particularly, biomass and wind. Electricity generators respond more strongly than end-use consumers to higher energy prices because generation in the reference case is highly dependent on coal, fuel prices play a more significant role in fuel choice decisions, and there are more economically viable technologies available that can be used to shift generation from coal to natural gas or renewable sources as the carbon price increases.

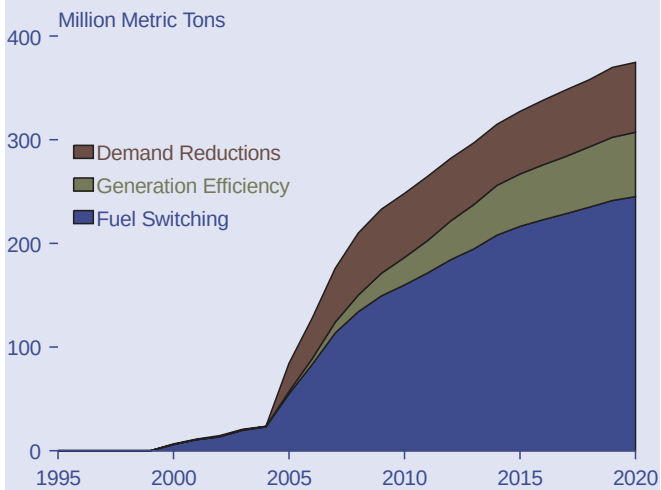
Overall, U.S. coal consumption is significantly lower in the carbon reduction cases, between 18 and 77 percent in 2010, than in the reference case. As a result, its share of total U.S. energy consumption is reduced to between 6 and 19 percent across the carbon reduction cases, compared to a 22-percent share in the reference case (Figure 6). Consumption of petroleum is also lower, although its share of the total fuel mix increases slightly because the transportation sector remains highly dependent on oil. Natural gas, nuclear power, and renewable energy consumption all increase, primarily because of increased use for electricity generation.

**Figure 4. Projections of U.S. Energy Intensity, 1970-2020**



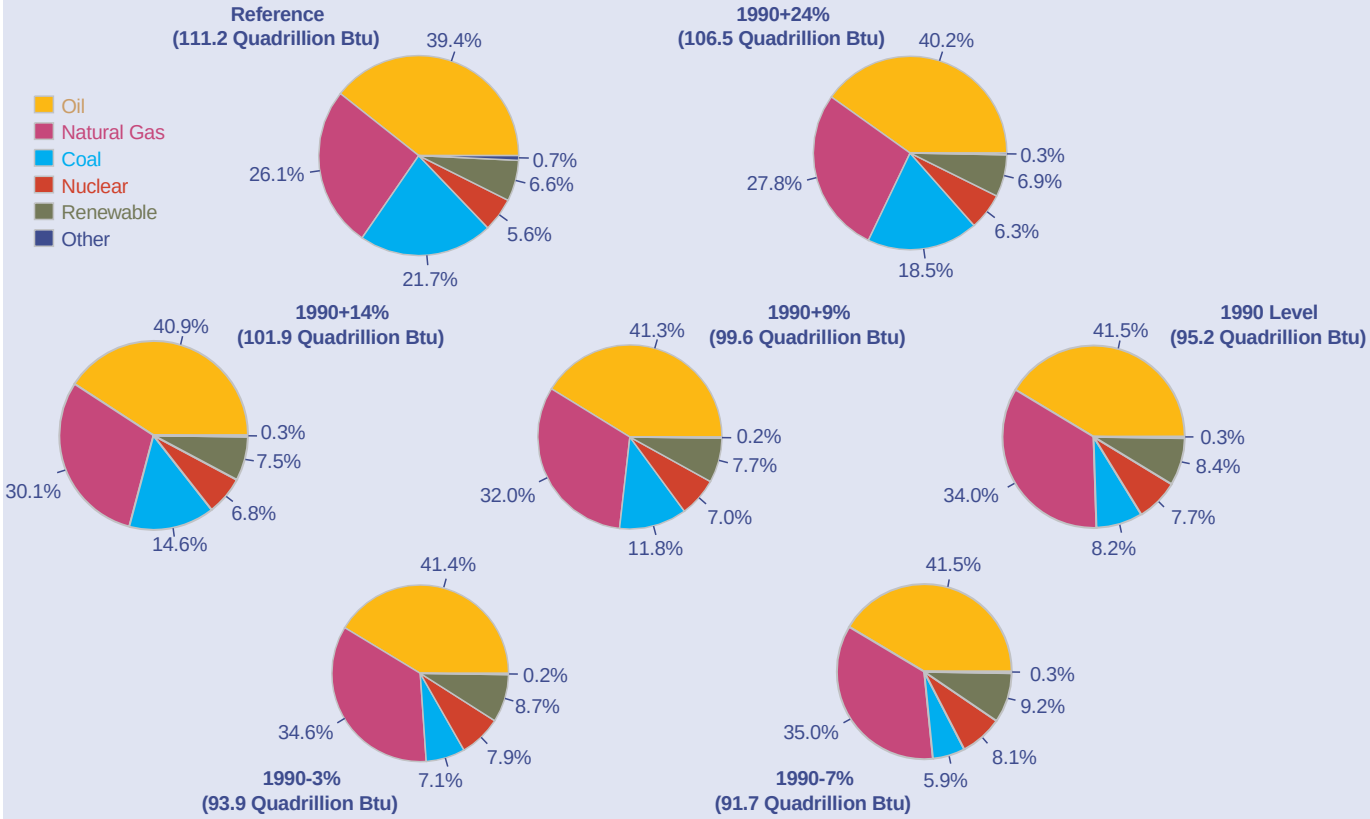

Sources: **History:** Energy Information Administration, *Annual Energy Review 1997*, DOE/EIA-0384(97) (Washington, DC, July 1998). **Projections:** Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, FD1998.D080398B, FD09ABV.D080398B, FD1990.D080398B, FD03BLW.D080398B, and FD07BLW.D080398B.

**Figure 5. Projected Reductions in Carbon Emissions From the Electricity Supply Sector, 1990+9% Case, 1996-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A and FD09ABV.D080398B.

## Figure 6. Projections of Fuel Shares of Total U.S. Energy Consumption, 2010




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, FD1998.D080398B, FD09ABV.D080398B, FD1990.D080398B, FD03BLW.D080398B, and FD07BLW.D080398B.

# 2. Timing of U.S. Carbon Reductions

## Background

In the EIA analysis released in October 1998, it was assumed that the carbon targets would be achieved on average from 2008 to 2012, the first commitment period in the Kyoto Protocol. Carbon reductions would be phased in beginning in 2005, with approximately one-fourth of the total reduction achieved in 2005, one-half in 2006, three-fourths in 2007, and the full level achieved in the commitment period. The phase-in period would allow for a more gradual transition of energy markets, and it is consistent with the requirement in the Protocol that countries must make demonstrable progress toward their commitments by 2005. It was also assumed that some energy sectors would begin to respond before 2005 in anticipation of the coming changes in energy prices. Any carbon reductions achieved before 2008 would not, however, count toward compliance.

At the request of the U.S. House of Representatives Committee on Science, EIA has analyzed the impacts of an earlier start date for carbon emissions reductions. In this analysis, the carbon emissions targets are assumed to be phased in beginning in 2000, instead of 2005, reaching the emissions target during the commitment period 2008 through 2012. Again, carbon reductions achieved before 2008 do not count toward compliance, and the early start date does not imply any change in the timing or level of the U.S. commitments under the Kyoto Protocol. Assuming U.S. compliance with the Kyoto Protocol, the analysis investigates whether binding limits on carbon emissions, imposed through a carbon price, would be less costly in terms of overall economic impacts if the limits began in 2000 rather than in 2005. Only three of the six cases from the 1998 study—1990+24%, 1990+9%, and 1990-7%—are included in this analysis, representing the most stringent (1990-7%), least stringent (1990+24%), and intermediate (1990+9%) cases.

It is possible that an earlier start and more gradual phase-in of the carbon emissions targets could lower the carbon price required to achieving the specified targets in the commitment period. Starting carbon reductions earlier could induce consumers who are replacing energy-using equipment over the next decade to purchase more efficient, less carbon-intensive equipment than they might otherwise buy, making it less costly to meet carbon emissions targets in the commitment period. Lower carbon prices would have less negative impact on the economy in the commitment period, and a smoother adjustment of the economy to higher energy prices would be possible.

In order to achieve the early start date, carbon prices are imposed starting in 2000, raising energy prices and incurring macroeconomic costs earlier than projected in EIA's 1998 study. Although the carbon price leads to higher energy prices before 2005 in the early start cases, it is assumed that consumers purchasing energy-using equipment will continue to rank energy prices along with other preferences in the same manner as in the cases with the 2005 start date. The analysis does not assume changes in consumer behavior as a result of additional information programs, voluntary early reduction programs, partnerships, or regulations; however, consumer behavior does respond to higher energy prices induced by the carbon price.

The imposition of carbon prices before 2005 reduces the demand for energy services and improves the efficiency and carbon intensity of the stock of energy-using equipment. Energy service demand is lower as a result of both the direct effect of energy prices (for example, as consumers adjust thermostats and reduce travel), and the indirect effect of higher energy prices on the economy (reductions in freight and air transport and industrial output). Three primary effects are expected to produce improvements in the efficiency and carbon intensity of the stock of energy-using equipment. First, retirements are accelerated for some equipment, such as less-efficient industrial equipment and oil and coal-fired generating capacity. Second, with higher fossil fuel prices, there is an economic incentive to invest in more efficient equipment, purchase smaller light-duty vehicles[7] with lower horsepower, and shift to natural gas or renewable generation capacity. Third, higher prices lead to the acceleration of technology improvements prior to 2005.

For most parts of the energy-consuming sectors—residential, commercial, industrial, and transportation—it is assumed that the evolution of technology is dependent on the passage of time as more advanced, more efficient,

[7]Light-duty vehicles include cars, vans, pickup trucks, and sport utility vehicles.

and / or lower-cost equipment becomes available to consumers. An earlier start date for carbon reductions and higher energy prices prior to 2005 will increase the demand for more energy-efficient equipment. Consequently, efficiency improvements for existing equipment that are included in the reference case are assumed to accelerate in the 2000-2005 time period, as manufacturers respond to consumer demand for efficiency. For example, in the residential and commercial sectors, more energy-efficient models of current technologies that are available in the reference case in 2005 are assumed to be available in 2001 (although the equipment still must be economical to be adopted). The acceleration of technology improvements in the early start cases is not assumed to continue after 2005, because carbon prices decline in the commitment period. In the electricity generation sector, the evolution of technology is influenced by the rate of adoption, with the costs of new generation technologies declining as the technologies penetrate. For example, the earlier adoption of renewable generating technologies reduces the costs of the technologies so that there is a greater economic incentive for their adoption.

Both the earlier EIA study and this analysis use a carbon price as the primary instrument for change in energy markets. Energy consumers in the residential, commercial, industrial, and transportation sectors are assumed to respond to changes in energy prices as they occur without anticipating future price increases. In the electricity generation sector, however, future price increases are anticipated when capacity expansion decisions are made. Similarly, automobile manufactures factor future increases in the price of gasoline into the decision to offer more efficient vehicles. Capacity expansion decisions by electricity generators, refiners, and natural gas pipelines also incorporate anticipated growth in the demand for electricity, petroleum products, and natural gas.

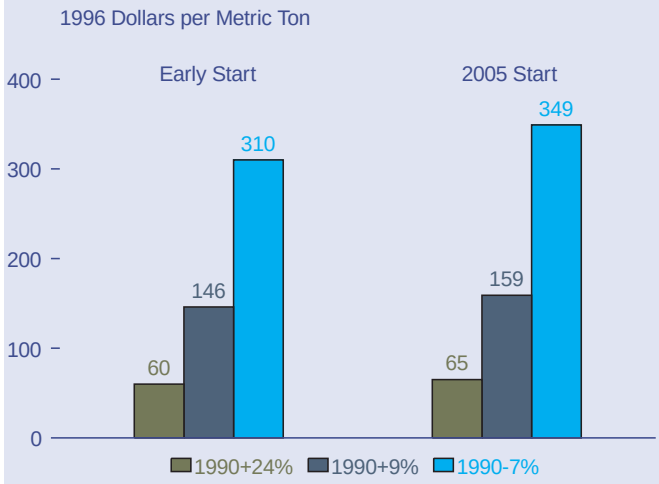
Even if carbon emissions reductions are imposed earlier, the carbon emissions targets do not change after 2008. As a result, carbon emissions in the first commitment period are essentially the same whether the phase-in of reductions begins in 2000 or 2005. Due to changes in energy-using equipment before 2005 in the early start cases, the equipment stock is likely to be less carbon intensive in the commitment period. As a result, the demand for energy services may be higher while still meeting the carbon targets. A key question is whether the early start date encourages sufficient investment in more energy-efficient and less carbon-intensive technologies to reduce the cost of compliance and the overall macroeconomic impacts significantly in the commitment period.

# Results of the Early Start Analysis

## Carbon Prices

In general, an earlier start date for reducing carbon emissions has the immediate impact of improving energy efficiency and encouraging fuel switching, resulting in reductions in energy consumption and carbon emissions before 2005. The longer phase-in results in a more gradual reduction in carbon emissions than projected with a start date of 2005 and an easier transition to the targets within the commitment period. Because of the changes in energy efficiency and fuel mix that occur before 2005 with the earlier start date, the average and marginal costs of compliance are reduced in the commitment period (Figures 7 and 8).

**Figure 7. Average Projected Carbon Prices, 2008-2012**

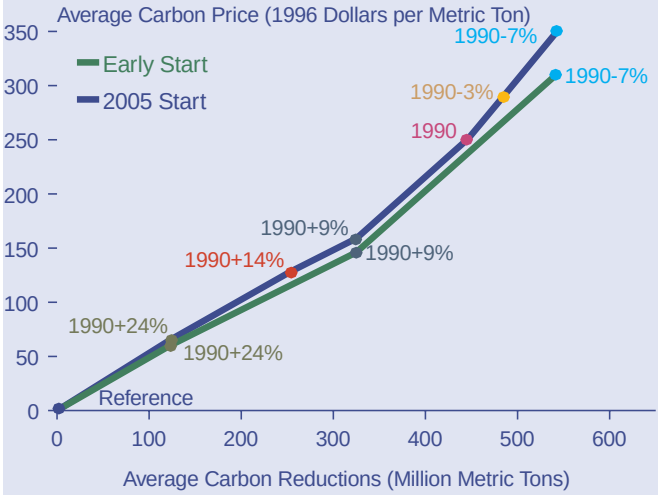



Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD24ABV.D080398B, FD09ABV.D080398B, FD07BLW.D080398B, EARLY24.D052099A, EARLY09.D053199A, and EARLY07.D052199A.

### *1990+24% Carbon Emissions Target*

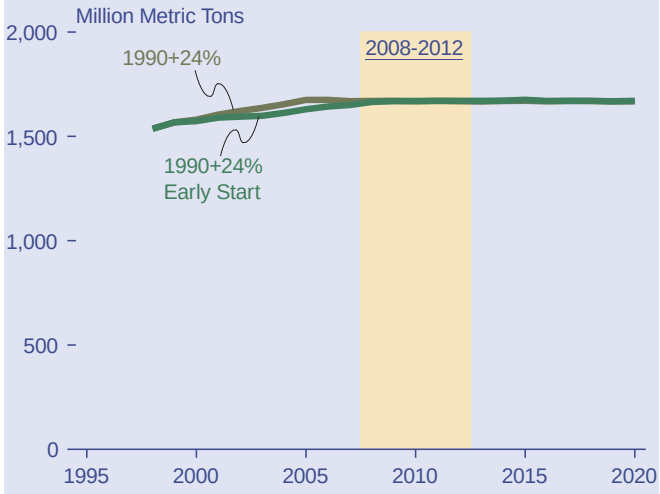
Because the overall target for reductions in domestic energy-related carbon emissions is relatively low in the 1990+24% case, an earlier phase-in results in relatively small emissions reductions between 2000 and 2004 (Figure 9). Early in the projection period, energy consumption is 2.2 quadrillion British thermal units (Btu) lower in 2005 in the early start case than in the 1990+24% case, in part because of efficiency improvements (Figure 10). By 2010 and beyond, energy consumption is virtually the same in the two cases (Tables 1 and 2). Electricity generators adjust to a slightly lower demand for electricity early in the period by reducing coal-fired generation; however, the overall fuel mix is not significantly changed with the earlier start date.

**Figure 8. Average Projected Carbon Prices and Annual Carbon Emission Reductions, 2008-2012**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, FD1998.D080398B, FD09ABV.D080398B, FD1990.D080398B, FD03BLW.D080398B, FD07BLW.D080398B, EARLY24.D052099A, EARLY09.D053199A, and EARLY07.D052199A.

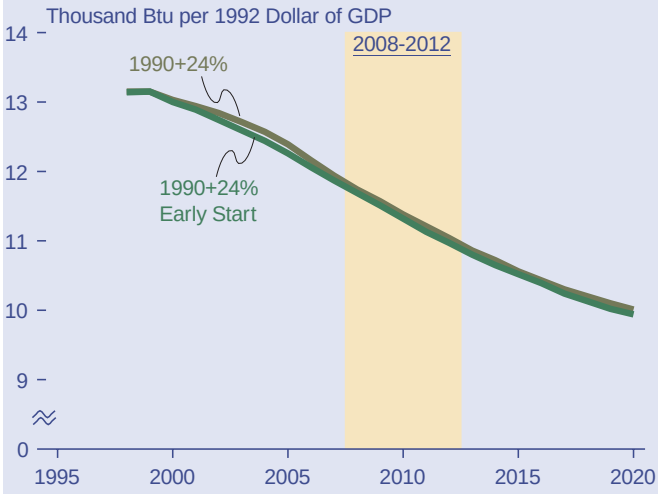
**Figure 9. Projected Carbon Emissions in the 1990+24% and 1990+24% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD24ABV.D080398B and EARLY24.D052099A.

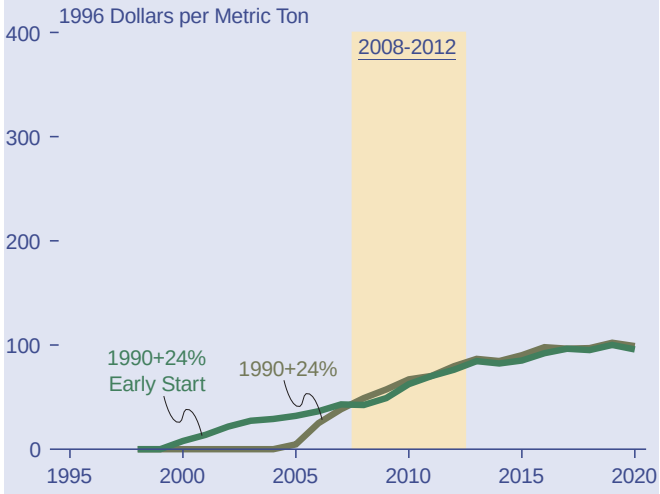
The impact of the early start date on carbon prices in the 1990+24% case is small (Figure 11). In 2010, the midpoint of the first commitment period in the Kyoto Protocol, the carbon price in the 1990+24% case is $67 per metric ton, which is reduced to $62 per metric ton in the early start case. Over the 2008 to 2012 period, the average carbon price is $60 per metric ton in the early start case, compared with $65 per metric ton in the 1990+24% case. Although the carbon prices are lower in the commitment period, a carbon price is imposed for an additional 5 years in the early start case. From 2000 through 2020, average carbon prices are about $59 per metric ton in the early start case and $55 per metric ton in the 1990+24% case. In the same period, carbon reductions total 2,762 million metric tons and 2,552 million metric tons, respectively, in the two cases, although reductions in the commitment period are approximately the same.

**Figure 10. Projected U.S. Energy Intensity in the 1990+24% and 1990+24% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD24ABV.D080398B and EARLY24.D052099A.

**Figure 11. Projected Carbon Prices in the 1990+24% and 1990+24% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD24ABV.D080398B and EARLY24.D052099A.

## Table 1. Selected Variables in the Carbon Reduction Cases, 1996 and 2010

| Variable | 1996 | 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| U.S. Carbon Emissions (Million Metric Tons) | 1,463 | 1,791 | 1,668 | 1,670 | 1,462 | 1,466 | 1,243 | 1,249 |
| Emissions Reductions (Percent Change From Reference Case) | — | — | 6.9 | 6.8 | 18.4 | 18.1 | 30.6 | 30.3 |
| Total Energy Consumption (Quadrillion Btu) | 93.8 | 111.2 | 106.5 | 106.4 | 99.6 | 100.1 | 91.7 | 93.0 |
| (Percent Change From Reference Case) | — | — | -4.2 | -4.3 | -10.4 | -10.0 | -17.5 | -16.4 |
| Carbon Price (1996 Dollars per Metric Ton) | — | — | 67 | 62 | 163 | 149 | 348 | 316 |
| Carbon Revenue[a] (Billion 1996 Dollars) | — | — | 110 | 102 | 233 | 214 | 424 | 386 |
| Gasoline Price (1996 Dollars per Gallon) | 1.23 | 1.25 | 1.39 | 1.37 | 1.55 | 1.53 | 1.91 | 1.82 |
| (Percent Change From Reference Case) | — | — | 11.2 | 9.6 | 24.0 | 22.4 | 52.8 | 45.6 |
| Average Electricity Price (1996 Cents per Kilowatthour) | 6.8 | 5.9 | 7.1 | 7.0 | 8.8 | 8.5 | 11.0 | 10.4 |
| (Percent Change From Reference Case) | — | — | 20.3 | 18.6 | 49.2 | 44.1 | 86.4 | 76.3 |
| Actual Gross Domestic Product[b] (Billion 1992 Dollars) | 6,928 | 9,429 | 9,333 | 9,385 | 9,241 | 9,363 | 9,032 | 9,312 |
| (Percent Change From Reference Case) | — | — | -1.0 | -0.5 | -2.0 | -0.7 | -4.2 | -1.2 |
| (Annual Percentage Growth Rate, 2000-2010) | — | 2.1 | 2.0 | 2.0 | 1.9 | 2.0 | 1.6 | 2.0 |
| Potential Gross Domestic Product (Billion 1992 Dollars) | 6,930 | 9,482 | 9,469 | 9,468 | 9,448 | 9,452 | 9,410 | 9,417 |
| (Percent Change From Reference Case) | — | — | -0.1 | -0.1 | -0.4 | -0.3 | -0.8 | -0.7 |
| (Annual Percentage Growth Rate, 2000-2010) | — | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 |
| Change in Energy Intensity (Annual Percent Change, 2000-2010) | — | -1.0 | -1.3 | -1.3 | -1.9 | -1.9 | -2.4 | -2.4 |
| (Percent Change From Reference Case) | — | — | 33.3 | 36.4 | 91.0 | 92.4 | 149.9 | 148.7 |

[a]The carbon revenues do not include fees on the nonsequestered portion of petrochemical feedstocks, nonpurchased refinery fuels, or industrial other petroleum.

[b]Carbon permit revenues are assumed to be returned to households through personal income tax rebates.

Note: In the cases with an early start date, the peak impact on the economy occurs in 2005 and declines by 2010. For example, in the 1990+9% case with the 2000 start date, the percent change in actual gross domestic product is -1.6 percent in 2005, compared to -0.7 percent in 2010.

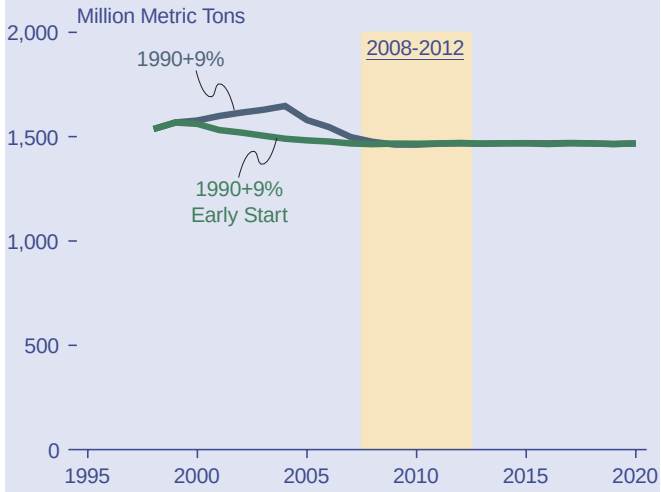
Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

### *1990+9% Carbon Emissions Target*

Earlier reductions have a larger impact on carbon emissions in the 1990+9% case than in the 1990+24% case (Figure 12). Total energy consumption in 2005 in the early start case is about 3.9 quadrillion Btu lower than in the 1990+9% case, and energy intensity is also lower (Figure 13). The difference in consumption essentially disappears by 2008, the beginning of the first commitment period.

In response to the carbon prices, electricity generators use less coal and more natural gas before 2005 in the early start case. Because electricity generators are assumed to anticipate future prices, some changes in capacity additions begin almost immediately in the projection period. In 2005, coal consumption by electricity generators is about 3.0 quadrillion Btu lower in the early start case than in the 1990+9% case, and consumption of natural gas by generators is about 1.0 quadrillion Btu higher. Efficiency improvements reduce the consumption of natural gas by end-use consumers, however, so

**Figure 12. Projected Carbon Emissions in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD09ABV.D080398B and EARLY09.D053199A.

## Table 2. Selected Variables in the Carbon Reduction Cases, 1996 and 2020

| Variable | 1996 | 2020 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| U.S. Carbon Emissions (Million Metric Tons) | 1,463 | 1,929 | 1,668 | 1,670 | 1,468 | 1,468 | 1,251 | 1,249 |
| Emissions Reductions (Percent Change From Reference Case) | — | — | 13.5 | 13.4 | 23.9 | 23.9 | 35.1 | 35.3 |
| Total Energy Consumption (Quadrillion Btu) | 93.8 | 117.0 | 108.6 | 108.4 | 103.8 | 103.6 | 98.8 | 99.0 |
| (Percent Change From Reference Case) | — | — | -7.2 | -7.4 | -11.3 | -11.5 | -15.6 | -15.4 |
| Carbon Price (1996 Dollars per Metric Ton) | — | — | 99 | 96 | 141 | 137 | 305 | 267 |
| Carbon Revenue[a] (Billion 1996 Dollars) | — | — | 162 | 157 | 202 | 196 | 372 | 325 |
| Gasoline Price (1996 Dollars per Gallon) | 1.23 | 1.24 | 1.42 | 1.39 | 1.49 | 1.46 | 1.80 | 1.69 |
| (Percent Change From Reference Case) | — | — | 14.5 | 12.1 | 20.2 | 17.7 | 45.2 | 36.3 |
| Average Electricity Price (1996 Cents per Kilowatthour) | 6.8 | 5.6 | 7.3 | 7.3 | 8.1 | 8.0 | 9.3 | 8.9 |
| (Percent Change From Reference Case) | — | — | 30.4 | 30.4 | 44.6 | 42.9 | 66.1 | 58.9 |
| Actual Gross Domestic Product[b] (Billion 1992 Dollars) | 6,928 | 10,865 | 10,815 | 10,820 | 10,796 | 10,803 | 10,782 | 10,812 |
| (Percent Change From Reference Case) | — | — | -0.5 | -0.4 | -0.6 | -0.6 | -0.8 | -0.5 |
| (Annual Percentage Growth Rate, 2000-2020) | — | 1.8 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| Potential Gross Domestic Product (Billion 1992 Dollars) | 6,930 | 10,994 | 10,968 | 10,966 | 10,954 | 10,952 | 10,925 | 10,926 |
| (Percent Change From Reference Case) | — | — | -0.2 | -0.3 | -0.4 | -0.4 | -0.6 | -0.6 |
| (Annual Percentage Growth Rate, 2000-2020) | — | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Change in Energy Intensity (Annual Percent Change, 2000-2020) | — | -0.9 | -1.3 | -1.3 | -1.5 | -1.5 | -1.7 | -1.6 |
| (Percent Change From Reference Case) | — | — | 37.1 | 36.5 | 59.7 | 57.7 | 84.5 | 76.1 |

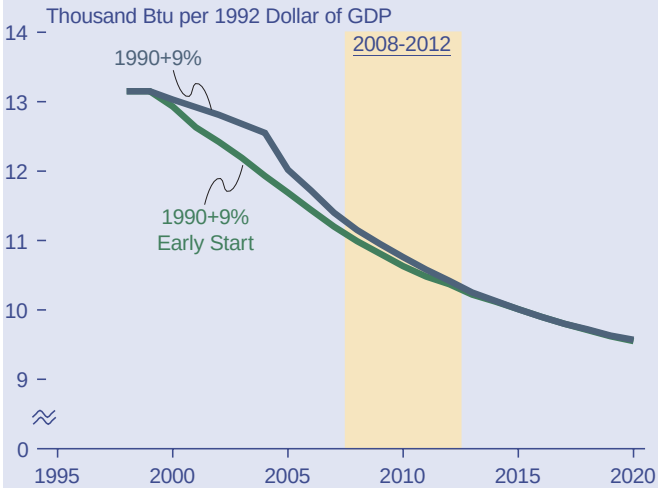
[a]The carbon revenues do not include fees on the nonsequestered portion of petrochemical feedstocks, nonpurchased refinery fuels, or industrial other petroleum.

[b]Carbon permit revenues are assumed to be returned to households through personal income tax rebates.

Note: In the cases with an early start date, the peak impact on the economy occurs in 2005 and declines by 2010. For example, in the 1990+9% case with the 2000 start date, the percent change in actual gross domestic product is -1.6 percent in 2005, compared to -0.4 percent in 2020.

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Figure 13. Projected U.S. Energy Intensity in the 1990+9% and 1990+9% Early Start Cases, 1998-2020

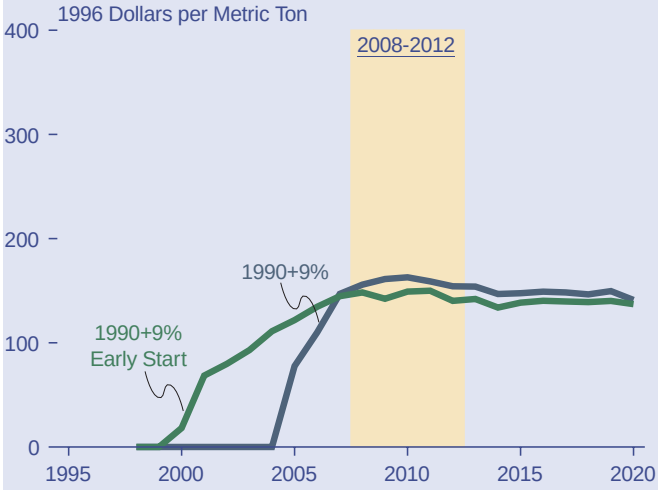



Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD09ABV.D080398B and EARLY09.D053199A.

that total natural gas consumption in 2005 is only about 0.5 quadrillion Btu higher in the early start case. As was seen for the 1990+24% case, earlier carbon reductions in the 1990+9% case have little impact on the economics of nuclear plant life extensions. Also, the use of renewable energy is essentially unchanged early in the projection period, implying that increased use of natural gas is more cost-effective than renewables before 2005, even with higher prices for fossil fuels.

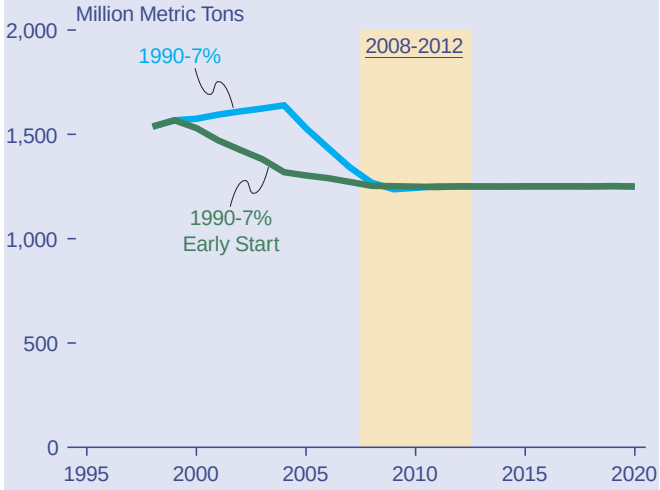
As a result of lower energy consumption and a shift from coal to natural gas before 2005, carbon prices in the 2008 to 2012 period are lower in the early start case. In 2010, the carbon price is $149 per metric ton in the early start case, compared with $163 per metric ton in the 1990+9% case (Figure 14). Carbon prices average $146 per metric ton between 2008 and 2012 in the early start case, compared with $159 in the 1990+9% case. From 2000 through 2020, average carbon prices are about $124 per metric ton in the early start case and $110 per metric ton in the 1990+9% case, with total carbon reductions of

**Figure 14. Projected Carbon Prices in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD09ABV.D080398B and EARLY09.D053199A.

**Figure 15. Projected Carbon Emissions in the 1990-7% and 1990-7% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD07BLW.D080398B and EARLY07.D052199A.

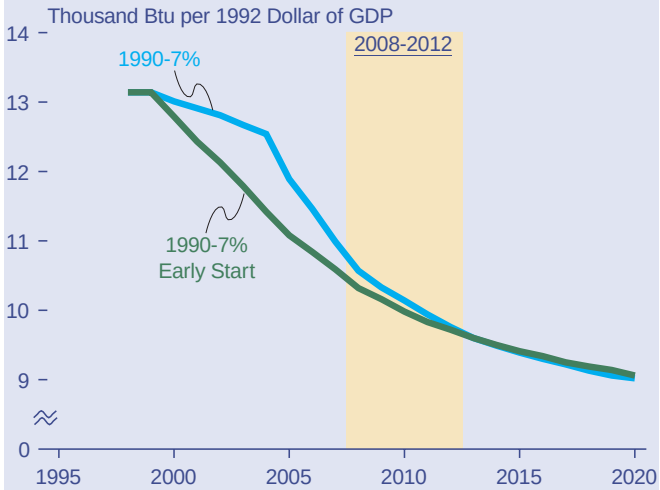
6,259 million metric tons and 5,596 million metric tons, respectively, in the two cases.

### *1990-7% Carbon Emissions Target*

Because the 1990-7% case requires larger reductions in carbon emissions (Figure 15), the impact of an earlier start date is more significant before 2005 than it is in the 1990+24% and 1990+9% cases. In 2005, total energy consumption in the early start case is about 8.4 quadrillion Btu lower than in the 1990-7% case, and energy intensity is also reduced (Figure 16), although total consumption is the same in 2008 when the carbon reductions in the two cases are the same. Total energy consumption is as much as 1.7 quadrillion Btu higher after 2008 in the early start case, with the difference between the two cases narrowing later in the forecast period. Higher use of renewable sources, primarily for electricity generation, changes the fuel mix and allows the carbon reduction targets to be met later in the period, despite higher demand for petroleum in the transportation sector and higher total energy consumption.

Before 2005, electricity generators shift from coal to natural gas and begin to increase the use of renewable energy slightly. In 2005, natural gas consumption by electricity generators is 10.3 quadrillion Btu in the early start case, compared with 7.1 quadrillion Btu in the 1990-7% case, and coal consumption is reduced to 7.5 quadrillion Btu compared to 15.1 quadrillion Btu. By 2008, the differences between coal and gas consumption in the two cases lessen. The use of renewable energy for electricity generation is higher by 0.2 and 0.6 quadrillion Btu in 2005 and 2008, respectively, in the early start case, and the earlier adoption of renewables tends to encourage their continued penetration. As a result, renewable energy consumption for electricity generation is as much as 1.0 quadrillion Btu higher in 2015 in the early start case.

**Figure 16. Projected U.S. Energy Intensity in the 1990-7% and 1990-7% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD07BLW.D080398B and EARLY07.D052199A.

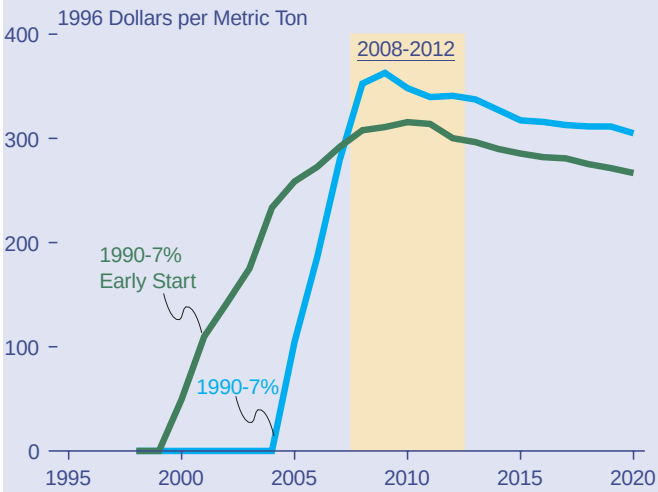
Because of the shift to natural gas for electricity generation, total natural gas consumption is 1.1 quadrillion Btu higher in 2001 in the early start case than in the 1990-7% case. To satisfy demand, domestic natural gas production exceeds 21 quadrillion Btu in 2001 and continues to grow at a rate of nearly 1 quadrillion Btu a year through 2005. Some additional pipeline capacity is required in the early start case, but the pace of capacity expansion is gradual enough to assure that the needed lead times can be met. In 2000, 2001, and 2002, small amounts of additional capacity—0.03, 0.20, and 0.45 trillion cubic feet,

respectively—are added. Pipeline capacity increases are greater after 2002, but the industry has the 2- to 3-year lead time necessary for the expansion. In the early years, the utilization of existing capacity is slightly higher in the early start case than in the 1990-7% case.

In the early years, the increases in natural gas production in the early start case—spread over both onshore and offshore sources—appear achievable, inasmuch as similar increases have occurred in the past. In order to meet the higher production levels, wellhead prices are higher in the early start case by as much as $0.33 per thousand cubic feet in 2005; however, the difference in wellhead prices between the two cases diminishes by 2012, and prices are lower in the early start case through the rest of the forecast horizon, in part because natural gas consumption is lower. The higher production in the early years is achieved without a significant increase in drilling, because sufficient reserves are available. Natural gas reserves are lower through 2006 in the early start case but higher later in the forecast as a result of increased drilling and reserve additions. Although such increases could strain the industry, the early start date may prove to be beneficial to consumers in the longer term. End-use prices for natural gas are higher in the early start case than in the 1990-7% case before 2010 but lower after that.

In the 1990-7% early start case, the carbon price in 2010 is reduced by $32 per metric ton to $316 per metric ton from $348 per metric ton in the 1990-7% case with the 2005 start date (Figure 17). Average carbon prices between 2008 and 2012 in the 1990-7% early start case are $310 per metric ton, compared with $349 in the 2005 start case. From 2000 through 2020, average carbon prices are about $254 per metric ton in the early start case and $231 per metric ton in the 2005 start case, and total carbon reductions of 10,113 million metric tons and 8,758 million metric tons, respectively, are achieved in the two cases.

**Figure 17. Projected Carbon Prices in the 1990-7% and 1990-7% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD07BLW.D080398B and EARLY07.D052199A.

## Carbon Permit Payments and the Aggregate Economy

The implementation of a carbon permit system will have two effects on the aggregate economy. The carbon permit price will increase the price of energy, resulting in an increase in prices for goods and services. Also, the process of auctioning emissions permits will raise large sums of money, and if permits are also purchased from other countries as assumed in the 1990+9% and 1990+24% cases, there will be both domestic and international payment flows. This analysis assumes that the Federal Government will return the domestic portion of the carbon permit payments to households through a lump sum personal income tax rebate.

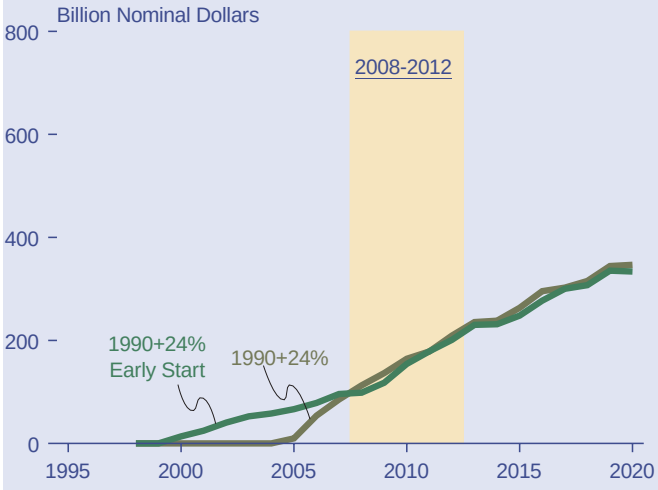
### *Carbon Permit Payments*

An earlier start date will affect the time profile of the permit payments but, in general, will not have a significant impact on the total cumulative payments over the entire forecast horizon (Figures 18, 19, and 20). In all cases, the profile of the payments is similar to the carbon price profile. In the commitment period, 2008 through 2012, and beyond to 2020, the carbon emissions targets are identical in the early start and 2005 start cases; consequently, any differences in payments after 2007 are directly attributable to moderations in the carbon price. In all three carbon reduction cases, the early start date changes the carbon price profiles by moderating both the peak prices and the average carbon prices over the 2008 through 2012 period.

In the 1990+24% early start case, projected payments (in nominal dollars) rise to $67 billion in 2005. By 2010, projected payments rise to $154 billion in the early start case, compared with $164 billion in the case with the 2005 start date. Through 2020, payments in both 1990+24% cases rise steadily, with payments in the early start case slightly below those in the case with the 2005 start date. Total cumulative payments between 2000 and 2020 are similar in the two cases, however, at $3,445 billion in the early start case and $3,292 billion in the 2005 start case—a difference of 4.6 percent. In the early start case, slightly lower payments in the post-2005 period do not offset the additional collections between 2000 and 2005.

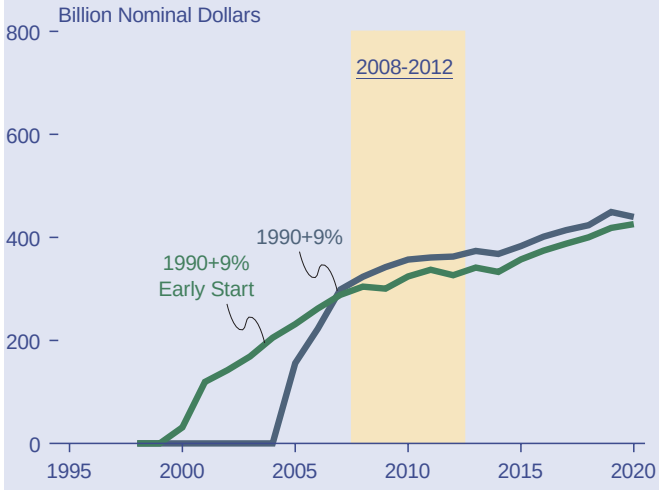
In the 1990+9% cases there are larger differences with an early start date in the commitment period and beyond. Payments in the early start case mirror the carbon price profile, and they are consistently below payments in the case with the 2005 start date in the commitment period and beyond. Cumulative payments in the 1990+9% early start case total $6,080 billion,

**Figure 18. Total Projected U.S. Payments for Domestic and International Carbon Permits in the 1990+24% and 1990+24% Early Start Cases, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Figure 19. Total Projected U.S. Payments for Domestic and International Carbon Permits in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

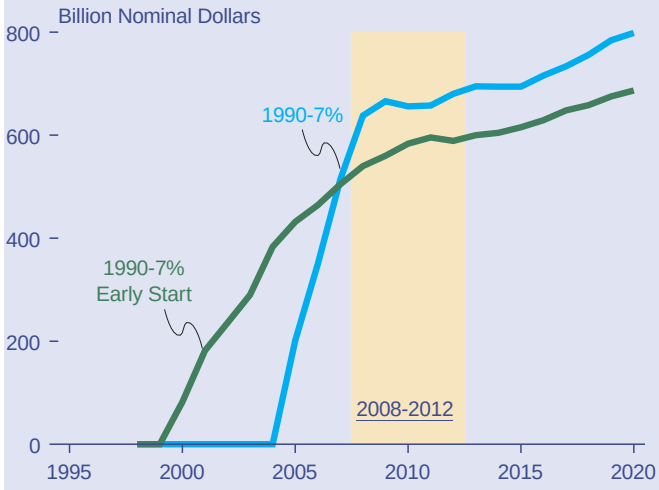
compared with $5,676 billion in the case with the 2005 start date, a difference of 7.1 percent. As was seen in the 1990+24% cases, the lower payments in the post-2005 period in the early start case do not offset the additional payments between 2000 and 2005. In the 1990-7% early start case, projected cumulative payments total $10,558 billion, compared with $10,234 billion in the 1990-7% case with the 2005 start date—a 3.2-percent difference.

### *Impacts on the Aggregate Economy*

In the early start cases, the different carbon price and permit payment profiles change both the timing and the magnitude of the impacts on the aggregate economy for two related reasons. First, the early start cases reflect a slower ramping of both the carbon price and payments relative to the cases with a 2005 start date. Also, in the commitment period of 2008 through 2012 and beyond to 2020, the carbon prices and payments are slightly lower in the early start cases. The 1998 EIA analysis of the Kyoto Protocol focused attention on potential GDP and actual GDP to measure economic impacts. The loss of potential GDP is a measure of the loss in productive capacity of the economy directly attributable to the reduction in energy resources available to the economy. The loss in actual GDP incorporates the adjustment cost to the economy and reflects short-term economic dislocations of capital and labor that may result from higher energy prices. Both are measured in constant 1992 dollars.

In the 1990+9% early case, there is a loss in potential GDP beginning in the year 2000, progressing slowly through 2010 (Figure 21). In the 1990+9% case with the 2005 start date, the movement in potential GDP is more rapid. The difference in time profiles between the two

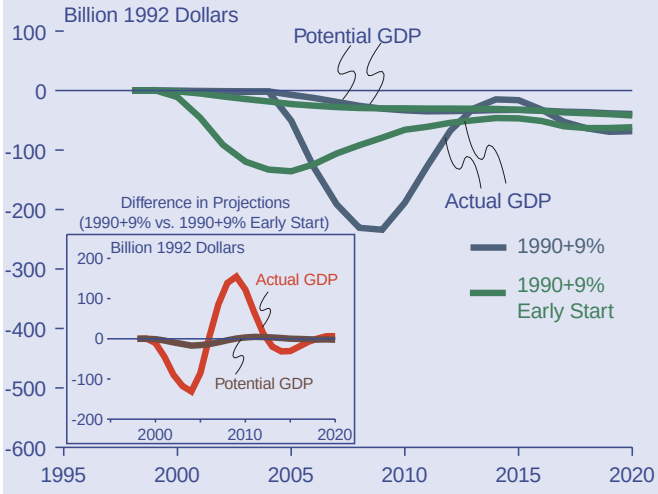
**Figure 20. Total Projected U.S. Payments for Domestic and International Carbon Permits in the 1990-7% and 1990-7% Early Start Cases, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

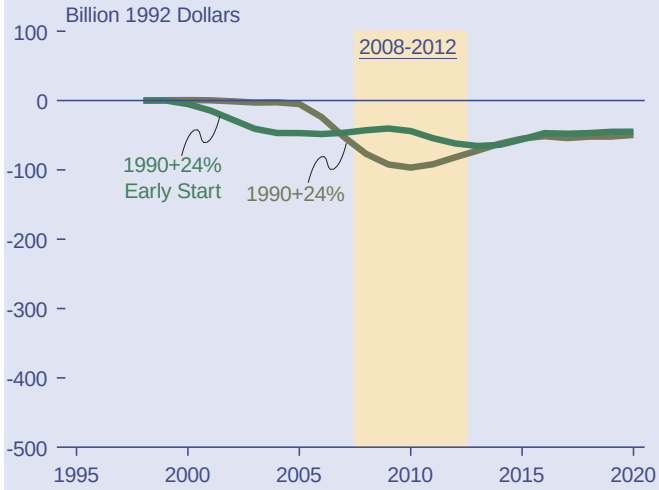
cases is directly attributable to the difference in energy resources available to the economy as the system adjusts to the target level of carbon emissions for the commitment period, 2008 through 2012. Once the carbon emissions target has been reached, however, the two cases merge, and the rates of decline in carbon emissions and energy use are similar. Potential GDP, which is tied to the level of energy availability and use in the economy, then takes on the same path in both the 1990+9% cases. The ultimate impact of the early start on potential GDP is small. By 2010, potential GDP declines by $33 billion in the 2005 start case and by $30 billion in the early start

**Figure 21. Projected Dollar Losses in Potential and Actual U.S. Gross Domestic Product in the 1990+9% and 1990+9% Early Start Cases Relative to the Reference Case, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Figure 22. Projected Dollar Losses in Actual Gross Domestic Product in the 1990+24% and 1990+24% Early Start Cases Relative to the Reference Case, 1998-2020**

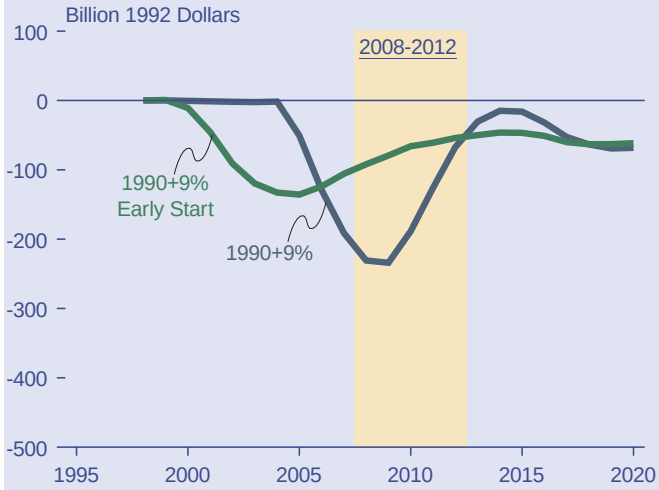



Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

case. By 2020, the loss in potential GDP is $39 billion with the 2005 start date and $42 billion with the 2000 start date. The pattern of results is similar in the 1990+24% and 1990-7% cases (Table 3).

There are also differences between the early start and 2005 start cases in the impacts of the transition on the economy, which are reflected in actual GDP. In the three early start cases, the economy experiences a loss in GDP beginning in 2000; however, the early start date smooths the transition of the economy to the longer run target (Figures 22, 23, and 24). The largest portion of the adjustment loss occurs in roughly the first 5 years after the imposition of the permit system, whether the start date is 2000 or 2005. In general, the loss in actual GDP between 2000 and 2005 in the early start cases is between one-half and nearly three-quarters of the loss between 2005 and 2010 in the cases with the 2005 start date. In the early start cases, actual GDP begins to rebound back toward the reference case level sooner, and the recovery is smoother, than in the cases with a 2005 start. By 2010, the GDP impacts in the 1990+24% early start case are about half those in the case with the 2005 start date. In

**Figure 23. Projected Dollar Losses in Actual Gross Domestic Product in the 1990+9% and 1990+9% Early Start Cases Relative to the Reference Case, 1998-2020**



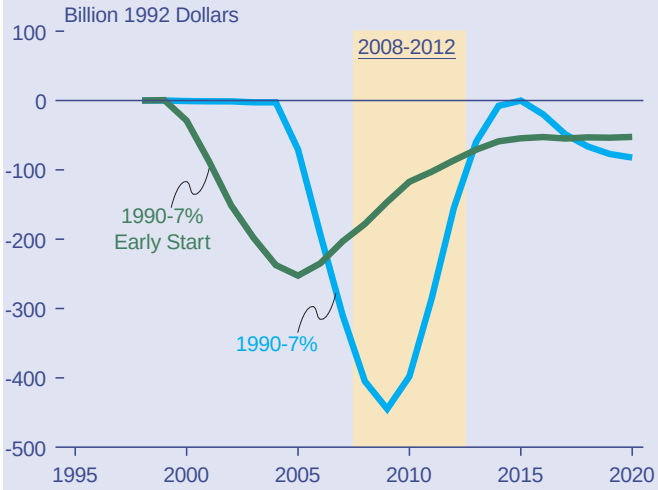

Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Table 3. Projected Impacts on Potential GDP, 2010 and 2020**
(Billion 1992 Dollars)

| Analysis Case | 2010 | | 2020 | |
|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start |
| 1990+24% | 12 | 14 | 26 | 28 |
| 1990+9% | 33 | 30 | 39 | 42 |
| 1990-7% | 72 | 64 | 68 | 68 |

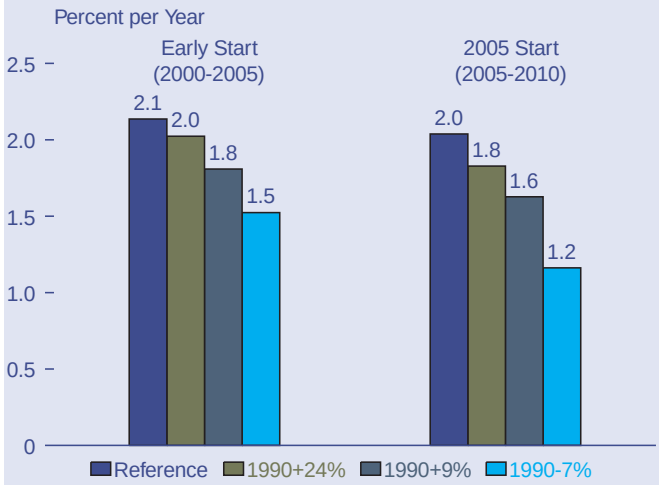
Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Figure 24. Projected Dollar Losses in Actual Gross Domestic Product in the 1990-7% and 1990-7% Early Start Cases Relative to the Reference Case, 1998-2020**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

**Figure 25. Projected Five-Year Average GDP Growth Rates in the Early Start Cases, 2000-2005, and in the Kyoto Protocol Analysis Cases, 2005-2010**




Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

the 1990+9% and 1990-7% cases, the GDP impacts with the early start date are about one-third of those with the 2005 start date. Ultimately, in all cases, the economy transitions into a long-run path and the losses in actual and potential GDP become very close by 2020.

The effects on the economy can be considered from three perspectives: (1) impacts during the first 5 years, (2) impacts measured in 2010 (in the middle of the commitment period) and 2020 (at the end of the forecast period), and (3) the cumulative and net present value of the impacts from 2000 through 2020.

### The First Five Years

In the 1990+24% early start case, the projected loss in actual GDP after 5 years totals $47 billion (constant 1992 dollars). By comparison, in the 1990+24% 2005 start case, the actual GDP loss after 5 years is $97 billion. The difference can also be seen in the growth rate of the economy over the first 5 years (Figure 25). In the 1990+24% 2005 start case, the GDP growth rate between 2005 and 2010 is reduced by 0.2 percentage point relative to the projected growth rate in the reference case. In the early start case, however, the growth rate between 2000 and 2005 is reduced by only 0.1 percentage point relative to the reference case. In the 1990+9% early start case, the loss in actual GDP after 5 years is $136 billion, compared with $189 billion in the 1990+9% 2005 start case. The 5-year average GDP growth rate between 2000 and 2005 is reduced by 0.3 percentage point in the early start case and by 0.4 percentage point in the 2005 start case relative to the reference case. Although the 1990-7% cases have considerably larger impacts on the economy, the same trends are seen in the cases with different start dates. The loss in actual GDP between 2000 and 2005 in the 1990-7% early start case is $253 billion, compared with $398 billion between 2005 and 2010 in the 2005 start case, and the corresponding reductions in GDP growth rate are 0.6 and 0.9 percentage point relative to the reference case.

### Impacts in 2010 and 2020

When the impact is measured in the year 2010, in the middle of the commitment period, the loss in actual GDP for the 1990+24% early start case relative to the reference case is $44 billion, as compared with $97 billion in the 2005 start case (Table 4). Thus, in 2010, the GDP impact in the 1990+24% early start case is 45 percent of the impact in the 2005 start case. For the more stringent carbon reduction cases, the effects of an early start date are even more pronounced: actual GDP losses

**Table 4. Projected Impacts on Actual GDP, 2010 and 2020**
(Billion 1992 Dollars)

| Analysis Case | 2010 | | 2020 | |
|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start |
| 1990+24% | 97 | 44 | 50 | 45 |
| 1990+9% | 189 | 66 | 68 | 62 |
| 1990-7% | 398 | 117 | 82 | 52 |

Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

of $66 billion and $117 billion in 2010 are projected for the 1990+9% and 1990-7% early start cases, respectively, compared with projected losses of $189 billion and $398 billion in 2010 in the corresponding 2005 start cases. The 2010 GDP losses in the two early start cases are therefore only 35 percent and 29 percent of those in the 2005 start cases. Smaller GDP losses are also seen in 2020 for the early start cases, but the differences from the 2005 start cases are not nearly as significant (Table 4).

As indicated above (Figures 22, 23, and 24), the impacts on actual GDP begin to merge with the path of potential GDP by 2020, and the difference between the early start and 2005 start cases narrows. In the 1990+24% cases, the projected loss in actual GDP in the early start case is $45 billion in 2020, compared with $50 billion in the 2005 start case. In the 1990+9% cases, the loss in actual GDP in the early start case is $62 billion, compared with $68 billion in the 2005 start case. In the 1990-7% cases, the projected losses are $52 billion in the early start case and $82 billion in the 2005 start case.

### Cumulative and Net Present Value Impacts

For each of the three carbon reduction targets examined in this analysis, the early start and 2005 start cases project roughly the same undiscounted values for the cumulative impact on GDP from 2000 through 2020 (Table 5). In the 1990+24% early start case, the cumulative loss in actual GDP totals $937 billion, compared with $975 billion in the 1990+24% case. Similarly, the projected cumulative GDP losses in the 1990+9% cases are $1,560 (early start) and $1,573 billion (2005 start), and in the 1990-7% cases the projected cumulative losses are $2,475 billion and $2,631 billion, respectively.

Although the cumulative impacts on GDP are similar for the early start and 2005 start cases, the early start cases do involve a tradeoff. The peak impacts are less severe in the early start cases, but they are felt earlier. A net present value calculation takes into consideration the time value of money. Using a discount rate of 7 percent beginning in 2000, the cumulative discounted impacts are larger in the early start cases. In the 1990+24% early start case, the net present value of the cumulative loss in actual GDP is $439 billion, compared with only $404 billion in the 1990+24% 2005 start case. For the 1990+9% cases the projected net present value losses are $846 billion and $750 billion, and for the 1990-7% cases they are $1,430 billion and $1,285 billion in the early start and 2005 start cases, respectively.

### *Summary*

In summary, four primary effects characterize the impacts of the earlier start date:

- The early start date affects the time profile of the carbon permit payments but, in general, does not have a significant impact on cumulative payments over the entire time period.
- With the early start, the peak impact on the economy is smaller because the carbon price profile is more gradual and the peak carbon price is lower.
- Although the peak impact is smaller with the early start, the economy begins the adjustment 5 years earlier and incurs GDP losses earlier in the forecast.
- The economy rebounds more smoothly over time under the early start assumptions.

## Impacts on the Buildings Sector

### *Early Start Assumptions*

In the reference case, more efficient and advanced technologies for the buildings sector (residential and commercial) become available to consumers over time, reflecting the ongoing development of technology. Because an early start date increases the demand for more energy-efficient equipment, the early start cases assume that more efficient models of current technologies, available in the reference case in 2005, will be available in 2001. Efficiency improvements for existing equipment are assumed to accelerate as manufacturers respond to increased consumer demand for more efficient products.[8]

The 2000 start date for carbon prices causes an additional 5 years of higher energy prices, which encourages consumers to buy more energy-efficient equipment

**Table 5. Projected Cumulative Impacts on Actual GDP, 2000-2020**
(Billion 1992 Dollars)

| Analysis Case | Undiscounted Value | | Net Present Value at 7-Percent Discount Rate | |
|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start |
| 1990+24% | 975 | 937 | 404 | 439 |
| 1990+9% | 1,573 | 1,560 | 750 | 846 |
| 1990-7% | 2,631 | 2,475 | 1,285 | 1,430 |

Source: Simulations of the Data Resources, Inc. (DRI) Macroeconomic Model of the U.S. Economy.

[8]In the electricity generation sector, for example, endogenous technological change is based on more rapid penetration of efficient technologies. In the buildings sectors, technological changes are represented by explicitly increasing the rates of change in the assumed cost and performance of end-use technologies. Other changes are assumed for the industrial and transportation sectors.

when it becomes economical. A 1-year lag in the availability of new, more efficient equipment allows for existing inventories to be cleared and the production of new equipment models to begin. After 2005, the technology characteristics in the early start cases are assumed to be the same as in the reference case.

In all cases, it is assumed that consumers factor current, but not expected future, prices into their purchase decisions. Fuel price increases cause some short-run response in the buildings sector, such as adjusting thermostat levels or turning lights off when not needed. Also, the purchased efficiency of major appliances increases, as fuel costs become a more important factor in consumers' purchasing decisions. However, consumers still consider a number of factors other than energy efficiency in their purchase decisions, including preferences for other equipment attributes. Consumer behavior, as reflected in the value placed on energy efficiency, is assumed to be the same in all the analysis cases.

### *Analysis Results*

In the three early start cases evaluated, delivered energy intensities for both the residential and commercial sectors are lower from 2000 through 2008 than in the corresponding 2005 start cases. In 2004, delivered energy intensity in the buildings sector is 2 percent lower in the 1990+24% early start case, 7 percent lower in the 1990+9% early start case, and 14 percent lower in the 1990-7% early start case than in the corresponding 2005 start cases. Both short-run responses to higher energy prices and purchases of more efficient equipment contribute to the reductions in energy use. Because carbon and energy prices are lower in the early start cases after 2006, building sector energy intensities are virtually identical by 2010 to those projected in the 2005 start cases, given the same carbon emissions reduction targets. After 2010, delivered energy intensity converges for the cases with and without the early start date, except in the 1990-7% case, where continued lower delivered energy prices through 2020 increase energy intensity in the early start case.

Even with earlier carbon reductions and earlier efficiency improvements, significant carbon prices are required after 2005 to reduce carbon emissions in the 2008-2012 period. In the buildings sector, the stock of installed equipment changes over time as old, worn-out equipment is replaced and new buildings are outfitted with new equipment. However, many types of equipment have useful lifetimes ranging from 10 to 20 or more years, limiting the penetration rate of more efficient equipment. In addition, the number of households and the amount of commercial floorspace are projected to grow by 1.1 percent and 1.0 percent per year, respectively, through 2010 in all the cases.

The relatively slow rate of growth in new buildings dampens the growth of energy consumption and carbon emissions; however, it also slows the impact of more efficient equipment on total stock efficiency. For example, the average useful life of commercial natural-gas-fired space heating equipment is at least 20 years (a conservative estimate, inasmuch as the average life of a natural gas boiler is closer to 25 years). Heating systems typically are purchased only for new construction, for major renovations, or when an existing system needs replacement. An earlier start date in the 1990-7% case results in an improvement of 2.4 percent in the 2005 projected average stock efficiency of commercial gas heating equipment relative to the 1990-7% 2005 start case. By 2005, however, about three-fourths of the commercial sector gas heating equipment that was purchased before 2000 is still expected to be in use. As a result, high price signals continue to be required after 2005 to encourage the purchase of more energy-efficient equipment as older equipment is replaced.

An earlier start date for emissions reductions, earlier availability of more energy-efficient appliances, and higher delivered energy prices encourage the more rapid adoption of more efficient technologies for most products through 2004. As the assumed technology menus in the early start and 2005 start cases converge in 2005, the difference in delivered prices between the cases determines the efficiency level of newly purchased equipment. In the residential sector, purchased equipment efficiencies in 2010 are higher in the 2005 start cases than in the early start cases, because delivered energy prices are higher (Table 6). In the commercial sector, the penetration of more efficient equipment in the 2005 start cases approaches that in the early start cases by 2010, although the effects of the pre-2005 purchases in the early start cases are still evident (Table 7).

## Impacts on the Industrial Sector

### *Early Start Assumptions*

In the industrial sector, earlier carbon prices could lead to a more rapid adoption of energy-efficiency improvements as energy conservation investments become more attractive, when compared with competing investment opportunities. With earlier carbon reductions and prices, there is likely to be more rapid retirement of existing capital stock, which typically is less energy efficient than new capital stock. As was assumed for the buildings sector, the more efficient models of new industrial technologies are assumed to be available

**Table 6. Change in Projected Average Efficiencies of Newly Purchased Residential Equipment Relative to the Reference Case, 2004 and 2010**
(Percent)

| Technology | 1990+24% | | 1990+9% | | 1990-7% | |
|---|---|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| | 2004 | | | | | |
| Air-Source Heat Pump | 0.0 | 1.4 | 0.0 | 3.9 | 0.0 | 6.8 |
| Electric Water Heater | 0.0 | 0.9 | 0.0 | 1.8 | 0.0 | 8.8 |
| Natural Gas Water Heater | 0.0 | 3.6 | 0.0 | 5.6 | 0.0 | 7.6 |
| Building Shell | 0.0 | 0.6 | 0.0 | 2.2 | 0.0 | 4.2 |
| | 2010 | | | | | |
| Air-Source Heat Pump | 1.3 | 0.8 | 3.6 | 3.5 | 6.1 | 5.5 |
| Electric Water Heater | 0.3 | 0.1 | 2.4 | 1.9 | 18.8 | 12.9 |
| Natural Gas Water Heater | 1.1 | 0.9 | 3.7 | 3.6 | 5.1 | 5.0 |
| Building Shell | 1.5 | 1.4 | 4.9 | 4.8 | 9.5 | 9.5 |

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

**Table 7. Change in Projected Penetration Levels for Selected Technologies in the Commercial Sector Relative to the Reference Case, 2004 and 2010**
(Percent)

| Technology | 1990+24% | | 1990+9% | | 1990-7% | |
|---|---|---|---|---|---|---|
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| | 2004 | | | | | |
| High-Efficiency Boiler | -1 | 89 | -1 | 175 | -1 | 320 |
| Air-Source Heat Pump | 0 | 1 | 0 | 4 | 0 | 7 |
| High-Efficiency Chiller | 0 | 12 | 0 | 20 | 0 | 33 |
| Heat Pump Water Heater | 1 | 15 | 0 | 57 | 0 | 116 |
| Compact Fluorescent Lights | 0 | 1 | 0 | 5 | 0 | 10 |
| Electronic Ballast Fluorescent Lights with Reflectors or Controls | 0 | 5 | 0 | 20 | 0 | 27 |
| | 2010 | | | | | |
| High-Efficiency Boiler | 19 | 42 | 97 | 131 | 259 | 304 |
| Air-Source Heat Pump | 2 | 3 | 9 | 12 | 11 | 16 |
| High-Efficiency Chiller | 4 | 8 | 18 | 26 | 24 | 38 |
| Heat Pump Water Heater | 29 | 39 | 102 | 134 | 186 | 268 |
| Compact Fluorescent Lights | 6 | 7 | 14 | 15 | 26 | 27 |
| Electronic Ballast Fluorescent Lights with Reflectors or Controls | 14 | 16 | 26 | 33 | 36 | 41 |

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

somewhat earlier as a result of the earlier imposition of carbon prices.[9] After a period of time, however, new equipment efficiencies are similar in the early start and 2005 start cases.

## *Analysis Results*

In each of the three early start carbon reduction cases, the 2000 start date for carbon prices results in lower projected cumulative industrial output from 2000 through 2020 than in the corresponding 2005 start case. The impacts of the early carbon prices on output cannot be overcome by the relatively modest reductions in carbon prices in later years.

There are countervailing forces in the industrial sector. Earlier carbon reductions imposed by means of a carbon price have a negative impact on the overall economy, which leads to reduced domestic industrial output and reduces the incentive to invest in more energy-efficient equipment. As a result, although new equipment installed before 2005 in the early start cases tends to be more energy efficient than in the 2005 start cases, less investment takes place because economic growth is

[9]The energy intensity of each process step declines gradually from the base period intensity to a target energy intensity for the year 2020. However, with rapidly rising energy prices, the 2020 target intensity can be achieved earlier, up to twice as rapidly as in the reference case.

lower. In the commitment period, 2008 to 2012, industrial growth is larger in two of the three early start cases because of the lower carbon prices in that period. Therefore, although the accelerated retirements and the addition of more energy-efficient equipment that occur with an earlier start date help to reduce energy consumption, the reduction is at least partially offset by higher economic growth and industrial output.

As an example, in the 1990-7% early start case, higher equipment retirement rates lead to a 5-percent reduction in the stock of existing equipment in the cement industry by 2008 relative to that in the 1990-7% case. The higher rate of stock turnover, combined with the adoption of more energy-efficient equipment, results in a 3.6-percent decrease in energy intensity in the early start case in 2008. However, the output of the cement industry is 6.4 percent higher in 2008 in the early start case because carbon prices are lower. Consequently, energy consumption in 2008 in the cement industry is 2.5 percent higher in the 1990-7% early start case than in the 1990-7% case with the 2005 start date.

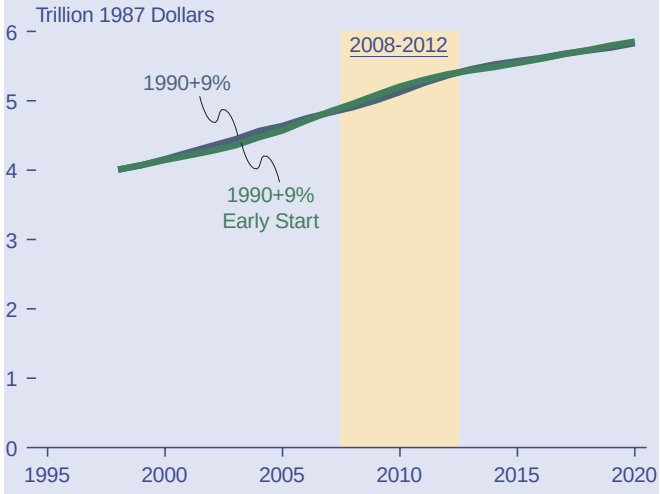
### 1990+24% Carbon Emissions Target

From 2000 through 2005, industrial output is $294 billion lower and energy consumption is 3.5 quadrillion Btu lower in the 1990+24% early start case than in the 1990+24% case. Industrial output and energy consumption from 2008 through 2012 in the early start case do not exceed the levels in the 2005 start case—in contrast to the results for the other carbon reduction cases. As a result, the relative impact on cumulative industrial output from 2000 through 2020 is almost as large for the 1990+24% early start case as for the 1990-7% early start case. Cumulatively, from 2000 through 2020, industrial output is $750 billion lower in the 1990+24% early start case than in the 2005 start case, and energy consumption is 7.4 quadrillion Btu lower. Cumulative expenditures for energy consumption are only $15 billion higher (discounted at 7 percent) in the 1990+24% early start case than in the 1990+24% case.

### 1990+9% Carbon Emissions Target

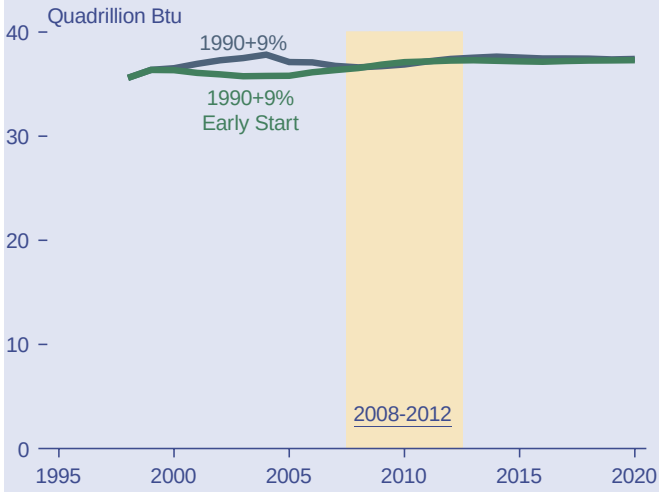
From 2000 through 2005, industrial gross output is $372 billion less in the 1990+9% early start case than in the 1990+9% case, and energy consumption is 7.5 quadrillion Btu lower (Figures 26 and 27). In the early start case, industrial output returns to the output levels projected in the 1990+9% case by the end of the forecast period. Industrial energy consumption in the early start case exceeds that in the 1990+9% case for a few years in the 2008-2012 period, due to the slightly higher industrial gross output in those years. As a result, the cumulative loss in output from 2000 through 2020 is only $160 billion lower than in the 1990+9% case with the 2005 start date. For most years, industrial energy consumption in the early start case falls below that in the 1990+9% case.

**Figure 26. Projections of U.S. Industrial Output in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD09ABV.D080398B and EARLY09.D053199A.

**Figure 27. Projected Energy Consumption in the U.S. Industrial Sector in the 1990+9% and 1990+9% Early Start Cases, 1998-2020**




Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs FD09ABV.D080398B and EARLY09.D053199A.

From 2000 through 2020, cumulative energy consumption is 10.7 quadrillion Btu less than in the 1990+9% case with the 2005 start date, and expenditures for industrial energy consumption are $97 billion higher (discounted at 7 percent).

### 1990-7% Carbon Emissions Target

The results for the 1990-7% cases are similar to those for the 1990+9% cases. From 2000 through 2005, industrial output in the 1990-7% early start case is $685 billion lower, and industrial energy consumption is 12.4 quadrillion Btu lower, than in the 1990-7% case. Although industrial output and energy consumption are higher

in the early start case from 2008 through 2012, they are lower in the later years. As a result, cumulative industrial output from 2000 through 2020 is $825 billion lower and energy consumption is 15.7 quadrillion lower in the early start case than in the 2005 start case, and cumulative expenditures for energy are $183 billion higher (discounted at 7 percent).

## Impacts on the Transportation Sector

### *Early Start Assumptions*

In the early start cases, fuel prices for transportation are higher before 2005 than they are in the corresponding 2005 start cases, resulting in higher fuel efficiency, lower travel, and lower projected fuel consumption. As for the other end-use consumption sectors, it is assumed that the availability of efficiency improvements is accelerated in the early start cases. The time to introduce technologies for improving the efficiency of light-duty vehicles is assumed to be shortened by 20 percent at an additional incremental cost of 10 percent.

### *Analysis Results*

#### 1990-7% Carbon Emissions Target

In the 1990-7% early start case, gasoline consumption is 1.6 quadrillion Btu lower in 2005 than it is in the 1990-7% case, jet fuel consumption is 0.4 quadrillion Btu lower, and distillate fuel consumption is 0.2 quadrillion Btu lower. More efficient light-duty vehicles penetrate more rapidly and earlier in the projection period in response to higher gasoline prices and slightly (0.9 percent) lower income levels, and the efficiency of new cars is almost 4 miles per gallon higher in 2004. Consumers also respond to higher projected fuel prices by purchasing smaller vehicles and fewer light trucks and by reducing the demand for horsepower. Subcompacts capture a larger share of total car sales in 2005 (23 percent in the early start case, 17 percent in the 2005 start case), the average horsepower of new vehicles is almost 22 percent lower in 2004, and the light truck share of total vehicle sales is lower in 2004 (42.9 percent vs. 46.0 percent). With gasoline prices higher and income levels slightly lower in the early start case, consumers travel less. Light-duty vehicle travel is 6.6 percent lower in 2004, leading to further reductions in fuel consumption (Table 8).

**Table 8. Projected Transportation Efficiency and Travel by Mode, 2004 and 2010**

| Travel Mode | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
|---|---|---|---|---|---|---|---|
| | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| | 2004 | | | | | | |
| **Light-Duty Vehicle** | | | | | | | |
| Annual Travel (Billion Vehicle-Miles Traveled) | 2,621 | 2,621 | 2,612 | 2,621 | 2,556 | 2,621 | 2,448 |
| New Car Efficiency (Miles per Gallon) | 29.7 | 29.7 | 30.3 | 29.7 | 31.7 | 29.7 | 33.3 |
| Average Vehicle Stock Efficiency (Miles per Gallon) | 20.3 | 20.3 | 20.4 | 20.3 | 20.6 | 20.3 | 20.8 |
| **Air** | | | | | | | |
| Annual Travel (Billion Seat-Miles) | 1,418 | 1,418 | 1,399 | 1,418 | 1,363 | 1,418 | 1,249 |
| New Aircraft Efficiency (Seat-Miles per Gallon) | 53.8 | 53.8 | 53.8 | 53.8 | 53.8 | 53.8 | 54.9 |
| Average Aircraft Efficiency (Seat-Miles per Gallon) | 53.5 | 53.5 | 53.5 | 53.5 | 53.4 | 53.5 | 53.3 |
| **Freight Truck** | | | | | | | |
| Annual Travel (Billion Vehicles-Miles Traveled) | 207 | 207 | 204 | 207 | 204 | 207 | 200 |
| New Vehicle Efficiency (Miles per Gallon) | 6.4 | 6.4 | 6.4 | 6.4 | 6.4 | 6.4 | 6.5 |
| Average Vehicle Efficiency (Miles per Gallon) | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 |
| | 2010 | | | | | | |
| **Light-Duty Vehicle** | | | | | | | |
| Annual Travel (Billion Vehicle-Miles Traveled) | 2,895 | 2,857 | 2,877 | 2,752 | 2,789 | 2,505 | 2,597 |
| New Car Efficiency (Miles per Gallon) | 30.6 | 32.0 | 32.1 | 33.6 | 33.2 | 36.4 | 35.3 |
| Average Vehicle Stock Efficiency (Miles per Gallon) | 20.5 | 20.7 | 20.9 | 21.2 | 21.5 | 21.7 | 22.4 |
| **Air** | | | | | | | |
| Annual Travel (Billion Seat-Miles) | 1,753 | 1,729 | 1,738 | 1,638 | 1,685 | 1,434 | 1,530 |
| New Aircraft Efficiency (Seat-Miles per Gallon) | 56.0 | 56.6 | 57.6 | 57.4 | 57.9 | 62.2 | 57.8 |
| Average Aircraft Efficiency (Seat-Miles per Gallon) | 55.6 | 55.6 | 55.8 | 55.6 | 55.8 | 55.4 | 55.7 |
| **Freight Truck** | | | | | | | |
| Annual Travel (Billion Vehicles-Miles Traveled) | 232 | 229 | 230 | 226 | 230 | 220 | 227 |
| New Vehicle Efficiency (Miles per Gallon) | 6.5 | 6.5 | 6.5 | 6.6 | 6.6 | 6.4 | 6.5 |
| Average Vehicle Efficiency (Miles per Gallon) | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.2 |

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

Although new car fuel efficiency is significantly improved in the early start case, the average stock efficiency of vehicles is only 0.7 miles per gallon higher in 2005 because of the slow turnover in the vehicle stock. Stock turnover is slower in the early start case, with 6.7 percent fewer vehicle sales. Therefore, most reductions in fuel consumption in the early start case relative to the 2005 start case are the result of reduced travel. In the air and freight modes, most fuel savings also result from reduced travel due to higher jet fuel prices and lower industrial output. Aircraft and freight trucks have very long useful lives and slow turnover rates. In the early start case, lower travel early in the projection period reduces the opportunity for efficiency improvements in these modes. As a result, the average fuel efficiency projected for these modes in the early start case does not improve even with the higher fuel prices through 2005.

By 2010, projected gasoline fuel prices are 9.1 cents per gallon lower in the 1990-7% early start case than in the 1990-7% case, because the carbon prices are lower. Vehicle travel is almost 4 percent higher in 2010, and new car fuel efficiency is approximately 1.1 miles per gallon lower as consumers shift their purchases to more light trucks, larger vehicles, and higher horsepower. As a result, gasoline consumption in 2010 is similar in the two cases. Air travel is 6.7 percent higher and freight travel is 3.2 percent higher in 2010 in the early start case because the carbon price is lower, with a smaller negative impact on the economy. Total transportation energy consumption is almost 0.5 quadrillion Btu higher in 2010 in the early start case.

The gap in fuel consumption between the two 1990-7% cases narrows slightly by 2020, with a relative increase of only 0.3 quadrillion Btu in the early start case. In 2020, gasoline prices are 11.2 cents per gallon lower in the 1990-7% early start case than in the 1990-7% case. New car fuel economy is the same by 2020 in the two cases; however, light-duty vehicle travel is 3.0 percent higher and air travel is 2.3 percent higher in the early start case, primarily because fuel prices are lower.

### 1990+9% Carbon Emissions Target

In the 1990+9% early start case, the projected gasoline prices in 2010 are about 3 cents per gallon lower and transportation fuel consumption is nearly 0.2 quadrillion Btu higher than in the 1990+9% case. Lower gasoline prices and higher disposable income in 2010 result in 1.3 percent higher travel for light-duty vehicles and 0.4 miles per gallon lower fuel efficiency for new cars.

### 1990+24% Carbon Emissions Target

For the 1990+24% cases, transportation energy consumption in 2010 is projected to be the same in the early start and 2005 start cases as a result of the countervailing effects of lower gasoline prices (by 2.1 cents per gallon) and higher income (by 0.7 percent) in the early start case. New car fuel efficiency is only 0.1 miles per gallon higher in the early start case, and the difference is offset by 0.7 percent higher travel.

## Impacts on the Electricity Generation Sector

In the electricity generation sector, the primary impact of an early start date is the acceleration of retirements of carbon-intensive generating capacity, mainly oil- and coal-fired capacity. For example, in the 1990+9% early start case, 11 additional gigawatts of coal-fired capacity and 22 additional gigawatts of other fossil steam capacity, mostly oil-fired, are projected to be retired by 2005, as compared with the 1990+9% case (Table 9). By 2010, even more coal-fired and other fossil steam capacity is retired in the early start case. By 2020, patterns of capacity are similar in the two cases, although slightly less coal-fired capacity is retired, slightly less combustion turbine capacity is added, and there is noticeably more generation from petroleum and less from natural gas in the early start case than in the 2005 start case.

In both of the 1990-7% cases, there are more early retirements than in the less stringent carbon reduction cases. Further, in the early start case, retirements of coal-fired capacity between 2000 and 2010 are nearly triple those in the 2005 start case. There is little additional impact on other fossil steam units in the early start case. After 2010, because of the earlier retirements of coal-fired generating units, there is less opportunity for reducing carbon emissions through retirements of coal-fired units.

To meet electricity demands, additional low-carbon or noncarbon capacity must be built to replace coal-fired capacity. In the 1990+9% cases, the requirements are met primarily with natural-gas-fired combined-cycle capacity. By 2010, an additional 13 gigawatts of combined-cycle capacity are added in the 1990+9% early start case compared with the 2005 start case.

In the 1990-7% cases, the projected differences in coal- and natural-gas-fired capacity are larger, and additional renewable capacity is also built. In the 1990-7% early start case, 26 more gigawatts of combined-cycle capacity and 23 more gigawatts of renewable capacity are built by 2010 than in the 2005 start case. After 2010, however, the differences are reduced or eliminated. By 2020, combined-cycle capacity is slightly lower in the early start case and renewable capacity is 21 gigawatts higher, as the result of two related effects. First, in the early start case, capital costs for new capacity for units beyond a certain threshold (generally 20 percent of the previous year's installed capacity) are reduced, because it is assumed that equipment manufacturers will be able to increase their output at a lower cost in light of earlier and more gradual growth in demand for new capacity. As a result, capital costs are lower in the later years because of

## Table 9. Projected Generator Retirements, Capacity Additions, and Generation Efficiency, 2005 and 2010

| Projection | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
|---|---|---|---|---|---|---|---|
| | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| | | | | 2005 | | | |
| **Cumulative Retirements (Thousand Megawatts)** | | | | | | | |
| Coal Steam | 0.1 | 0.3 | 0.7 | 0.3 | 11.5 | 0.5 | 14.8 |
| Other Fossil Steam | 7.3 | 9.4 | 15.0 | 10.1 | 31.7 | 11.1 | 15.6 |
| Combined Cycle | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combustion Turbine/Diesel | 1.6 | 1.1 | 0.9 | 1.5 | 1.5 | 1.3 | 1.2 |
| Nuclear | 5.7 | 2.0 | 2.0 | 2.0 | 1.2 | 0.0 | 0.0 |
| Renewable/Other | 0.0 | 0.0 | 0.7 | 0.0 | 0.3 | 0.0 | 0.0 |
| **Total** | **14.8** | **12.9** | **19.3** | **13.9** | **46.2** | **12.9** | **31.7** |
| **Cumulative Capacity Additions (Thousand Megawatts)** | | | | | | | |
| Coal Steam[a] | 6.0 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| Other Fossil Steam | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Combined Cycle | 36.9 | 47.8 | 47.6 | 60.9 | 81.0 | 64.7 | 111.5 |
| Combustion Turbine/Diesel | 73.6 | 64.8 | 56.7 | 48.5 | 35.1 | 45.6 | 28.4 |
| Nuclear | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Renewable/Other | 5.6 | 5.8 | 5.8 | 7.6 | 8.2 | 11.5 | 21.1 |
| **Total** | **123.4** | **122.5** | **114.3** | **121.2** | **128.5** | **126.0** | **165.2** |
| **Efficiency (Thousand Btu per Kilowatthour)[b]** | **9.21** | **9.14** | **9.07** | **8.88** | **8.65** | **8.75** | **8.16** |
| | | | | 2010 | | | |
| **Cumulative Retirements (Thousand Megawatts)** | | | | | | | |
| Coal Steam | 0.4 | 2.5 | 6.1 | 26.6 | 47.8 | 43.5 | 138.0 |
| Other Fossil Steam | 12.3 | 31.2 | 31.4 | 42.8 | 53.9 | 27.5 | 24.8 |
| Combined Cycle | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combustion Turbine/Diesel | 2.9 | 2.7 | 2.2 | 2.7 | 2.2 | 2.6 | 1.6 |
| Nuclear | 19.4 | 12.9 | 12.9 | 7.3 | 6.9 | 0.8 | 2.0 |
| Renewable/Other | 0.4 | 0.8 | 0.8 | 0.4 | 0.4 | 0.1 | 0.1 |
| **Total** | **35.5** | **50.1** | **53.3** | **79.9** | **111.3** | **74.5** | **166.5** |
| **Cumulative Capacity Additions (Thousand Megawatts)** | | | | | | | |
| Coal Steam[a] | 8.7 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| Other Fossil Steam | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Combined Cycle | 76.3 | 103.3 | 106.7 | 172.9 | 185.7 | 177.5 | 203.3 |
| Combustion Turbine/Diesel | 103.1 | 72.6 | 68.6 | 50.8 | 37.4 | 48.6 | 34.3 |
| Nuclear | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Renewable/Other | 6.4 | 8.4 | 8.1 | 14.7 | 15.6 | 29.5 | 52.5 |
| **Total** | **195.8** | **188.4** | **187.7** | **242.7** | **242.9** | **259.8** | **294.3** |
| **Efficiency (Thousand Btu per Kilowatthour)[b]** | **8.98** | **8.64** | **8.63** | **7.92** | **7.87** | **7.57** | **7.30** |

[a]The coal capacity additions are planned units brought on line by 2000.
[b]Fuel inputs include coal, natural gas, petroleum, biomass, and municipal solid waste, excluding cogeneration.
Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

earlier market penetration, primarily for wind and biomass technologies. The impact of increased wind capacity is relatively small, however, because of the low capacity utilization rates for wind power stations.

The early start date has little impact in the 1990+24% case. Although 4 additional gigawatts of coal-fired capacity are retired by 2010 in the early start case, generation from coal remains similar to that in the 1990+24% case. By 2020, the primary impact is slightly lower renewable capacity in the early start case, because about 5 gigawatts of other fossil steam units remain in service, due to the slightly lower carbon price later in the projection period. Generation and capacity patterns are similar throughout the entire period in the two 1990+24% cases.

Measured in terms of fuel input[10] per kilowatthour of electrical output, electricity generation is more efficient in the early start cases between 2005 and 2010 than it is in the 2005 start cases. For example, efficiency is 7 percent

[10] Fuel inputs include coal, natural gas, petroleum, biomass, and municipal solid waste, excluding cogeneration.

higher in 2005 in the 1990-7% early start case than in the 1990-7% case, primarily because coal-fired generation is lower and natural-gas-fired generation is higher in the early start case to meet the earlier carbon reduction target. By 2020, however, the differences in generation efficiency are essentially eliminated.

Accelerated retirements of coal-fired and other fossil steam units in the early start cases are primarily the result of the higher carbon prices projected in the early years. Retirement decisions are based on expected operating costs, which are made up mainly of fuel costs. In the early start cases, coal prices are as much as $4 per million Btu higher in 2005 due to the higher carbon price, resulting in early retirements of coal-fired capacity. After 2010, in order to meet electricity demands and carbon reductions that are approximately the same in the early start and 2005 start cases, similar capacity additions and generation are required. As a result, patterns are virtually unchanged in the early start cases. An exception is the noticeable decrease in nuclear and natural-gas-fired generation in the 1990-7% early start case relative to the 1990-7% case, which is offset by increased renewable generation in 2020 in the early start case.

## Conclusion

For the three carbon reduction targets examined in this analysis, an earlier start date for emissions reductions has the immediate impact of improving energy efficiency and/or causing a shift in fuel use before 2005, which allows for lower carbon prices during the commitment period of 2008 through 2012. Many advanced or renewable technologies are not available until later in the projection period or are still not cost-effective even with the imposition of carbon prices before 2005. Also, from 2008 on, the same carbon emissions targets are required in each set of early start and 2005 start cases. As a result, the differences in energy consumption and fuel between the cases with the different start dates generally are not significant during the commitment period and beyond, with the exception of the increased use of renewable sources, primarily for electricity generation, in the 1990-7% early start case compared with the 1990-7% case with the 2005 start date.

In the 1990+24% and 1990+9% cases, the early start date reduces the respective carbon prices by $5 and $14 per metric ton (7 and 9 percent) in 2010; however, the impact on the carbon price narrows to only 3 percent in both sets of cases in 2020. In the 1990-7% early start case, the carbon price is reduced by $32 per metric ton (9 percent) in 2010 from that in the 1990-7% case, but a more significant impact continues through 2020, when the carbon price in the early start case is $38 per metric ton (12 percent) lower than in the 2005 start date, largely due to increased use of renewable sources for electricity generation.

The imposition of carbon prices through a carbon permit system has two effects on the aggregate economy. The carbon price raises the price of energy, resulting in an increase in prices for goods and services in the aggregate economy. Also, auctioning emissions permits and buying permits on the international market results in large expenditures of money. The early start cases affect both the magnitude and time profile of each of these two factors.

In the early start cases, the carbon prices and payments increase more gradually than in the 2005 start case. Also, in the commitment period of 2008 through 2012, and beyond to 2020, the carbon prices and annual permit payments are slightly lower in the early start cases. The different carbon price and permit payment profiles in the early start cases change the impacts on the aggregate economy. The peak estimated impact on the economy is reduced substantially in the early start cases, because the carbon price profile is more gradual and the peak carbon price is lower than in the respective cases with 2005 start dates. The economy also rebounds more smoothly over time in the early start cases. Although the peak impact on the economy is much smaller, the adjustment period starts 5 years earlier, and the economy incurs GDP losses earlier in the forecast period.

## Appendix A

# Results for the Carbon Reduction Cases

## Table A1. Total Energy Supply and Disposition Summary

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Supply, Disposition, and Prices | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Production** | | | | | | | | |
| Crude Oil and Lease Condensate | 13.71 | 12.74 | 12.72 | 12.65 | 12.71 | 12.59 | 12.70 | 12.50 |
| Natural Gas Plant Liquids | 2.46 | 2.53 | 2.56 | 2.50 | 2.59 | 2.64 | 2.62 | 2.83 |
| Dry Natural Gas | 19.55 | 22.03 | 22.24 | 21.74 | 22.53 | 22.89 | 22.72 | 24.43 |
| Coal | 22.64 | 25.83 | 24.73 | 23.55 | 21.02 | 17.99 | 18.65 | 11.04 |
| Nuclear Power | 7.20 | 6.95 | 7.29 | 7.29 | 7.30 | 7.36 | 7.45 | 7.45 |
| Renewable Energy[1] | 6.83 | 6.99 | 7.10 | 7.08 | 7.18 | 7.18 | 7.44 | 7.68 |
| Other[2] | 1.33 | 0.58 | 0.58 | 0.52 | 0.52 | 0.52 | 0.51 | 0.52 |
| **Total** | **73.73** | **77.65** | **77.22** | **75.33** | **73.84** | **71.17** | **72.10** | **66.46** |
| **Imports** | | | | | | | | |
| Crude Oil[3] | 16.30 | 21.51 | 21.49 | 21.48 | 21.33 | 20.85 | 21.13 | 20.16 |
| Petroleum Products[4] | 3.98 | 5.79 | 5.78 | 5.41 | 5.23 | 4.63 | 5.08 | 3.03 |
| Natural Gas | 2.93 | 4.87 | 4.88 | 4.80 | 4.93 | 5.04 | 5.32 | 5.65 |
| Other Imports[5] | 0.57 | 1.04 | 0.52 | 0.53 | 0.52 | 0.55 | 0.47 | 0.50 |
| **Total** | **23.78** | **33.21** | **32.67** | **32.22** | **32.00** | **31.07** | **32.00** | **29.35** |
| **Exports** | | | | | | | | |
| Petroleum[6] | 2.04 | 1.99 | 2.02 | 1.99 | 1.88 | 1.94 | 1.90 | 1.66 |
| Natural Gas | 0.16 | 0.28 | 0.15 | 0.15 | 0.15 | 0.15 | 0.14 | 0.14 |
| Coal | 2.37 | 2.64 | 2.27 | 2.27 | 2.27 | 2.27 | 2.11 | 2.11 |
| **Total** | **4.57** | **4.91** | **4.44** | **4.41** | **4.30** | **4.36** | **4.14** | **3.91** |
| **Discrepancy[7]** | **0.82** | **-0.13** | **-0.13** | **-0.09** | **0.07** | **-0.13** | **0.26** | **-0.09** |
| **Consumption** | | | | | | | | |
| Petroleum Products[8] | 36.01 | 41.09 | 41.01 | 40.47 | 40.36 | 39.15 | 39.97 | 37.28 |
| Natural Gas | 22.43 | 26.51 | 26.85 | 26.29 | 27.18 | 27.66 | 27.74 | 29.81 |
| Coal | 20.90 | 23.50 | 22.75 | 21.61 | 19.28 | 16.09 | 17.29 | 9.27 |
| Nuclear Power | 7.20 | 6.95 | 7.29 | 7.29 | 7.30 | 7.36 | 7.45 | 7.45 |
| Renewable Energy[1] | 6.84 | 7.01 | 7.12 | 7.09 | 7.20 | 7.19 | 7.45 | 7.70 |
| Other[9] | 0.39 | 0.77 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Total** | **93.77** | **105.82** | **105.32** | **103.06** | **101.61** | **97.75** | **100.22** | **91.80** |
| **Net Imports - Petroleum** | **18.25** | **25.31** | **25.25** | **24.91** | **24.68** | **23.55** | **24.32** | **21.53** |
| **Prices (1996 dollars per unit)** | | | | | | | | |
| World Oil Price (dollars per barrel)[10] | 20.48 | 20.26 | 20.12 | 19.71 | 19.96 | 19.32 | 19.89 | 18.72 |
| Gas Wellhead Price (dollars per Mcf)[11] | 2.24 | 2.20 | 2.18 | 2.15 | 2.21 | 2.26 | 2.24 | 2.57 |
| Coal Minemouth Price (dollars per ton) | 18.50 | 15.03 | 15.39 | 15.42 | 16.10 | 16.51 | 16.36 | 18.20 |
| Average Electric Price (cents per kwh) | 6.8 | 6.0 | 6.1 | 6.6 | 7.4 | 8.2 | 7.9 | 10.3 |

## Table A1. Total Energy Supply and Disposition Summary (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 12.40 | 12.32 | 12.15 | 12.14 | 11.93 | 12.00 | 11.64 | 10.96 | 10.59 | 10.43 | 10.44 | 10.33 | 10.02 | 9.73 |
| 2.82 | 2.88 | 2.85 | 3.11 | 3.11 | 3.11 | 2.74 | 3.24 | 3.41 | 3.39 | 3.57 | 3.52 | 3.37 | 3.30 |
| 24.33 | 24.79 | 24.58 | 26.67 | 26.67 | 26.50 | 26.41 | 27.66 | 29.05 | 28.88 | 30.27 | 29.93 | 28.52 | 27.96 |
| 26.75 | 21.71 | 21.87 | 13.69 | 13.69 | 7.21 | 6.85 | 28.15 | 17.30 | 17.52 | 9.08 | 9.04 | 3.51 | 3.54 |
| 6.17 | 6.68 | 6.68 | 6.98 | 7.11 | 7.41 | 7.36 | 3.80 | 5.06 | 4.99 | 5.90 | 5.92 | 7.41 | 7.16 |
| 7.25 | 7.42 | 7.42 | 7.70 | 7.73 | 8.41 | 9.33 | 7.56 | 8.26 | 8.14 | 9.73 | 9.67 | 12.89 | 13.63 |
| 0.57 | 0.53 | 0.53 | 0.56 | 0.56 | 0.75 | 0.73 | 0.64 | 0.63 | 0.63 | 0.66 | 0.60 | 0.87 | 0.84 |
| **80.29** | **76.32** | **76.08** | **70.85** | **70.79** | **65.39** | **65.06** | **82.01** | **74.30** | **73.98** | **69.65** | **69.01** | **66.59** | **66.16** |
| 22.09 | 22.08 | 22.20 | 21.94 | 21.73 | 20.31 | 21.45 | 24.73 | 24.47 | 24.70 | 24.67 | 24.80 | 24.13 | 24.03 |
| 7.77 | 7.07 | 7.07 | 5.34 | 5.98 | 3.54 | 3.68 | 9.26 | 8.14 | 7.92 | 7.42 | 7.66 | 4.96 | 5.90 |
| 5.12 | 5.12 | 5.11 | 5.49 | 5.56 | 5.94 | 5.92 | 5.50 | 5.80 | 5.77 | 6.10 | 6.07 | 6.37 | 6.30 |
| 1.05 | 0.43 | 0.44 | 0.44 | 0.47 | 0.34 | 0.39 | 1.08 | 0.47 | 0.47 | 0.49 | 0.50 | 0.41 | 0.42 |
| **36.03** | **34.70** | **34.82** | **33.21** | **33.75** | **30.13** | **31.44** | **40.57** | **38.87** | **38.86** | **38.67** | **39.02** | **35.87** | **36.65** |
| 1.75 | 1.90 | 1.82 | 1.87 | 1.80 | 1.68 | 1.71 | 1.69 | 1.67 | 1.63 | 1.67 | 1.70 | 1.52 | 1.53 |
| 0.29 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.32 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| 2.88 | 2.28 | 2.28 | 2.28 | 2.28 | 1.95 | 1.95 | 3.29 | 2.37 | 2.37 | 2.37 | 2.37 | 1.92 | 1.92 |
| **4.93** | **4.32** | **4.24** | **4.29** | **4.22** | **3.77** | **3.79** | **5.30** | **4.18** | **4.14** | **4.18** | **4.21** | **3.58** | **3.59** |
| **-0.21** | **-0.22** | **-0.22** | **-0.20** | **-0.27** | **-0.08** | **0.31** | **-0.26** | **-0.34** | **-0.31** | **-0.34** | **-0.27** | **-0.12** | **-0.28** |
| 43.82 | 42.83 | 42.82 | 41.12 | 41.37 | 38.06 | 38.88 | 46.88 | 45.25 | 45.12 | 44.78 | 44.84 | 41.67 | 41.98 |
| 28.97 | 29.57 | 29.36 | 31.82 | 31.89 | 32.09 | 31.99 | 32.65 | 34.50 | 34.31 | 36.02 | 35.64 | 34.54 | 33.92 |
| 24.14 | 19.70 | 19.87 | 11.68 | 11.68 | 5.44 | 5.21 | 25.27 | 15.28 | 15.53 | 7.06 | 7.19 | 1.98 | 1.98 |
| 6.17 | 6.68 | 6.68 | 6.98 | 7.11 | 7.41 | 7.36 | 3.80 | 5.06 | 4.99 | 5.90 | 5.92 | 7.41 | 7.16 |
| 7.27 | 7.44 | 7.44 | 7.72 | 7.75 | 8.44 | 9.35 | 7.59 | 8.29 | 8.18 | 9.77 | 9.71 | 12.92 | 13.67 |
| 0.80 | 0.25 | 0.25 | 0.25 | 0.25 | 0.23 | 0.24 | 0.83 | 0.26 | 0.26 | 0.26 | 0.25 | 0.24 | 0.25 |
| **111.18** | **106.48** | **106.43** | **99.57** | **100.05** | **91.67** | **93.02** | **117.02** | **108.64** | **108.39** | **103.79** | **103.56** | **98.76** | **98.95** |
| **28.11** | **27.26** | **27.44** | **25.41** | **25.91** | **22.17** | **23.42** | **32.31** | **30.94** | **30.98** | **30.42** | **30.76** | **27.57** | **28.40** |
| 20.77 | 19.99 | 19.60 | 18.72 | 18.49 | 17.54 | 16.85 | 21.69 | 20.14 | 19.65 | 19.73 | 19.40 | 18.38 | 17.71 |
| 2.33 | 2.38 | 2.35 | 2.78 | 2.79 | 3.03 | 3.14 | 2.62 | 3.02 | 3.03 | 3.71 | 3.61 | 3.53 | 3.35 |
| 14.29 | 14.72 | 14.34 | 16.42 | 16.18 | 18.29 | 18.68 | 12.53 | 14.29 | 13.95 | 16.24 | 16.15 | 20.50 | 20.33 |
| 5.9 | 7.1 | 7.0 | 8.8 | 8.5 | 11.0 | 10.4 | 5.6 | 7.3 | 7.3 | 8.1 | 8.0 | 9.3 | 8.9 |

[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. See Table A18 for selected nonmarketed residential and commercial 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, imports of 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, and net storage withdrawals.

[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.

Mcf = Thousand cubic feet.

Kwh = Kilowatthour.

Note: Totals may not equal sum of components due to independent rounding. Figures may differ from published data due to internal conversion factors.

**Sources:** 1996 natural gas values: Energy Information Administration (EIA), *Natural Gas Monthly*, DOE/EIA-0130(97/06) (Washington, DC, June 1997). 1996 coal minemouth price: *Coal Industry Annual 1996* DOE/EIA-0584(96) (Washington, DC, November 1997). Coal production and exports derived from: EIA, *Monthly Energy Review*, DOE/EIA-0035(97/08) (Washington, DC, August 1997). Other 1996 values: EIA, *Annual Energy Review 1996*, DOE/EIA-0384(96) (Washington, DC, July 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A2. Energy Consumption by Sector and Source

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Sector and Source | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Energy Consumption** | | | | | | | | |
| **Residential** | | | | | | | | |
| Distillate Fuel | 0.89 | 0.77 | 0.77 | 0.75 | 0.74 | 0.71 | 0.73 | 0.65 |
| Kerosene | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 |
| Liquefied Petroleum Gas | 0.42 | 0.44 | 0.43 | 0.45 | 0.43 | 0.43 | 0.42 | 0.41 |
| Petroleum Subtotal | 1.40 | 1.28 | 1.28 | 1.27 | 1.23 | 1.20 | 1.22 | 1.13 |
| Natural Gas | 5.39 | 5.53 | 5.52 | 5.40 | 5.25 | 5.05 | 5.16 | 4.65 |
| Coal | 0.05 | 0.06 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 |
| Renewable Energy[1] | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.62 |
| Electricity | 3.68 | 4.34 | 4.32 | 4.21 | 4.13 | 4.00 | 4.07 | 3.78 |
| **Delivered Energy** | **11.13** | **11.81** | **11.77** | **11.53** | **11.26** | **10.91** | **11.10** | **10.20** |
| Electricity Related Losses | 8.21 | 9.12 | 8.98 | 8.69 | 8.33 | 7.84 | 8.15 | 7.08 |
| **Total** | **19.34** | **20.92** | **20.75** | **20.22** | **19.59** | **18.75** | **19.25** | **17.28** |
| **Commercial** | | | | | | | | |
| Distillate Fuel | 0.44 | 0.39 | 0.39 | 0.38 | 0.36 | 0.35 | 0.35 | 0.30 |
| Residual Fuel | 0.15 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 |
| Kerosene | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Liquefied Petroleum Gas | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Motor Gasoline[2] | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Petroleum Subtotal | 0.71 | 0.64 | 0.64 | 0.63 | 0.61 | 0.60 | 0.60 | 0.54 |
| Natural Gas | 3.30 | 3.63 | 3.62 | 3.55 | 3.42 | 3.27 | 3.34 | 2.83 |
| Coal | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.07 |
| Renewable Energy[3] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity | 3.37 | 3.91 | 3.90 | 3.81 | 3.70 | 3.56 | 3.63 | 3.24 |
| **Delivered Energy** | **7.47** | **8.28** | **8.26** | **8.09** | **7.82** | **7.52** | **7.66** | **6.70** |
| Electricity Related Losses | 7.52 | 8.23 | 8.11 | 7.87 | 7.46 | 6.97 | 7.27 | 6.08 |
| **Total** | **14.98** | **16.51** | **16.37** | **15.96** | **15.29** | **14.49** | **14.93** | **12.77** |
| **Industrial[4]** | | | | | | | | |
| Distillate Fuel | 1.17 | 1.33 | 1.33 | 1.31 | 1.33 | 1.31 | 1.33 | 1.33 |
| Liquefied Petroleum Gas | 2.12 | 2.28 | 2.28 | 2.23 | 2.25 | 2.22 | 2.24 | 2.22 |
| Petrochemical Feedstock | 1.28 | 1.39 | 1.39 | 1.35 | 1.36 | 1.34 | 1.35 | 1.31 |
| Residual Fuel | 0.34 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.34 | 0.31 |
| Motor Gasoline[2] | 0.19 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| Other Petroleum[5] | 4.12 | 4.56 | 4.55 | 4.50 | 4.44 | 4.32 | 4.35 | 4.08 |
| Petroleum Subtotal | 9.23 | 10.14 | 10.12 | 9.95 | 9.95 | 9.73 | 9.83 | 9.46 |
| Natural Gas[6] | 9.96 | 10.97 | 10.97 | 10.76 | 11.11 | 10.96 | 11.14 | 11.03 |
| Metallurgical Coal | 0.85 | 0.76 | 0.76 | 0.74 | 0.75 | 0.68 | 0.74 | 0.65 |
| Steam Coal | 1.55 | 1.69 | 1.67 | 1.51 | 1.24 | 1.07 | 1.15 | 0.86 |
| Net Coal Coke Imports | 0.00 | 0.16 | 0.16 | 0.16 | 0.15 | 0.18 | 0.14 | 0.18 |
| Coal Subtotal | 2.40 | 2.60 | 2.58 | 2.41 | 2.13 | 1.93 | 2.04 | 1.69 |
| Renewable Energy[7] | 1.82 | 2.11 | 2.11 | 2.09 | 2.10 | 2.10 | 2.09 | 2.08 |
| Electricity | 3.46 | 4.05 | 4.03 | 3.93 | 3.92 | 3.75 | 3.85 | 3.58 |
| **Delivered Energy** | **26.87** | **29.87** | **29.82** | **29.14** | **29.21** | **28.46** | **28.95** | **27.83** |
| Electricity Related Losses | 7.72 | 8.52 | 8.39 | 8.12 | 7.91 | 7.34 | 7.71 | 6.71 |
| **Total** | **34.59** | **38.39** | **38.22** | **37.26** | **37.12** | **35.80** | **36.66** | **34.54** |

**Table A2. Energy Consumption by Sector and Source (Continued)**
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 0.73 | 0.70 | 0.69 | 0.65 | 0.65 | 0.59 | 0.59 | 0.66 | 0.61 | 0.61 | 0.59 | 0.59 | 0.53 | 0.54 |
| 0.07 | 0.07 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.06 |
| 0.45 | 0.44 | 0.46 | 0.43 | 0.45 | 0.41 | 0.42 | 0.47 | 0.46 | 0.48 | 0.46 | 0.48 | 0.42 | 0.44 |
| 1.25 | 1.21 | 1.22 | 1.15 | 1.16 | 1.05 | 1.07 | 1.20 | 1.13 | 1.15 | 1.11 | 1.13 | 1.01 | 1.04 |
| 5.71 | 5.43 | 5.45 | 5.00 | 5.02 | 4.51 | 4.53 | 5.98 | 5.45 | 5.47 | 5.10 | 5.11 | 4.68 | 4.79 |
| 0.05 | 0.04 | 0.05 | 0.04 | 0.04 | 0.03 | 0.03 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 |
| 0.61 | 0.61 | 0.61 | 0.62 | 0.62 | 0.63 | 0.64 | 0.62 | 0.63 | 0.63 | 0.64 | 0.64 | 0.67 | 0.68 |
| 4.62 | 4.42 | 4.43 | 4.19 | 4.21 | 3.93 | 3.97 | 5.30 | 4.97 | 4.95 | 4.82 | 4.83 | 4.65 | 4.69 |
| **12.24** | **11.72** | **11.75** | **11.00** | **11.05** | **10.15** | **10.24** | **13.14** | **12.22** | **12.24** | **11.71** | **11.75** | **11.04** | **11.23** |
| 9.30 | 8.49 | 8.49 | 7.27 | 7.24 | 6.72 | 6.69 | 9.81 | 8.19 | 8.21 | 7.28 | 7.30 | 7.25 | 7.39 |
| **21.55** | **20.20** | **20.23** | **18.27** | **18.29** | **16.86** | **16.93** | **22.95** | **20.41** | **20.45** | **18.99** | **19.04** | **18.29** | **18.61** |
| 0.38 | 0.36 | 0.36 | 0.33 | 0.33 | 0.26 | 0.28 | 0.36 | 0.33 | 0.33 | 0.31 | 0.32 | 0.26 | 0.28 |
| 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 | 0.11 |
| 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 0.64 | 0.61 | 0.61 | 0.58 | 0.58 | 0.51 | 0.52 | 0.62 | 0.58 | 0.59 | 0.57 | 0.57 | 0.51 | 0.53 |
| 3.79 | 3.59 | 3.61 | 3.22 | 3.24 | 2.65 | 2.71 | 3.93 | 3.55 | 3.56 | 3.27 | 3.29 | 2.84 | 2.97 |
| 0.10 | 0.09 | 0.09 | 0.08 | 0.08 | 0.06 | 0.07 | 0.10 | 0.09 | 0.09 | 0.08 | 0.08 | 0.06 | 0.07 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4.17 | 3.96 | 3.98 | 3.68 | 3.71 | 3.30 | 3.37 | 4.53 | 4.19 | 4.19 | 4.02 | 4.03 | 3.77 | 3.84 |
| **8.69** | **8.26** | **8.30** | **7.56** | **7.62** | **6.52** | **6.67** | **9.18** | **8.41** | **8.42** | **7.94** | **7.98** | **7.18** | **7.42** |
| 8.39 | 7.60 | 7.63 | 6.38 | 6.38 | 5.64 | 5.67 | 8.39 | 6.90 | 6.95 | 6.06 | 6.10 | 5.88 | 6.05 |
| **17.08** | **15.86** | **15.93** | **13.94** | **14.00** | **12.16** | **12.34** | **17.57** | **15.31** | **15.37** | **14.00** | **14.08** | **13.06** | **13.47** |
| 1.42 | 1.41 | 1.41 | 1.43 | 1.44 | 1.44 | 1.47 | 1.52 | 1.52 | 1.53 | 1.55 | 1.55 | 1.58 | 1.55 |
| 2.44 | 2.40 | 2.38 | 2.38 | 2.41 | 2.37 | 2.43 | 2.52 | 2.47 | 2.44 | 2.46 | 2.47 | 2.47 | 2.52 |
| 1.48 | 1.45 | 1.43 | 1.41 | 1.43 | 1.35 | 1.38 | 1.52 | 1.46 | 1.44 | 1.44 | 1.44 | 1.41 | 1.37 |
| 0.35 | 0.35 | 0.35 | 0.36 | 0.36 | 0.41 | 0.43 | 0.35 | 0.37 | 0.37 | 0.50 | 0.52 | 0.44 | 0.44 |
| 0.24 | 0.24 | 0.24 | 0.23 | 0.24 | 0.23 | 0.23 | 0.26 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| 4.79 | 4.68 | 4.70 | 4.61 | 4.64 | 4.22 | 4.44 | 5.08 | 5.08 | 5.09 | 5.16 | 5.10 | 4.82 | 4.79 |
| 10.72 | 10.53 | 10.51 | 10.41 | 10.51 | 10.01 | 10.39 | 11.25 | 11.16 | 11.12 | 11.37 | 11.32 | 10.97 | 10.92 |
| 11.43 | 11.47 | 11.39 | 11.54 | 11.50 | 11.12 | 11.06 | 11.78 | 11.65 | 11.55 | 11.31 | 11.23 | 11.37 | 10.84 |
| 0.70 | 0.65 | 0.63 | 0.61 | 0.55 | 0.59 | 0.52 | 0.58 | 0.44 | 0.43 | 0.40 | 0.36 | 0.38 | 0.34 |
| 1.74 | 1.36 | 1.37 | 1.07 | 1.12 | 0.83 | 0.86 | 1.79 | 1.36 | 1.35 | 1.26 | 1.26 | 0.90 | 0.92 |
| 0.20 | 0.22 | 0.23 | 0.23 | 0.26 | 0.22 | 0.27 | 0.27 | 0.32 | 0.32 | 0.33 | 0.35 | 0.34 | 0.35 |
| 2.65 | 2.22 | 2.23 | 1.91 | 1.93 | 1.64 | 1.65 | 2.64 | 2.12 | 2.11 | 1.99 | 1.97 | 1.62 | 1.61 |
| 2.25 | 2.25 | 2.25 | 2.23 | 2.29 | 2.17 | 2.27 | 2.35 | 2.39 | 2.39 | 2.39 | 2.40 | 2.40 | 2.39 |
| 4.30 | 4.13 | 4.11 | 3.95 | 4.00 | 3.67 | 3.78 | 4.51 | 4.27 | 4.23 | 4.13 | 4.13 | 3.98 | 3.88 |
| **31.35** | **30.60** | **30.50** | **30.04** | **30.23** | **28.61** | **29.15** | **32.53** | **31.59** | **31.39** | **31.19** | **31.06** | **30.34** | **29.63** |
| 8.65 | 7.92 | 7.88 | 6.85 | 6.87 | 6.28 | 6.37 | 8.37 | 7.05 | 7.01 | 6.23 | 6.24 | 6.20 | 6.10 |
| **40.00** | **38.52** | **38.38** | **36.89** | **37.11** | **34.88** | **35.52** | **40.89** | **38.64** | **38.40** | **37.42** | **37.30** | **36.55** | **35.74** |

## Table A2. Energy Consumption by Sector and Source (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Sector and Source | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Transportation** | | | | | | | | |
| Distillate Fuel[8] | 4.48 | 5.65 | 5.64 | 5.55 | 5.54 | 5.44 | 5.49 | 5.28 |
| Jet Fuel[9] | 3.27 | 4.36 | 4.35 | 4.30 | 4.31 | 4.18 | 4.25 | 3.87 |
| Motor Gasoline[2] | 14.94 | 17.04 | 17.02 | 16.85 | 16.81 | 16.17 | 16.69 | 15.12 |
| Residual Fuel | 0.90 | 1.10 | 1.10 | 1.09 | 1.10 | 1.09 | 1.09 | 1.09 |
| Liquefied Petroleum Gas | 0.04 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 |
| Other Petroleum[10] | 0.29 | 0.32 | 0.32 | 0.32 | 0.32 | 0.31 | 0.32 | 0.31 |
| Petroleum Subtotal | 23.92 | 28.61 | 28.57 | 28.24 | 28.21 | 27.32 | 27.98 | 25.79 |
| Pipeline Fuel Natural Gas | 0.73 | 0.80 | 0.83 | 0.81 | 0.82 | 0.83 | 0.83 | 0.89 |
| Compressed Natural Gas | 0.01 | 0.18 | 0.18 | 0.17 | 0.17 | 0.16 | 0.17 | 0.15 |
| Renewable Energy (E85)[11] | 0.01 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| Methanol[12] | 0.01 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Liquid Hydrogen | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity | 0.06 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Delivered Energy** | **24.73** | **29.81** | **29.81** | **29.45** | **29.45** | **28.55** | **29.22** | **27.06** |
| Electricity Related Losses | 0.13 | 0.17 | 0.17 | 0.17 | 0.17 | 0.16 | 0.16 | 0.15 |
| **Total** | **24.86** | **29.99** | **29.98** | **29.62** | **29.61** | **28.71** | **29.39** | **27.20** |
| **Delivered Energy Consumption for All Sectors** | | | | | | | | |
| Distillate Fuel | 6.98 | 8.15 | 8.13 | 8.00 | 7.97 | 7.81 | 7.90 | 7.56 |
| Kerosene | 0.14 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 |
| Jet Fuel[9] | 3.27 | 4.36 | 4.35 | 4.30 | 4.31 | 4.18 | 4.25 | 3.87 |
| Liquefied Petroleum Gas | 2.66 | 2.94 | 2.94 | 2.89 | 2.90 | 2.86 | 2.88 | 2.83 |
| Motor Gasoline[2] | 15.16 | 17.29 | 17.27 | 17.09 | 17.06 | 16.41 | 16.93 | 15.36 |
| Petrochemical Feedstock | 1.28 | 1.39 | 1.39 | 1.35 | 1.36 | 1.34 | 1.35 | 1.31 |
| Residual Fuel | 1.39 | 1.57 | 1.57 | 1.55 | 1.55 | 1.53 | 1.55 | 1.51 |
| Other Petroleum[13] | 4.37 | 4.85 | 4.84 | 4.79 | 4.74 | 4.61 | 4.65 | 4.36 |
| Petroleum Subtotal | 35.26 | 40.67 | 40.61 | 40.10 | 40.01 | 38.85 | 39.63 | 36.92 |
| Natural Gas[6] | 19.39 | 21.11 | 21.12 | 20.68 | 20.77 | 20.28 | 20.64 | 19.55 |
| Metallurgical Coal | 0.85 | 0.76 | 0.76 | 0.74 | 0.75 | 0.68 | 0.74 | 0.65 |
| Steam Coal | 1.68 | 1.83 | 1.81 | 1.65 | 1.37 | 1.20 | 1.28 | 0.97 |
| Net Coal Coke Imports | 0.00 | 0.16 | 0.16 | 0.16 | 0.15 | 0.18 | 0.14 | 0.18 |
| Coal Subtotal | 2.53 | 2.75 | 2.73 | 2.55 | 2.26 | 2.06 | 2.16 | 1.80 |
| Renewable Energy[14] | 2.44 | 2.79 | 2.79 | 2.76 | 2.78 | 2.78 | 2.77 | 2.77 |
| Methanol[12] | 0.01 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Liquid Hydrogen | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity | 10.57 | 12.38 | 12.33 | 12.03 | 11.83 | 11.40 | 11.63 | 10.68 |
| **Delivered Energy** | **70.19** | **79.78** | **79.66** | **78.20** | **77.74** | **75.44** | **76.92** | **71.79** |
| Electricity Related Losses | 23.57 | 26.04 | 25.66 | 24.85 | 23.87 | 22.31 | 23.29 | 20.01 |
| **Total** | **93.77** | **105.82** | **105.32** | **103.06** | **101.61** | **97.75** | **100.22** | **91.80** |
| **Electric Generators[15]** | | | | | | | | |
| Distillate Fuel | 0.07 | 0.08 | 0.05 | 0.04 | 0.04 | 0.03 | 0.04 | 0.05 |
| Residual Fuel | 0.67 | 0.34 | 0.35 | 0.33 | 0.31 | 0.27 | 0.31 | 0.31 |
| Petroleum Subtotal | 0.75 | 0.42 | 0.40 | 0.37 | 0.35 | 0.31 | 0.34 | 0.36 |
| Natural Gas | 3.04 | 5.40 | 5.73 | 5.61 | 6.41 | 7.38 | 7.10 | 10.26 |
| Steam Coal | 18.36 | 20.75 | 20.02 | 19.06 | 17.01 | 14.03 | 15.13 | 7.47 |
| Nuclear Power | 7.20 | 6.95 | 7.29 | 7.29 | 7.30 | 7.36 | 7.45 | 7.45 |
| Renewable Energy[16] | 4.40 | 4.22 | 4.33 | 4.33 | 4.42 | 4.41 | 4.68 | 4.93 |
| Electricity Imports[17] | 0.39 | 0.69 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| **Total** | **34.14** | **38.43** | **37.99** | **36.89** | **35.70** | **33.71** | **34.93** | **30.69** |

**Table A2. Energy Consumption by Sector and Source (Continued)**
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 6.03 | 5.91 | 5.92 | 5.73 | 5.79 | 5.49 | 5.58 | 6.38 | 6.15 | 6.14 | 5.93 | 5.89 | 5.77 | 5.64 |
| 4.98 | 4.91 | 4.92 | 4.68 | 4.78 | 4.18 | 4.40 | 5.93 | 5.78 | 5.82 | 5.68 | 5.70 | 5.35 | 5.45 |
| 18.03 | 17.57 | 17.54 | 16.55 | 16.53 | 14.71 | 14.81 | 19.03 | 18.08 | 17.92 | 17.49 | 17.27 | 15.59 | 15.85 |
| 1.27 | 1.26 | 1.27 | 1.26 | 1.27 | 1.25 | 1.27 | 1.56 | 1.56 | 1.57 | 1.56 | 1.56 | 1.57 | 1.57 |
| 0.20 | 0.20 | 0.20 | 0.19 | 0.19 | 0.17 | 0.17 | 0.27 | 0.26 | 0.26 | 0.25 | 0.25 | 0.23 | 0.24 |
| 0.34 | 0.34 | 0.34 | 0.33 | 0.34 | 0.32 | 0.34 | 0.37 | 0.36 | 0.37 | 0.36 | 0.36 | 0.37 | 0.37 |
| 30.86 | 30.19 | 30.19 | 28.75 | 28.90 | 26.11 | 26.57 | 33.54 | 32.19 | 32.07 | 31.27 | 31.03 | 28.88 | 29.12 |
| 0.87 | 0.90 | 0.89 | 0.96 | 0.99 | 0.95 | 0.95 | 0.98 | 1.05 | 1.05 | 1.10 | 1.10 | 1.05 | 1.05 |
| 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.33 | 0.32 | 0.32 | 0.31 | 0.30 | 0.29 | 0.29 |
| 0.12 | 0.12 | 0.12 | 0.13 | 0.13 | 0.11 | 0.11 | 0.17 | 0.18 | 0.17 | 0.18 | 0.18 | 0.16 | 0.16 |
| 0.14 | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.13 | 0.22 | 0.22 | 0.22 | 0.21 | 0.21 | 0.20 | 0.20 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 | 0.13 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| **32.35** | **31.70** | **31.70** | **30.30** | **30.49** | **27.60** | **28.07** | **35.37** | **34.08** | **33.96** | **33.19** | **32.95** | **30.69** | **30.95** |
| 0.21 | 0.19 | 0.19 | 0.17 | 0.17 | 0.16 | 0.16 | 0.23 | 0.20 | 0.21 | 0.18 | 0.19 | 0.18 | 0.18 |
| **32.55** | **31.90** | **31.89** | **30.47** | **30.66** | **27.76** | **28.23** | **35.60** | **34.29** | **34.16** | **33.38** | **33.13** | **30.87** | **31.13** |
| 8.55 | 8.38 | 8.39 | 8.14 | 8.21 | 7.77 | 7.92 | 8.91 | 8.62 | 8.61 | 8.39 | 8.35 | 8.14 | 8.00 |
| 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 |
| 4.98 | 4.91 | 4.92 | 4.68 | 4.78 | 4.18 | 4.40 | 5.93 | 5.78 | 5.82 | 5.68 | 5.70 | 5.35 | 5.45 |
| 3.18 | 3.13 | 3.12 | 3.08 | 3.13 | 3.03 | 3.11 | 3.36 | 3.28 | 3.27 | 3.27 | 3.28 | 3.21 | 3.29 |
| 18.30 | 17.83 | 17.80 | 16.81 | 16.79 | 14.97 | 15.07 | 19.31 | 18.36 | 18.20 | 17.76 | 17.54 | 15.87 | 16.13 |
| 1.48 | 1.45 | 1.43 | 1.41 | 1.43 | 1.35 | 1.38 | 1.52 | 1.46 | 1.44 | 1.44 | 1.44 | 1.41 | 1.37 |
| 1.74 | 1.74 | 1.74 | 1.73 | 1.75 | 1.78 | 1.82 | 2.03 | 2.05 | 2.06 | 2.18 | 2.19 | 2.13 | 2.12 |
| 5.11 | 4.99 | 5.01 | 4.91 | 4.95 | 4.50 | 4.75 | 5.42 | 5.42 | 5.43 | 5.50 | 5.44 | 5.16 | 5.13 |
| 43.46 | 42.54 | 42.53 | 40.88 | 41.16 | 37.68 | 38.55 | 46.60 | 45.07 | 44.92 | 44.32 | 44.05 | 41.37 | 41.60 |
| 22.06 | 21.64 | 21.59 | 20.96 | 20.98 | 19.43 | 19.46 | 23.01 | 22.02 | 21.95 | 21.09 | 21.04 | 20.23 | 19.94 |
| 0.70 | 0.65 | 0.63 | 0.61 | 0.55 | 0.59 | 0.52 | 0.58 | 0.44 | 0.43 | 0.40 | 0.36 | 0.38 | 0.34 |
| 1.89 | 1.49 | 1.51 | 1.19 | 1.24 | 0.92 | 0.96 | 1.94 | 1.48 | 1.48 | 1.38 | 1.38 | 1.00 | 1.02 |
| 0.20 | 0.22 | 0.23 | 0.23 | 0.26 | 0.22 | 0.27 | 0.27 | 0.32 | 0.32 | 0.33 | 0.35 | 0.34 | 0.35 |
| 2.80 | 2.36 | 2.37 | 2.03 | 2.05 | 1.73 | 1.75 | 2.79 | 2.25 | 2.24 | 2.11 | 2.10 | 1.72 | 1.71 |
| 2.98 | 2.98 | 2.99 | 2.98 | 3.04 | 2.92 | 3.02 | 3.13 | 3.20 | 3.20 | 3.21 | 3.23 | 3.23 | 3.23 |
| 0.14 | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.13 | 0.22 | 0.22 | 0.22 | 0.21 | 0.21 | 0.20 | 0.20 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 13.19 | 12.61 | 12.62 | 11.92 | 12.02 | 10.98 | 11.22 | 14.47 | 13.55 | 13.49 | 13.09 | 13.11 | 12.51 | 12.53 |
| **84.63** | **82.28** | **82.24** | **78.90** | **79.39** | **72.87** | **74.13** | **90.21** | **86.30** | **86.01** | **84.04** | **83.74** | **79.25** | **79.23** |
| 26.55 | 24.20 | 24.19 | 20.67 | 20.66 | 18.79 | 18.88 | 26.80 | 22.35 | 22.38 | 19.76 | 19.82 | 19.51 | 19.72 |
| **111.18** | **106.48** | **106.43** | **99.57** | **100.05** | **91.67** | **93.02** | **117.02** | **108.64** | **108.39** | **103.79** | **103.56** | **98.76** | **98.95** |
| 0.07 | 0.04 | 0.04 | 0.03 | 0.03 | 0.10 | 0.09 | 0.07 | 0.04 | 0.04 | 0.37 | 0.70 | 0.20 | 0.29 |
| 0.29 | 0.25 | 0.25 | 0.21 | 0.18 | 0.28 | 0.24 | 0.21 | 0.14 | 0.15 | 0.09 | 0.09 | 0.10 | 0.09 |
| 0.36 | 0.29 | 0.29 | 0.24 | 0.21 | 0.38 | 0.33 | 0.28 | 0.18 | 0.19 | 0.47 | 0.79 | 0.30 | 0.38 |
| 6.91 | 7.93 | 7.78 | 10.86 | 10.91 | 12.66 | 12.53 | 9.64 | 12.49 | 12.37 | 14.93 | 14.60 | 14.32 | 13.97 |
| 21.35 | 17.34 | 17.50 | 9.65 | 9.63 | 3.71 | 3.46 | 22.48 | 13.04 | 13.29 | 4.95 | 5.10 | 0.25 | 0.27 |
| 6.17 | 6.68 | 6.68 | 6.98 | 7.11 | 7.41 | 7.36 | 3.80 | 5.06 | 4.99 | 5.90 | 5.92 | 7.41 | 7.16 |
| 4.30 | 4.46 | 4.46 | 4.74 | 4.71 | 5.52 | 6.33 | 4.46 | 5.10 | 4.98 | 6.56 | 6.48 | 9.69 | 10.43 |
| 0.66 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.61 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| **39.74** | **36.81** | **36.81** | **32.58** | **32.68** | **29.78** | **30.10** | **41.27** | **35.90** | **35.87** | **32.85** | **32.92** | **32.02** | **32.26** |

## Table A2. Energy Consumption by Sector and Source (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Sector and Source | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Total Energy Consumption** | | | | | | | | |
| Distillate Fuel | 7.06 | 8.22 | 8.17 | 8.05 | 8.01 | 7.84 | 7.94 | 7.61 |
| Kerosene | 0.14 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 |
| Jet Fuel[9] | 3.27 | 4.36 | 4.35 | 4.30 | 4.31 | 4.18 | 4.25 | 3.87 |
| Liquefied Petroleum Gas | 2.66 | 2.94 | 2.94 | 2.89 | 2.90 | 2.86 | 2.88 | 2.83 |
| Motor Gasoline[2] | 15.16 | 17.29 | 17.27 | 17.09 | 17.06 | 16.41 | 16.93 | 15.36 |
| Petrochemical Feedstock | 1.28 | 1.39 | 1.39 | 1.35 | 1.36 | 1.34 | 1.35 | 1.31 |
| Residual Fuel | 2.07 | 1.92 | 1.92 | 1.87 | 1.86 | 1.81 | 1.86 | 1.82 |
| Other Petroleum[13] | 4.37 | 4.85 | 4.84 | 4.79 | 4.74 | 4.61 | 4.65 | 4.36 |
| Petroleum Subtotal | 36.01 | 41.09 | 41.01 | 40.47 | 40.36 | 39.15 | 39.97 | 37.28 |
| Natural Gas | 22.43 | 26.51 | 26.85 | 26.29 | 27.18 | 27.66 | 27.74 | 29.81 |
| Metallurgical Coal | 0.85 | 0.76 | 0.76 | 0.74 | 0.75 | 0.68 | 0.74 | 0.65 |
| Steam Coal | 20.05 | 22.58 | 21.83 | 20.71 | 18.38 | 15.23 | 16.41 | 8.44 |
| Net Coal Coke Imports | 0.00 | 0.16 | 0.16 | 0.16 | 0.15 | 0.18 | 0.14 | 0.18 |
| Coal Subtotal | 20.90 | 23.50 | 22.75 | 21.61 | 19.28 | 16.09 | 17.29 | 9.27 |
| Nuclear Power | 7.20 | 6.95 | 7.29 | 7.29 | 7.30 | 7.36 | 7.45 | 7.45 |
| Renewable Energy[18] | 6.84 | 7.01 | 7.12 | 7.09 | 7.20 | 7.19 | 7.45 | 7.70 |
| Methanol[12] | 0.01 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Liquid Hydrogen | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity Imports[17] | 0.39 | 0.69 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| **Total** | **93.77** | **105.82** | **105.32** | **103.06** | **101.61** | **97.75** | **100.22** | **91.80** |
| **Energy Use and Related Statistics** | | | | | | | | |
| Delivered Energy Use | 70.19 | 79.78 | 79.66 | 78.20 | 77.74 | 75.44 | 76.92 | 71.79 |
| Total Energy Use | 93.77 | 105.83 | 105.34 | 103.07 | 101.63 | 97.76 | 100.23 | 91.81 |
| Total Carbon Emissions (million metric tons) | 1462.90 | 1690.92 | 1674.61 | 1629.78 | 1579.45 | 1482.19 | 1529.60 | 1302.75 |

## Table A2. Energy Consumption by Sector and Source (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 8.62 | 8.42 | 8.43 | 8.17 | 8.24 | 7.87 | 8.02 | 8.98 | 8.65 | 8.65 | 8.76 | 9.05 | 8.34 | 8.30 |
| 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 |
| 4.98 | 4.91 | 4.92 | 4.68 | 4.78 | 4.18 | 4.40 | 5.93 | 5.78 | 5.82 | 5.68 | 5.70 | 5.35 | 5.45 |
| 3.18 | 3.13 | 3.12 | 3.08 | 3.13 | 3.03 | 3.11 | 3.36 | 3.28 | 3.27 | 3.27 | 3.28 | 3.21 | 3.29 |
| 18.30 | 17.83 | 17.80 | 16.81 | 16.79 | 14.97 | 15.07 | 19.31 | 18.36 | 18.20 | 17.76 | 17.54 | 15.87 | 16.13 |
| 1.48 | 1.45 | 1.43 | 1.41 | 1.43 | 1.35 | 1.38 | 1.52 | 1.46 | 1.44 | 1.44 | 1.44 | 1.41 | 1.37 |
| 2.03 | 1.99 | 1.99 | 1.94 | 1.93 | 2.05 | 2.05 | 2.24 | 2.19 | 2.21 | 2.27 | 2.28 | 2.23 | 2.21 |
| 5.11 | 4.99 | 5.01 | 4.91 | 4.95 | 4.50 | 4.75 | 5.42 | 5.42 | 5.43 | 5.50 | 5.44 | 5.16 | 5.13 |
| 43.82 | 42.83 | 42.82 | 41.12 | 41.37 | 38.06 | 38.88 | 46.88 | 45.25 | 45.12 | 44.78 | 44.84 | 41.67 | 41.98 |
| 28.97 | 29.57 | 29.36 | 31.82 | 31.89 | 32.09 | 31.99 | 32.65 | 34.50 | 34.31 | 36.02 | 35.64 | 34.54 | 33.92 |
| 0.70 | 0.65 | 0.63 | 0.61 | 0.55 | 0.59 | 0.52 | 0.58 | 0.44 | 0.43 | 0.40 | 0.36 | 0.38 | 0.34 |
| 23.24 | 18.83 | 19.01 | 10.85 | 10.87 | 4.63 | 4.42 | 24.42 | 14.52 | 14.77 | 6.33 | 6.48 | 1.26 | 1.29 |
| 0.20 | 0.22 | 0.23 | 0.23 | 0.26 | 0.22 | 0.27 | 0.27 | 0.32 | 0.32 | 0.33 | 0.35 | 0.34 | 0.35 |
| 24.14 | 19.70 | 19.87 | 11.68 | 11.68 | 5.44 | 5.21 | 25.27 | 15.28 | 15.53 | 7.06 | 7.19 | 1.98 | 1.98 |
| 6.17 | 6.68 | 6.68 | 6.98 | 7.11 | 7.41 | 7.36 | 3.80 | 5.06 | 4.99 | 5.90 | 5.92 | 7.41 | 7.16 |
| 7.27 | 7.44 | 7.44 | 7.72 | 7.75 | 8.44 | 9.35 | 7.59 | 8.29 | 8.18 | 9.77 | 9.71 | 12.92 | 13.67 |
| 0.14 | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.13 | 0.22 | 0.22 | 0.22 | 0.21 | 0.21 | 0.20 | 0.20 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.66 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.61 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| **111.18** | **106.48** | **106.43** | **99.57** | **100.05** | **91.67** | **93.02** | **117.02** | **108.64** | **108.39** | **103.79** | **103.56** | **98.76** | **98.95** |
| 84.63 | 82.28 | 82.24 | 78.90 | 79.39 | 72.87 | 74.13 | 90.21 | 86.30 | 86.01 | 84.04 | 83.74 | 79.25 | 79.23 |
| 111.19 | 106.49 | 106.44 | 99.58 | 100.06 | 91.68 | 93.03 | 117.01 | 108.64 | 108.38 | 103.79 | 103.55 | 98.75 | 98.94 |
| 1790.62 | 1667.93 | 1669.84 | 1461.50 | 1466.00 | 1243.42 | 1249.40 | 1928.74 | 1668.05 | 1670.07 | 1467.78 | 1467.81 | 1250.80 | 1249.40 |

[1]Includes wood used for residential heating. See Table A18 estimates of nonmarketed renewable energy consumption for geothermal heat pumps & solar thermal hot water heating.

[2]Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.

[3]Includes commercial sector electricity cogenerated by using wood and wood waste, landfill gas, municipal solid waste, and other biomass. See Table A18 for estimates of nonmarketed renewable energy consumption for solar thermal hot water heating.

[4]Fuel consumption includes consumption for cogeneration.

[5]Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

[6]Includes lease and plant fuel.

[7]Includes consumption of energy from hydroelectric, wood & wood waste, municipal solid waste, & other biomass; includes for cogeneration, both sales to the grid & for own use.

[8]Low sulfur diesel fuel.

[9]Includes naphtha and kerosene type.

[10]Includes aviation gas and lubricants.

[11]E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline(nonrenewable).

[12]Only M85 (85 percent methanol and 15 percent motor gasoline).

[13]Includes unfinished oils, natural gasoline, motor gasoline blending compounds, aviation gasoline, lubricants, still gas, asphalt, road oil, petroleum coke, and miscellaneous petroleum products.

[14]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 and solar thermal hot water heaters.

[15]Includes consumption of energy by all electric power generators for grid-connected power except cogenerators, which produce electricity and other useful thermal energy.

[16]Includes conventional hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, E85, wind, photovoltaic and solar thermal sources. Excludes cogeneration. Excludes net electricity imports.

[17]In 1996 approximately two-thirds of the U.S. electricity imports were provided by renewable sources (hydroelectricity); EIA does not project future proportions.

[18]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 and solar thermal hot water heaters.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Figures for 1996 may differ from published data due to internal conversion factors. Consumption values of 0.00 are values that round to 0.00, because they are less than 0.005.

**Sources:** 1996 natural gas lease, plant, and pipeline fuel values: Energy Information Administration, *Short-Term Energy Outlook, August 1997.* Online. http://www.eia.doe.gov/emeu/steo /pub/upd/aug97/index.html (August 21, 1997). 1996 electric utility fuel consumption: EIA, *Electric Power Annual 1996, Volume I*, DOE/EIA-0348(96)/1 (Washington, DC, August 1997). 1996 nonutility consumption estimates: EIA Form 867, "Annual Nonutility Power Producer Report." Other 1996 values: EIA, *Short-Term Energy Outlook August 1997.* Online. http://www.eia.doe.gov/emeu/steo/pub/upd/aug97/index.html (August 21, 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A3. Energy Prices by Sector and Source
(1996 Dollars per Million Btu)

| Sector and Source | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Residential** | **12.86** | **12.18** | **12.37** | **13.22** | **14.92** | **16.32** | **15.84** | **20.75** |
| Primary Energy[1] | 6.63 | 6.26 | 6.33 | 6.72 | 7.52 | 8.27 | 7.99 | 10.68 |
| Petroleum Products[2] | 8.51 | 9.18 | 9.28 | 9.67 | 10.51 | 11.25 | 11.01 | 13.56 |
| Distillate Fuel | 7.09 | 7.59 | 7.68 | 8.07 | 9.00 | 9.75 | 9.52 | 12.29 |
| Liquefied Petroleum Gas | 11.59 | 12.11 | 12.23 | 12.46 | 13.22 | 13.77 | 13.66 | 15.61 |
| Natural Gas | 6.19 | 5.63 | 5.69 | 6.07 | 6.85 | 7.59 | 7.31 | 10.00 |
| Electricity | 24.42 | 21.55 | 21.95 | 23.59 | 26.62 | 28.96 | 28.21 | 36.23 |
| **Commercial** | **12.84** | **11.62** | **11.84** | **12.87** | **14.68** | **16.28** | **15.72** | **21.24** |
| Primary Energy[1] | 5.26 | 4.81 | 4.88 | 5.26 | 6.07 | 6.82 | 6.54 | 9.29 |
| Petroleum Products[2] | 5.56 | 5.76 | 5.86 | 6.25 | 7.19 | 7.93 | 7.71 | 10.43 |
| Distillate Fuel | 5.27 | 5.37 | 5.46 | 5.86 | 6.79 | 7.54 | 7.31 | 10.06 |
| Residual Fuel | 3.24 | 3.07 | 3.20 | 3.66 | 4.67 | 5.51 | 5.24 | 8.32 |
| Natural Gas[3] | 5.28 | 4.73 | 4.79 | 5.16 | 5.93 | 6.67 | 6.39 | 9.11 |
| Electricity | 22.05 | 19.21 | 19.62 | 21.38 | 24.28 | 26.78 | 25.89 | 33.97 |
| **Industrial[4]** | **5.35** | **4.96** | **5.07** | **5.51** | **6.37** | **7.12** | **6.85** | **9.41** |
| Primary Energy | 3.99 | 3.75 | 3.83 | 4.16 | 4.88 | 5.50 | 5.28 | 7.48 |
| Petroleum Products[2] | 5.58 | 5.21 | 5.28 | 5.49 | 6.09 | 6.51 | 6.41 | 8.00 |
| Distillate Fuel | 5.50 | 5.43 | 5.53 | 5.93 | 6.87 | 7.62 | 7.38 | 10.11 |
| Liquefied Petroleum Gas | 7.80 | 6.70 | 6.83 | 7.06 | 7.80 | 8.36 | 8.24 | 10.18 |
| Residual Fuel | 2.99 | 2.75 | 2.84 | 3.32 | 4.34 | 5.18 | 4.90 | 7.95 |
| Natural Gas[5] | 2.96 | 2.80 | 2.88 | 3.22 | 3.93 | 4.64 | 4.36 | 6.89 |
| Metallurgical Coal | 1.77 | 1.63 | 1.76 | 2.43 | 3.60 | 4.70 | 4.28 | 8.16 |
| Steam Coal | 1.46 | 1.30 | 1.42 | 2.10 | 3.27 | 4.38 | 3.96 | 7.84 |
| Electricity | 13.37 | 11.57 | 11.83 | 12.92 | 14.61 | 16.15 | 15.56 | 20.39 |
| **Transportation** | **8.77** | **8.62** | **8.78** | **9.10** | **10.03** | **10.69** | **10.53** | **12.93** |
| Primary Energy | 8.76 | 8.61 | 8.77 | 9.09 | 10.02 | 10.68 | 10.52 | 12.92 |
| Petroleum Products[2] | 8.76 | 8.61 | 8.76 | 9.09 | 10.02 | 10.68 | 10.52 | 12.92 |
| Distillate Fuel[6] | 8.90 | 8.47 | 8.62 | 8.97 | 9.89 | 10.63 | 10.39 | 13.01 |
| Jet Fuel[7] | 5.52 | 5.37 | 5.51 | 5.86 | 6.79 | 7.44 | 7.26 | 9.75 |
| Motor Gasoline[8] | 9.89 | 9.92 | 10.10 | 10.41 | 11.35 | 12.00 | 11.85 | 14.17 |
| Residual Fuel | 2.55 | 2.70 | 2.80 | 3.27 | 4.30 | 5.12 | 4.84 | 7.92 |
| Liquid Petroleum Gas[9] | 12.63 | 12.99 | 13.10 | 13.31 | 14.07 | 14.61 | 14.50 | 16.42 |
| Natural Gas[10] | 5.42 | 5.82 | 5.88 | 6.27 | 6.98 | 7.69 | 7.41 | 9.96 |
| E85[11] | 15.85 | 16.35 | 16.38 | 16.41 | 16.69 | 16.56 | 16.78 | 18.17 |
| M85[12] | 12.24 | 12.54 | 12.60 | 12.90 | 13.78 | 14.32 | 14.23 | 16.42 |
| Electricity | 15.33 | 13.44 | 13.56 | 13.82 | 13.93 | 14.34 | 14.06 | 15.53 |
| **Average End-Use Energy** | **8.65** | **8.21** | **8.36** | **8.89** | **9.97** | **10.86** | **10.56** | **13.62** |
| Primary Energy | 8.32 | 7.92 | 8.07 | 8.55 | 9.57 | 10.40 | 10.13 | 12.97 |
| Electricity | 20.00 | 17.49 | 17.85 | 19.34 | 21.82 | 23.96 | 23.20 | 30.08 |
| **Electric Generators[13]** | | | | | | | | |
| Fossil Fuel Average | 1.54 | 1.50 | 1.62 | 2.23 | 3.32 | 4.34 | 3.97 | 7.25 |
| Petroleum Products | 3.25 | 3.44 | 3.38 | 3.89 | 4.91 | 5.78 | 5.47 | 8.54 |
| Distillate Fuel | 4.91 | 4.97 | 5.10 | 5.50 | 6.45 | 7.23 | 6.98 | 9.67 |
| Residual Fuel | 3.07 | 3.10 | 3.15 | 3.67 | 4.71 | 5.60 | 5.29 | 8.36 |
| Natural Gas | 2.64 | 2.62 | 2.69 | 3.03 | 3.74 | 4.48 | 4.24 | 6.86 |
| Steam Coal | 1.29 | 1.17 | 1.28 | 1.97 | 3.13 | 4.24 | 3.81 | 7.74 |

**Table A3. Energy Prices by Sector and Source (Continued)**
(1996 Dollars per Million Btu)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **12.24** | **14.61** | **14.32** | **18.11** | **17.59** | **23.29** | **22.24** | **12.32** | **16.06** | **15.99** | **18.14** | **17.87** | **21.52** | **20.42** |
| 6.24 | 7.32 | 7.24 | 9.18 | 9.04 | 12.27 | 11.86 | 6.42 | 8.32 | 8.27 | 9.61 | 9.48 | 11.91 | 11.13 |
| 9.54 | 10.54 | 10.49 | 11.94 | 11.71 | 15.03 | 14.33 | 9.72 | 11.19 | 11.01 | 11.83 | 11.69 | 14.51 | 13.61 |
| 7.78 | 8.86 | 8.77 | 10.47 | 10.19 | 13.85 | 13.04 | 7.82 | 9.44 | 9.33 | 10.21 | 9.99 | 13.06 | 12.16 |
| 12.50 | 13.29 | 13.21 | 14.27 | 14.00 | 16.79 | 16.18 | 12.49 | 13.61 | 13.26 | 13.99 | 13.90 | 16.39 | 15.43 |
| 5.56 | 6.64 | 6.55 | 8.58 | 8.45 | 11.65 | 11.30 | 5.80 | 7.76 | 7.73 | 9.16 | 9.03 | 11.37 | 10.62 |
| 21.36 | 25.63 | 25.07 | 31.29 | 30.22 | 38.98 | 36.96 | 20.37 | 26.37 | 26.37 | 29.20 | 28.80 | 33.34 | 32.02 |
| **11.51** | **14.16** | **13.86** | **17.99** | **17.44** | **23.82** | **22.67** | **11.10** | **15.07** | **14.98** | **17.16** | **16.91** | **20.69** | **19.43** |
| 4.74 | 5.82 | 5.72 | 7.71 | 7.56 | 10.91 | 10.47 | 4.70 | 6.60 | 6.55 | 7.88 | 7.75 | 10.28 | 9.48 |
| 5.99 | 7.07 | 6.97 | 8.64 | 8.35 | 11.98 | 11.20 | 6.12 | 7.70 | 7.52 | 8.40 | 8.20 | 11.30 | 10.35 |
| 5.57 | 6.65 | 6.56 | 8.26 | 7.98 | 11.62 | 10.82 | 5.66 | 7.24 | 7.10 | 7.98 | 7.77 | 10.85 | 9.94 |
| 3.18 | 4.43 | 4.28 | 6.26 | 5.91 | 10.02 | 9.18 | 3.38 | 5.23 | 5.09 | 6.06 | 5.83 | 9.33 | 8.32 |
| 4.61 | 5.67 | 5.58 | 7.60 | 7.47 | 10.72 | 10.36 | 4.57 | 6.49 | 6.46 | 7.87 | 7.74 | 10.12 | 9.36 |
| 18.87 | 23.21 | 22.66 | 28.85 | 27.85 | 36.43 | 34.63 | 17.67 | 23.61 | 23.50 | 26.21 | 25.88 | 30.13 | 28.66 |
| **5.12** | **6.26** | **6.14** | **7.92** | **7.71** | **10.79** | **10.25** | **5.15** | **6.92** | **6.80** | **7.83** | **7.70** | **9.93** | **9.25** |
| 3.96 | 4.86 | 4.77 | 6.26 | 6.09 | 8.90 | 8.42 | 4.16 | 5.62 | 5.49 | 6.44 | 6.31 | 8.52 | 7.85 |
| 5.46 | 6.05 | 5.96 | 6.87 | 6.70 | 8.95 | 8.41 | 5.58 | 6.41 | 6.19 | 6.75 | 6.60 | 8.49 | 7.88 |
| 5.68 | 6.76 | 6.66 | 8.35 | 8.09 | 11.70 | 10.90 | 5.86 | 7.40 | 7.22 | 8.10 | 7.88 | 10.97 | 10.06 |
| 7.01 | 7.79 | 7.73 | 8.76 | 8.52 | 11.37 | 10.79 | 6.99 | 8.12 | 7.72 | 8.47 | 8.42 | 10.87 | 9.99 |
| 2.94 | 4.17 | 4.03 | 5.96 | 5.66 | 9.65 | 8.83 | 3.16 | 4.97 | 4.82 | 5.74 | 5.53 | 8.91 | 7.99 |
| 2.98 | 3.96 | 3.87 | 5.74 | 5.60 | 8.65 | 8.30 | 3.25 | 5.06 | 5.03 | 6.35 | 6.24 | 8.50 | 7.80 |
| 1.58 | 3.28 | 3.15 | 5.69 | 5.35 | 10.36 | 9.54 | 1.51 | 4.00 | 3.92 | 5.05 | 4.95 | 9.19 | 8.22 |
| 1.26 | 2.96 | 2.83 | 5.37 | 5.03 | 10.03 | 9.21 | 1.18 | 3.67 | 3.59 | 4.72 | 4.62 | 8.83 | 7.86 |
| 11.28 | 13.86 | 13.59 | 17.12 | 16.59 | 21.51 | 20.49 | 10.31 | 13.83 | 13.79 | 15.38 | 15.19 | 17.67 | 16.90 |
| **8.75** | **9.84** | **9.69** | **11.22** | **10.96** | **14.19** | **13.43** | **8.59** | **10.05** | **9.83** | **10.67** | **10.42** | **13.22** | **12.34** |
| 8.74 | 9.83 | 9.68 | 11.21 | 10.95 | 14.18 | 13.42 | 8.57 | 10.04 | 9.82 | 10.66 | 10.41 | 13.22 | 12.34 |
| 8.73 | 9.82 | 9.67 | 11.20 | 10.94 | 14.18 | 13.41 | 8.55 | 10.02 | 9.80 | 10.63 | 10.38 | 13.20 | 12.31 |
| 8.49 | 9.58 | 9.50 | 11.18 | 10.92 | 14.39 | 13.63 | 8.22 | 9.75 | 9.55 | 10.42 | 10.21 | 13.34 | 12.43 |
| 5.62 | 6.69 | 6.57 | 8.15 | 7.88 | 11.20 | 10.47 | 5.76 | 7.32 | 7.18 | 8.01 | 7.80 | 10.73 | 9.88 |
| 10.12 | 11.25 | 11.07 | 12.55 | 12.33 | 15.44 | 14.71 | 10.01 | 11.46 | 11.23 | 12.05 | 11.79 | 14.53 | 13.62 |
| 2.90 | 4.16 | 4.02 | 5.96 | 5.66 | 9.66 | 8.85 | 3.08 | 4.92 | 4.78 | 5.70 | 5.53 | 8.96 | 8.06 |
| 13.18 | 13.95 | 13.85 | 14.89 | 14.64 | 17.36 | 16.77 | 12.76 | 13.88 | 13.56 | 14.27 | 14.19 | 16.61 | 15.69 |
| 6.53 | 7.60 | 7.47 | 9.39 | 9.19 | 12.32 | 11.82 | 7.17 | 8.95 | 8.88 | 10.15 | 10.03 | 12.20 | 11.50 |
| 16.73 | 16.79 | 16.63 | 16.39 | 16.12 | 19.61 | 18.62 | 16.58 | 16.20 | 15.98 | 16.54 | 16.16 | 19.09 | 17.96 |
| 12.63 | 13.54 | 13.33 | 14.71 | 14.42 | 17.21 | 16.43 | 12.69 | 13.86 | 13.62 | 14.42 | 14.21 | 16.74 | 15.85 |
| 13.27 | 13.78 | 13.68 | 14.74 | 14.37 | 15.91 | 15.29 | 12.39 | 12.77 | 12.86 | 13.15 | 13.01 | 13.27 | 13.05 |
| **8.31** | **9.76** | **9.59** | **11.73** | **11.43** | **15.17** | **14.41** | **8.27** | **10.39** | **10.26** | **11.43** | **11.23** | **13.98** | **13.17** |
| 8.04 | 9.38 | 9.22 | 11.16 | 10.88 | 14.38 | 13.66 | 7.98 | 9.90 | 9.75 | 10.80 | 10.60 | 13.24 | 12.46 |
| 17.22 | 20.92 | 20.48 | 25.70 | 24.83 | 32.19 | 30.52 | 16.31 | 21.44 | 21.42 | 23.77 | 23.47 | 27.21 | 26.14 |
| 1.55 | 3.14 | 3.02 | 5.49 | 5.27 | 8.96 | 8.52 | 1.68 | 4.22 | 4.16 | 5.90 | 5.76 | 8.52 | 7.77 |
| 3.67 | 4.87 | 4.74 | 6.71 | 6.47 | 10.48 | 9.71 | 4.03 | 5.94 | 5.80 | 7.36 | 7.23 | 10.28 | 9.42 |
| 5.21 | 6.35 | 6.24 | 8.03 | 7.75 | 11.14 | 10.36 | 5.36 | 6.99 | 6.80 | 7.52 | 7.31 | 10.38 | 9.47 |
| 3.29 | 4.63 | 4.48 | 6.52 | 6.26 | 10.24 | 9.46 | 3.56 | 5.67 | 5.51 | 6.72 | 6.62 | 10.06 | 9.28 |
| 2.82 | 3.81 | 3.73 | 5.70 | 5.59 | 8.63 | 8.32 | 3.20 | 4.97 | 4.95 | 6.31 | 6.15 | 8.48 | 7.73 |
| 1.11 | 2.81 | 2.68 | 5.23 | 4.88 | 9.95 | 9.12 | 1.00 | 3.48 | 3.39 | 4.52 | 4.42 | 8.80 | 7.83 |

## Table A3. Energy Prices by Sector and Source (Continued)

(1996 Dollars per Million Btu)

| Sector and Source | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Average Price to All Users**[14] | | | | | | | | |
| Petroleum Products[2] | 7.83 | 7.76 | 7.90 | 8.21 | 9.06 | 9.66 | 9.51 | 11.68 |
| Distillate Fuel | 7.84 | 7.71 | 7.86 | 8.22 | 9.15 | 9.89 | 9.66 | 12.30 |
| Jet Fuel | 5.52 | 5.37 | 5.51 | 5.86 | 6.79 | 7.44 | 7.26 | 9.75 |
| Liquefied Petroleum Gas | 8.53 | 7.89 | 8.01 | 8.27 | 8.98 | 9.55 | 9.42 | 11.33 |
| Motor Gasoline[8] | 9.89 | 9.91 | 10.08 | 10.39 | 11.33 | 11.99 | 11.83 | 14.16 |
| Residual Fuel | 2.84 | 2.81 | 2.89 | 3.37 | 4.39 | 5.23 | 4.95 | 8.02 |
| Natural Gas | 4.14 | 3.72 | 3.77 | 4.12 | 4.79 | 5.47 | 5.21 | 7.65 |
| Coal | 1.32 | 1.18 | 1.30 | 1.98 | 3.14 | 4.26 | 3.82 | 7.75 |
| E85[11] | 15.85 | 16.35 | 16.38 | 16.41 | 16.69 | 16.56 | 16.78 | 18.17 |
| M85[12] | 12.24 | 12.54 | 12.60 | 12.90 | 13.78 | 14.32 | 14.23 | 16.42 |
| Electricity | 20.00 | 17.49 | 17.85 | 19.34 | 21.82 | 23.96 | 23.20 | 30.08 |
| **Non-Renewable Energy Expenditures by Sector (Billion 1996 dollars)** | | | | | | | | |
| Residential | 135.23 | 136.41 | 138.12 | 144.42 | 158.96 | 168.07 | 166.15 | 198.89 |
| Commercial | 95.84 | 96.20 | 97.75 | 103.98 | 114.83 | 122.37 | 120.32 | 142.21 |
| Industrial | 111.91 | 112.58 | 114.87 | 122.14 | 142.18 | 154.51 | 151.70 | 200.77 |
| Transportation | 210.43 | 248.75 | 253.09 | 259.75 | 286.57 | 296.18 | 298.41 | 339.68 |
| **Total Non-Renewable Expenditures** | **553.41** | **593.94** | **603.84** | **630.30** | **702.54** | **741.13** | **736.59** | **881.54** |
| Transportation Renewable Expenditures | 0.08 | 1.13 | 1.13 | 1.12 | 1.19 | 1.17 | 1.22 | 1.26 |
| **Total Expenditures** | **553.49** | **595.07** | **604.97** | **631.42** | **703.74** | **742.31** | **737.81** | **882.81** |

## Table A3. Energy Prices by Sector and Source (Continued)

(1996 Dollars per Million Btu)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 7.94 | 8.91 | 8.79 | 10.14 | 9.90 | 12.83 | 12.12 | 7.88 | 9.18 | 8.97 | 9.69 | 9.45 | 12.02 | 11.22 |
| 7.81 | 8.91 | 8.82 | 10.50 | 10.24 | 13.72 | 12.95 | 7.67 | 9.21 | 9.01 | 9.79 | 9.49 | 12.73 | 11.78 |
| 5.62 | 6.69 | 6.57 | 8.15 | 7.88 | 11.20 | 10.47 | 5.76 | 7.32 | 7.18 | 8.01 | 7.80 | 10.73 | 9.88 |
| 8.29 | 9.05 | 9.02 | 10.00 | 9.77 | 12.52 | 11.95 | 8.32 | 9.44 | 9.09 | 9.80 | 9.75 | 12.11 | 11.22 |
| 10.11 | 11.23 | 11.06 | 12.53 | 12.31 | 15.43 | 14.69 | 10.00 | 11.45 | 11.22 | 12.04 | 11.78 | 14.51 | 13.61 |
| 2.98 | 4.24 | 4.10 | 6.04 | 5.73 | 9.76 | 8.94 | 3.15 | 4.99 | 4.86 | 5.77 | 5.59 | 9.02 | 8.11 |
| 3.76 | 4.71 | 4.63 | 6.45 | 6.32 | 9.31 | 8.99 | 3.96 | 5.69 | 5.67 | 6.95 | 6.82 | 9.09 | 8.39 |
| 1.12 | 2.82 | 2.70 | 5.24 | 4.90 | 9.97 | 9.14 | 1.01 | 3.50 | 3.42 | 4.57 | 4.46 | 8.84 | 7.87 |
| 16.73 | 16.79 | 16.63 | 16.39 | 16.12 | 19.61 | 18.62 | 16.58 | 16.20 | 15.98 | 16.54 | 16.16 | 19.09 | 17.96 |
| 12.63 | 13.54 | 13.33 | 14.71 | 14.42 | 17.21 | 16.43 | 12.69 | 13.86 | 13.62 | 14.42 | 14.21 | 16.74 | 15.85 |
| 17.22 | 20.92 | 20.48 | 25.70 | 24.83 | 32.19 | 30.52 | 16.31 | 21.44 | 21.42 | 23.77 | 23.47 | 27.21 | 26.14 |
| 142.47 | 162.27 | 159.55 | 187.98 | 183.46 | 221.60 | 213.62 | 154.21 | 186.09 | 185.61 | 200.87 | 198.49 | 223.12 | 215.48 |
| 100.04 | 116.91 | 114.91 | 136.02 | 132.86 | 155.24 | 151.15 | 101.88 | 126.71 | 126.14 | 136.19 | 134.93 | 148.56 | 144.08 |
| 121.43 | 145.88 | 142.36 | 181.59 | 178.03 | 238.74 | 231.22 | 125.47 | 164.58 | 160.61 | 184.55 | 181.28 | 231.62 | 210.67 |
| 273.12 | 301.43 | 296.89 | 328.53 | 322.71 | 379.60 | 365.31 | 292.00 | 329.71 | 321.39 | 340.63 | 330.09 | 392.18 | 368.74 |
| **637.05** | **726.49** | **713.71** | **834.12** | **817.06** | **995.18** | **961.31** | **673.57** | **807.09** | **793.75** | **862.23** | **844.78** | **995.49** | **938.97** |
| 1.97 | 2.01 | 1.97 | 2.07 | 2.02 | 2.18 | 2.10 | 2.81 | 2.86 | 2.79 | 2.93 | 2.86 | 3.02 | 2.93 |
| **639.03** | **728.51** | **715.68** | **836.18** | **819.08** | **997.35** | **963.41** | **676.38** | **809.95** | **796.55** | **865.16** | **847.64** | **998.51** | **941.91** |

[1]Weighted average price includes fuels below as well as coal.
[2] This quantity is the weighted average for all petroleum products, not just those listed below.
[3]Excludes independent power producers.
[4]Includes cogenerators.
[5]Excludes uses for lease and plant fuel.
[6] Low sulfur diesel fuel. Price includes Federal and State taxes while excluding county and local taxes.
[7]Kerosene-type jet fuel. Price includes Federal and State taxes while excluding county and local taxes.
[8]Sales weighted-average price for all grades. Includes Federal and State taxes and excludes county and local taxes.
[9]Includes Federal and State taxes while excluding county and local taxes.
[10]Compressed natural gas used as a vehicle fuel. Price includes estimated motor vehicle fuel taxes.
[11]E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable).
[12]Only M85 (85 percent methanol and 15 percent motor gasoline).
[13]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[14]Weighted averages of end-use fuel prices are derived from the prices shown in each sector and the corresponding sectoral consumption.
Btu = British thermal unit.
Note: 1996 figures may differ from published data due to internal rounding.

**Sources:** 1996 prices for gasoline, distillate, and jet fuel are based on prices in various issues of Energy Information Administration (EIA), *Petroleum Marketing Monthly*, DOE/EIA-0380(96/13-97/4) (Washington, DC, 1996-97). 1996 prices for all other petroleum products are derived from the EIA, *State Energy Price and Expenditure Report 1994*, DOE/EIA-0376(94) (Washington, DC, June 1997). 1996 industrial gas delivered prices are based on EIA, *Manufacturing Energy Consumption Survey 1991*. 1996 residential and commercial natural gas delivered prices: EIA, *Natural Gas Monthly*, DOE/EIA-0130(97/6) (Washington, DC, June 1997). Other 1996 natural gas delivered prices: EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A. Values for 1996 coal prices have been estimated from EIA, *State Energy Price and Expenditure Report 1994*, DOE/EIA-0376(94) (Washington, DC, June 1997) by use of consumption quantities aggregated from EIA, *State Energy Data Report 1994.* Online. ftp://ftp.eia.doe.gov/ pub/state.data/021494.pdf (August 26, 1997) and the *Coal Industry Annual 1996,* DOE/EIA-0584(96) (Washington, DC, November 1997). 1996 electricity prices for commercial, industrial, and transportation: EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D052199A, FD07BLW.D080398B, and EARLY07.D052199A. **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A4. Residential Sector Key Indicators and End-Use Consumption

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Key Indicators and Consumption | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Key Indicators** | | | | | | | | |
| **Households (millions)** | | | | | | | | |
| Single-Family | 69.61 | 77.46 | 77.46 | 77.36 | 77.40 | 77.35 | 77.37 | 77.21 |
| Multifamily | 24.76 | 26.54 | 26.54 | 26.44 | 26.50 | 26.41 | 26.48 | 26.28 |
| Mobile Homes | 6.00 | 7.08 | 7.08 | 7.07 | 7.07 | 7.07 | 7.07 | 7.05 |
| **Total** | **100.37** | **111.08** | **111.08** | **110.87** | **110.97** | **110.83** | **110.92** | **110.54** |
| **Average House Square Footage** | **1649** | **1691** | **1691** | **1691** | **1691** | **1692** | **1691** | **1692** |
| **Energy Intensity (million Btu consumed per household)** | | | | | | | | |
| Delivered Energy Consumption | 110.92 | 106.30 | 105.97 | 104.01 | 101.50 | 98.45 | 100.05 | 92.29 |
| Electricity Related Losses | 81.78 | 82.08 | 80.85 | 78.38 | 75.07 | 70.72 | 73.50 | 64.07 |
| Total Energy Consumption | 192.70 | 188.37 | 186.82 | 182.39 | 176.57 | 169.16 | 173.55 | 156.35 |
| **Delivered Energy Consumption by Fuel** | | | | | | | | |
| **Electricity** | | | | | | | | |
| Space Heating | 0.47 | 0.48 | 0.48 | 0.45 | 0.45 | 0.42 | 0.44 | 0.39 |
| Space Cooling | 0.46 | 0.51 | 0.51 | 0.48 | 0.48 | 0.45 | 0.47 | 0.41 |
| Water Heating | 0.37 | 0.37 | 0.37 | 0.36 | 0.35 | 0.34 | 0.35 | 0.32 |
| Refrigeration | 0.41 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| Cooking | 0.13 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| Clothes Dryers | 0.19 | 0.21 | 0.21 | 0.21 | 0.20 | 0.20 | 0.20 | 0.19 |
| Freezers | 0.13 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 |
| Lighting | 0.32 | 0.37 | 0.37 | 0.36 | 0.35 | 0.34 | 0.34 | 0.31 |
| Clothes Washers[1] | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dishwashers[1] | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 0.04 | 0.05 | 0.04 |
| Color Televisions | 0.21 | 0.29 | 0.29 | 0.29 | 0.28 | 0.27 | 0.27 | 0.26 |
| Personal Computers | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Furnace Fans | 0.09 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.09 |
| Other Uses[2] | 0.79 | 1.35 | 1.34 | 1.31 | 1.27 | 1.25 | 1.25 | 1.17 |
| **Delivered Energy** | **3.68** | **4.34** | **4.32** | **4.21** | **4.13** | **4.00** | **4.07** | **3.78** |
| **Natural Gas** | | | | | | | | |
| Space Heating | 3.77 | 3.86 | 3.85 | 3.76 | 3.65 | 3.50 | 3.58 | 3.19 |
| Space Cooling | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Water Heating | 1.31 | 1.35 | 1.35 | 1.32 | 1.28 | 1.24 | 1.26 | 1.15 |
| Cooking | 0.16 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| Clothes Dryers | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Other Uses[3] | 0.09 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 |
| **Delivered Energy** | **5.39** | **5.53** | **5.52** | **5.40** | **5.25** | **5.05** | **5.16** | **4.65** |
| **Distillate** | | | | | | | | |
| Space Heating | 0.80 | 0.68 | 0.68 | 0.66 | 0.65 | 0.62 | 0.64 | 0.57 |
| Water Heating | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 |
| Other Uses[4] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Delivered Energy** | **0.89** | **0.77** | **0.77** | **0.75** | **0.74** | **0.71** | **0.73** | **0.65** |
| **Liquefied Petroleum Gas** | | | | | | | | |
| Space Heating | 0.32 | 0.32 | 0.31 | 0.32 | 0.31 | 0.31 | 0.30 | 0.30 |
| Water Heating | 0.07 | 0.08 | 0.08 | 0.08 | 0.07 | 0.08 | 0.07 | 0.07 |
| Cooking | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.04 | 0.03 | 0.04 |
| Other Uses[3] | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **Delivered Energy** | **0.42** | **0.44** | **0.43** | **0.45** | **0.43** | **0.43** | **0.42** | **0.41** |
| Marketed Renewables (wood)[5] | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.62 |
| Other Fuels[6] | 0.13 | 0.13 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.10 |

## Table A4. Residential Sector Key Indicators and End-Use Consumption (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 81.55 | 81.48 | 81.53 | 81.34 | 81.52 | 81.08 | 81.41 | 89.52 | 89.50 | 89.63 | 89.50 | 89.52 | 89.61 | 89.81 |
| 27.92 | 27.85 | 27.83 | 27.68 | 27.81 | 27.42 | 27.65 | 30.84 | 30.76 | 30.84 | 30.71 | 30.71 | 30.70 | 30.85 |
| 7.58 | 7.57 | 7.60 | 7.56 | 7.60 | 7.54 | 7.61 | 8.35 | 8.37 | 8.38 | 8.40 | 8.38 | 8.47 | 8.44 |
| **117.04** | **116.90** | **116.96** | **116.58** | **116.92** | **116.04** | **116.67** | **128.71** | **128.62** | **128.84** | **128.60** | **128.61** | **128.78** | **129.10** |
| **1707** | **1707** | **1707** | **1707** | **1707** | **1708** | **1708** | **1732** | **1732** | **1732** | **1732** | **1732** | **1732** | **1732** |
| 104.60 | 100.24 | 100.46 | 94.35 | 94.51 | 87.44 | 87.80 | 102.07 | 94.99 | 95.01 | 91.07 | 91.36 | 85.69 | 86.96 |
| 79.49 | 72.59 | 72.56 | 62.35 | 61.90 | 57.88 | 57.32 | 76.23 | 63.67 | 63.75 | 56.62 | 56.73 | 56.32 | 57.21 |
| 184.09 | 172.83 | 173.01 | 156.70 | 156.42 | 145.32 | 145.12 | 178.30 | 158.66 | 158.76 | 147.68 | 148.08 | 142.01 | 144.17 |
| 0.48 | 0.46 | 0.45 | 0.42 | 0.42 | 0.39 | 0.39 | 0.51 | 0.47 | 0.46 | 0.45 | 0.44 | 0.43 | 0.43 |
| 0.53 | 0.50 | 0.50 | 0.46 | 0.45 | 0.42 | 0.41 | 0.57 | 0.52 | 0.51 | 0.49 | 0.49 | 0.46 | 0.46 |
| 0.38 | 0.36 | 0.36 | 0.34 | 0.34 | 0.31 | 0.31 | 0.41 | 0.38 | 0.38 | 0.37 | 0.37 | 0.34 | 0.35 |
| 0.29 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| 0.23 | 0.22 | 0.22 | 0.20 | 0.21 | 0.19 | 0.20 | 0.26 | 0.24 | 0.24 | 0.23 | 0.24 | 0.23 | 0.23 |
| 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 0.40 | 0.38 | 0.38 | 0.35 | 0.36 | 0.31 | 0.33 | 0.45 | 0.42 | 0.42 | 0.41 | 0.41 | 0.39 | 0.39 |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 0.30 | 0.29 | 0.29 | 0.27 | 0.28 | 0.26 | 0.26 | 0.33 | 0.31 | 0.31 | 0.31 | 0.31 | 0.30 | 0.30 |
| 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 |
| 0.12 | 0.11 | 0.12 | 0.11 | 0.11 | 0.10 | 0.10 | 0.14 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 | 0.13 |
| 1.55 | 1.48 | 1.49 | 1.41 | 1.42 | 1.32 | 1.35 | 1.96 | 1.84 | 1.84 | 1.79 | 1.80 | 1.73 | 1.76 |
| **4.62** | **4.42** | **4.43** | **4.19** | **4.21** | **3.93** | **3.97** | **5.30** | **4.97** | **4.95** | **4.82** | **4.83** | **4.65** | **4.69** |
| 3.97 | 3.76 | 3.78 | 3.44 | 3.45 | 3.05 | 3.07 | 4.13 | 3.74 | 3.75 | 3.47 | 3.49 | 3.15 | 3.23 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1.40 | 1.34 | 1.34 | 1.24 | 1.24 | 1.14 | 1.14 | 1.48 | 1.35 | 1.35 | 1.27 | 1.27 | 1.18 | 1.20 |
| 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.17 | 0.18 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 |
| 0.10 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 |
| **5.71** | **5.43** | **5.45** | **5.00** | **5.02** | **4.51** | **4.53** | **5.98** | **5.45** | **5.47** | **5.10** | **5.11** | **4.68** | **4.79** |
| 0.64 | 0.61 | 0.61 | 0.57 | 0.57 | 0.51 | 0.51 | 0.57 | 0.53 | 0.52 | 0.51 | 0.51 | 0.45 | 0.46 |
| 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **0.73** | **0.70** | **0.69** | **0.65** | **0.65** | **0.59** | **0.59** | **0.66** | **0.61** | **0.61** | **0.59** | **0.59** | **0.53** | **0.54** |
| 0.32 | 0.31 | 0.33 | 0.31 | 0.32 | 0.29 | 0.30 | 0.33 | 0.32 | 0.33 | 0.32 | 0.33 | 0.29 | 0.31 |
| 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.09 |
| 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **0.45** | **0.44** | **0.46** | **0.43** | **0.45** | **0.41** | **0.42** | **0.47** | **0.46** | **0.48** | **0.46** | **0.48** | **0.42** | **0.44** |
| 0.61 | 0.61 | 0.61 | 0.62 | 0.62 | 0.63 | 0.64 | 0.62 | 0.63 | 0.63 | 0.64 | 0.64 | 0.67 | 0.68 |
| 0.12 | 0.11 | 0.11 | 0.10 | 0.10 | 0.09 | 0.09 | 0.12 | 0.10 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 |

**Table A4. Residential Sector Key Indicators and End-Use Consumption (Continued)**
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Key Indicators and Consumption | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Delivered Energy Consumption by End-Use** | | | | | | | | |
| Space Heating | 6.10 | 6.06 | 6.05 | 5.92 | 5.78 | 5.57 | 5.69 | 5.16 |
| Space Cooling | 0.47 | 0.51 | 0.51 | 0.48 | 0.48 | 0.45 | 0.47 | 0.41 |
| Water Heating | 1.84 | 1.89 | 1.89 | 1.84 | 1.80 | 1.74 | 1.77 | 1.62 |
| Refrigeration | 0.41 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| Cooking | 0.33 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Clothes Dryers | 0.24 | 0.27 | 0.27 | 0.26 | 0.25 | 0.25 | 0.25 | 0.23 |
| Freezers | 0.13 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 |
| Lighting | 0.32 | 0.37 | 0.37 | 0.36 | 0.35 | 0.34 | 0.34 | 0.31 |
| Clothes Washers | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dishwashers | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 0.04 | 0.05 | 0.04 |
| Color Televisions | 0.21 | 0.29 | 0.29 | 0.29 | 0.28 | 0.27 | 0.27 | 0.26 |
| Personal Computers | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Furnace Fans | 0.09 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.09 |
| Other Uses[7] | 0.90 | 1.45 | 1.45 | 1.42 | 1.38 | 1.35 | 1.36 | 1.27 |
| **Delivered Energy** | **11.13** | **11.81** | **11.77** | **11.53** | **11.26** | **10.91** | **11.10** | **10.20** |
| **Electricity Related Losses** | **8.21** | **9.12** | **8.98** | **8.69** | **8.33** | **7.84** | **8.15** | **7.08** |
| **Total Energy Consumption by End-Use** | | | | | | | | |
| Space Heating | 7.15 | 7.07 | 7.03 | 6.85 | 6.69 | 6.39 | 6.58 | 5.89 |
| Space Cooling | 1.50 | 1.58 | 1.56 | 1.48 | 1.44 | 1.32 | 1.41 | 1.17 |
| Water Heating | 2.66 | 2.68 | 2.66 | 2.59 | 2.51 | 2.40 | 2.47 | 2.21 |
| Refrigeration | 1.32 | 0.98 | 0.97 | 0.96 | 0.95 | 0.93 | 0.94 | 0.90 |
| Cooking | 0.62 | 0.65 | 0.64 | 0.64 | 0.63 | 0.62 | 0.63 | 0.61 |
| Clothes Dryers | 0.68 | 0.71 | 0.71 | 0.69 | 0.66 | 0.63 | 0.65 | 0.58 |
| Freezers | 0.42 | 0.26 | 0.26 | 0.26 | 0.26 | 0.25 | 0.26 | 0.24 |
| Lighting | 1.05 | 1.15 | 1.13 | 1.10 | 1.05 | 1.01 | 1.03 | 0.90 |
| Clothes Washers | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 |
| Dishwashers | 0.15 | 0.14 | 0.14 | 0.14 | 0.14 | 0.13 | 0.14 | 0.13 |
| Color Televisions | 0.68 | 0.91 | 0.90 | 0.88 | 0.84 | 0.80 | 0.82 | 0.74 |
| Personal Computers | 0.05 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 |
| Furnace Fans | 0.29 | 0.33 | 0.33 | 0.32 | 0.30 | 0.30 | 0.30 | 0.27 |
| Other Uses[7] | 2.67 | 4.28 | 4.23 | 4.13 | 3.95 | 3.79 | 3.86 | 3.47 |
| **Total** | **19.34** | **20.92** | **20.75** | **20.22** | **19.59** | **18.75** | **19.25** | **17.28** |
| **Non-Marketed Renewables** | | | | | | | | |
| Geothermal[8] | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| Solar[9] | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **Total** | **0.02** | **0.02** | **0.02** | **0.03** | **0.02** | **0.03** | **0.02** | **0.03** |

## Table A4. Residential Sector Key Indicators and End-Use Consumption (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 6.14 | 5.86 | 5.88 | 5.45 | 5.47 | 4.96 | 4.99 | 6.28 | 5.78 | 5.80 | 5.49 | 5.51 | 5.08 | 5.19 |
| 0.54 | 0.50 | 0.50 | 0.46 | 0.46 | 0.42 | 0.42 | 0.58 | 0.53 | 0.52 | 0.50 | 0.50 | 0.47 | 0.47 |
| 1.96 | 1.87 | 1.87 | 1.75 | 1.75 | 1.61 | 1.61 | 2.06 | 1.90 | 1.91 | 1.81 | 1.81 | 1.68 | 1.71 |
| 0.29 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| 0.28 | 0.27 | 0.27 | 0.26 | 0.26 | 0.24 | 0.24 | 0.32 | 0.30 | 0.30 | 0.29 | 0.29 | 0.28 | 0.28 |
| 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 0.40 | 0.38 | 0.38 | 0.35 | 0.36 | 0.31 | 0.33 | 0.45 | 0.42 | 0.42 | 0.41 | 0.41 | 0.39 | 0.39 |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 0.30 | 0.29 | 0.29 | 0.27 | 0.28 | 0.26 | 0.26 | 0.33 | 0.31 | 0.31 | 0.31 | 0.31 | 0.30 | 0.30 |
| 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 |
| 0.12 | 0.11 | 0.12 | 0.11 | 0.11 | 0.10 | 0.10 | 0.14 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 | 0.13 |
| 1.67 | 1.59 | 1.60 | 1.51 | 1.53 | 1.42 | 1.45 | 2.09 | 1.96 | 1.96 | 1.91 | 1.91 | 1.84 | 1.87 |
| **12.24** | **11.72** | **11.75** | **11.00** | **11.05** | **10.15** | **10.24** | **13.14** | **12.22** | **12.24** | **11.71** | **11.75** | **11.04** | **11.23** |
| **9.30** | **8.49** | **8.49** | **7.27** | **7.24** | **6.72** | **6.69** | **9.81** | **8.19** | **8.21** | **7.28** | **7.30** | **7.25** | **7.39** |
| 7.11 | 6.74 | 6.73 | 6.18 | 6.18 | 5.63 | 5.64 | 7.23 | 6.55 | 6.56 | 6.17 | 6.18 | 5.75 | 5.86 |
| 1.60 | 1.46 | 1.45 | 1.26 | 1.24 | 1.14 | 1.11 | 1.63 | 1.38 | 1.37 | 1.24 | 1.23 | 1.18 | 1.19 |
| 2.72 | 2.56 | 2.56 | 2.34 | 2.33 | 2.14 | 2.13 | 2.82 | 2.53 | 2.53 | 2.36 | 2.36 | 2.22 | 2.26 |
| 0.86 | 0.83 | 0.83 | 0.78 | 0.77 | 0.77 | 0.76 | 0.78 | 0.72 | 0.73 | 0.68 | 0.69 | 0.70 | 0.70 |
| 0.67 | 0.65 | 0.65 | 0.62 | 0.62 | 0.62 | 0.62 | 0.71 | 0.68 | 0.68 | 0.65 | 0.65 | 0.66 | 0.67 |
| 0.74 | 0.68 | 0.69 | 0.61 | 0.61 | 0.57 | 0.57 | 0.80 | 0.70 | 0.70 | 0.64 | 0.65 | 0.63 | 0.65 |
| 0.23 | 0.22 | 0.22 | 0.21 | 0.21 | 0.20 | 0.20 | 0.21 | 0.19 | 0.19 | 0.18 | 0.18 | 0.18 | 0.18 |
| 1.20 | 1.10 | 1.11 | 0.97 | 0.98 | 0.85 | 0.88 | 1.28 | 1.11 | 1.12 | 1.02 | 1.02 | 0.99 | 1.02 |
| 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 |
| 0.14 | 0.14 | 0.14 | 0.13 | 0.13 | 0.13 | 0.13 | 0.15 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| 0.91 | 0.84 | 0.85 | 0.75 | 0.75 | 0.70 | 0.71 | 0.96 | 0.83 | 0.84 | 0.77 | 0.77 | 0.76 | 0.77 |
| 0.12 | 0.12 | 0.12 | 0.10 | 0.10 | 0.10 | 0.10 | 0.17 | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.14 |
| 0.36 | 0.33 | 0.34 | 0.29 | 0.30 | 0.27 | 0.28 | 0.40 | 0.35 | 0.35 | 0.32 | 0.33 | 0.31 | 0.32 |
| 4.79 | 4.44 | 4.46 | 3.95 | 3.97 | 3.69 | 3.72 | 5.72 | 4.99 | 5.01 | 4.61 | 4.63 | 4.55 | 4.63 |
| **21.55** | **20.20** | **20.23** | **18.27** | **18.29** | **16.86** | **16.93** | **22.95** | **20.41** | **20.45** | **18.99** | **19.04** | **18.29** | **18.61** |
| 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.06** | **0.06** |

[1]Does not include water heating of load.

[2]Includes small electric devices, heating elements and motors.

[3]Includes such appliances as swimming pool heaters, outdoor grills, and outdoor lighting (natural gas).

[4]Includes such appliances as swimming pool and hot tub heaters.

[5]Includes wood used for primary and secondary heating in wood stoves or fireplaces as reported in the *Residential Energy Consumption Survey 1993*.

[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.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding.

**Sources:** 1996: Energy Information Administration (EIA) *Short-Term Energy Outlook, August 1997*. Online. http://www.eia.doe.gov/emeu/steo/pub/upd/aug97/index.html (August 21, 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A. FD07BLW.D080398B, and EARLY07.D052199A.

## Table A5. Commercial Sector Key Indicators and End-Use Consumption
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Key Indicators and Consumption | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Key Indicators** | | | | | | | | | |
| **Total Floor Space (billion square feet)** | | | | | | | | | |
| Surviving | 69.2 | 77.3 | 77.3 | 77.3 | 77.3 | 77.2 | 77.3 | 77.1 |
| New Additions | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| **Total** | **70.9** | **79.0** | **79.0** | **79.0** | **79.0** | **78.9** | **79.0** | **78.7** |
| **Energy Consumption Intensity (thousand Btu per square foot)** | | | | | | | | | |
| Delivered Energy Consumption | 105.3 | 104.8 | 104.5 | 102.4 | 99.0 | 95.3 | 96.9 | 85.1 |
| Electricity Related Losses | 106.0 | 104.2 | 102.6 | 99.7 | 94.5 | 88.4 | 92.0 | 77.2 |
| Total Energy Consumption | 211.2 | 209.0 | 207.2 | 202.0 | 193.5 | 183.8 | 188.9 | 162.3 |
| **Delivered Energy Consumption by Fuel** | | | | | | | | | |
| **Electricity** | | | | | | | | | |
| Space Heating | 0.12 | 0.11 | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.09 |
| Space Cooling | 0.51 | 0.54 | 0.54 | 0.52 | 0.51 | 0.49 | 0.50 | 0.44 |
| Water Heating | 0.17 | 0.17 | 0.17 | 0.17 | 0.16 | 0.16 | 0.16 | 0.14 |
| Ventilation | 0.17 | 0.18 | 0.18 | 0.18 | 0.17 | 0.16 | 0.17 | 0.15 |
| Cooking | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| Lighting | 1.16 | 1.25 | 1.24 | 1.21 | 1.17 | 1.11 | 1.15 | 0.99 |
| Refrigeration | 0.14 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Office Equipment (PC) | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 |
| Office Equipment (non-PC) | 0.20 | 0.25 | 0.25 | 0.24 | 0.24 | 0.23 | 0.23 | 0.21 |
| Other Uses[1] | 0.80 | 1.15 | 1.14 | 1.12 | 1.09 | 1.06 | 1.07 | 0.97 |
| **Delivered Energy** | **3.37** | **3.91** | **3.90** | **3.81** | **3.70** | **3.56** | **3.63** | **3.24** |
| **Natural Gas[2]** | | | | | | | | | |
| Space Heating | 1.34 | 1.38 | 1.37 | 1.34 | 1.29 | 1.23 | 1.26 | 1.06 |
| Space Cooling | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| Water Heating | 0.46 | 0.50 | 0.49 | 0.48 | 0.47 | 0.44 | 0.45 | 0.38 |
| Cooking | 0.18 | 0.21 | 0.21 | 0.21 | 0.20 | 0.19 | 0.19 | 0.16 |
| Other Uses[3] | 1.29 | 1.52 | 1.52 | 1.49 | 1.44 | 1.38 | 1.40 | 1.21 |
| **Delivered Energy** | **3.30** | **3.63** | **3.62** | **3.55** | **3.42** | **3.27** | **3.34** | **2.83** |
| **Distillate** | | | | | | | | | |
| Space Heating | 0.20 | 0.17 | 0.17 | 0.17 | 0.16 | 0.15 | 0.15 | 0.13 |
| Water Heating | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 |
| Other Uses[4] | 0.19 | 0.17 | 0.17 | 0.17 | 0.16 | 0.15 | 0.16 | 0.13 |
| **Delivered Energy** | **0.44** | **0.39** | **0.39** | **0.38** | **0.36** | **0.35** | **0.35** | **0.30** |
| **Other Fuels[5]** | **0.36** | **0.34** | **0.34** | **0.34** | **0.33** | **0.33** | **0.33** | **0.32** |
| **Marketed Renewable Fuels** | | | | | | | | | |
| Biomass | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Delivered Energy** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| **Delivered Energy Consumption by End-Use** | | | | | | | | | |
| Space Heating | 1.65 | 1.65 | 1.65 | 1.62 | 1.55 | 1.48 | 1.52 | 1.28 |
| Space Cooling | 0.53 | 0.57 | 0.57 | 0.55 | 0.54 | 0.51 | 0.53 | 0.47 |
| Water Heating | 0.68 | 0.72 | 0.72 | 0.70 | 0.68 | 0.64 | 0.66 | 0.56 |
| Ventilation | 0.17 | 0.18 | 0.18 | 0.18 | 0.17 | 0.16 | 0.17 | 0.15 |
| Cooking | 0.21 | 0.24 | 0.24 | 0.24 | 0.23 | 0.21 | 0.22 | 0.18 |
| Lighting | 1.16 | 1.25 | 1.24 | 1.21 | 1.17 | 1.11 | 1.15 | 0.99 |
| Refrigeration | 0.14 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Office Equipment (PC) | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 |
| Office Equipment (non-PC) | 0.20 | 0.25 | 0.25 | 0.24 | 0.24 | 0.23 | 0.23 | 0.21 |
| Other Uses[6] | 2.64 | 3.18 | 3.18 | 3.12 | 3.02 | 2.93 | 2.96 | 2.64 |
| **Delivered Energy** | **7.47** | **8.28** | **8.26** | **8.09** | **7.82** | **7.52** | **7.66** | **6.70** |

**Table A5. Commercial Sector Key Indicators and End-Use Consumption (Continued)**
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 81.1 | 81.1 | 81.1 | 80.9 | 80.9 | 80.7 | 80.7 | 85.7 | 85.5 | 85.5 | 85.5 | 85.4 | 85.3 | 85.3 |
| 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 1.7 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| **82.8** | **82.7** | **82.8** | **82.6** | **82.7** | **82.3** | **82.5** | **86.8** | **86.7** | **86.7** | **86.6** | **86.6** | **86.4** | **86.4** |
| 105.0 | 99.8 | 100.2 | 91.6 | 92.2 | 79.2 | 80.9 | 105.8 | 97.0 | 97.2 | 91.7 | 92.2 | 83.1 | 85.8 |
| 101.3 | 91.8 | 92.2 | 77.2 | 77.2 | 68.6 | 68.7 | 96.7 | 79.6 | 80.2 | 70.0 | 70.4 | 68.0 | 70.0 |
| 206.2 | 191.6 | 192.4 | 168.9 | 169.4 | 147.8 | 149.6 | 202.4 | 176.7 | 177.3 | 161.7 | 162.6 | 151.1 | 155.9 |
| 0.11 | 0.10 | 0.10 | 0.09 | 0.09 | 0.08 | 0.09 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 |
| 0.54 | 0.51 | 0.51 | 0.48 | 0.48 | 0.43 | 0.44 | 0.54 | 0.50 | 0.50 | 0.48 | 0.48 | 0.45 | 0.46 |
| 0.17 | 0.16 | 0.16 | 0.15 | 0.15 | 0.13 | 0.14 | 0.16 | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.13 |
| 0.19 | 0.18 | 0.18 | 0.16 | 0.16 | 0.15 | 0.15 | 0.19 | 0.17 | 0.17 | 0.16 | 0.17 | 0.15 | 0.15 |
| 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 1.28 | 1.20 | 1.20 | 1.08 | 1.10 | 0.94 | 0.96 | 1.31 | 1.16 | 1.16 | 1.09 | 1.10 | 0.98 | 1.02 |
| 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.07 | 0.07 | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 |
| 0.28 | 0.27 | 0.27 | 0.25 | 0.26 | 0.23 | 0.24 | 0.34 | 0.32 | 0.32 | 0.31 | 0.32 | 0.30 | 0.31 |
| 1.33 | 1.27 | 1.28 | 1.19 | 1.21 | 1.08 | 1.11 | 1.59 | 1.50 | 1.50 | 1.45 | 1.46 | 1.39 | 1.41 |
| **4.17** | **3.96** | **3.98** | **3.68** | **3.71** | **3.30** | **3.37** | **4.53** | **4.19** | **4.19** | **4.02** | **4.03** | **3.77** | **3.84** |
| 1.42 | 1.34 | 1.35 | 1.20 | 1.20 | 0.97 | 0.99 | 1.43 | 1.29 | 1.29 | 1.18 | 1.19 | 1.02 | 1.07 |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 0.52 | 0.49 | 0.49 | 0.44 | 0.44 | 0.35 | 0.36 | 0.56 | 0.50 | 0.50 | 0.45 | 0.46 | 0.39 | 0.41 |
| 0.22 | 0.21 | 0.21 | 0.19 | 0.19 | 0.15 | 0.15 | 0.24 | 0.21 | 0.21 | 0.19 | 0.19 | 0.16 | 0.17 |
| 1.60 | 1.52 | 1.52 | 1.38 | 1.39 | 1.15 | 1.18 | 1.66 | 1.52 | 1.52 | 1.41 | 1.42 | 1.24 | 1.30 |
| **3.79** | **3.59** | **3.61** | **3.22** | **3.24** | **2.65** | **2.71** | **3.93** | **3.55** | **3.56** | **3.27** | **3.29** | **2.84** | **2.97** |
| 0.16 | 0.15 | 0.15 | 0.14 | 0.14 | 0.11 | 0.12 | 0.14 | 0.13 | 0.13 | 0.12 | 0.12 | 0.10 | 0.11 |
| 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 |
| 0.17 | 0.16 | 0.17 | 0.15 | 0.15 | 0.12 | 0.13 | 0.18 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.14 |
| **0.38** | **0.36** | **0.36** | **0.33** | **0.33** | **0.26** | **0.28** | **0.36** | **0.33** | **0.33** | **0.31** | **0.32** | **0.26** | **0.28** |
| **0.35** | **0.34** | **0.34** | **0.33** | **0.33** | **0.31** | **0.31** | **0.36** | **0.34** | **0.34** | **0.34** | **0.34** | **0.31** | **0.32** |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 1.68 | 1.59 | 1.60 | 1.43 | 1.44 | 1.17 | 1.20 | 1.67 | 1.51 | 1.51 | 1.39 | 1.40 | 1.20 | 1.26 |
| 0.58 | 0.55 | 0.55 | 0.51 | 0.51 | 0.45 | 0.46 | 0.58 | 0.54 | 0.53 | 0.51 | 0.51 | 0.48 | 0.49 |
| 0.74 | 0.70 | 0.70 | 0.63 | 0.63 | 0.52 | 0.53 | 0.76 | 0.69 | 0.69 | 0.63 | 0.64 | 0.55 | 0.58 |
| 0.19 | 0.18 | 0.18 | 0.16 | 0.16 | 0.15 | 0.15 | 0.19 | 0.17 | 0.17 | 0.16 | 0.17 | 0.15 | 0.15 |
| 0.25 | 0.24 | 0.24 | 0.21 | 0.21 | 0.17 | 0.17 | 0.26 | 0.23 | 0.23 | 0.21 | 0.21 | 0.18 | 0.19 |
| 1.28 | 1.20 | 1.20 | 1.08 | 1.10 | 0.94 | 0.96 | 1.31 | 1.16 | 1.16 | 1.09 | 1.10 | 0.98 | 1.02 |
| 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.07 | 0.07 | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 |
| 0.28 | 0.27 | 0.27 | 0.25 | 0.26 | 0.23 | 0.24 | 0.34 | 0.32 | 0.32 | 0.31 | 0.32 | 0.30 | 0.31 |
| 3.45 | 3.30 | 3.32 | 3.05 | 3.08 | 2.66 | 2.73 | 3.79 | 3.52 | 3.53 | 3.36 | 3.38 | 3.07 | 3.17 |
| **8.69** | **8.26** | **8.30** | **7.56** | **7.62** | **6.52** | **6.67** | **9.18** | **8.41** | **8.42** | **7.94** | **7.98** | **7.18** | **7.42** |

**Table A5. Commercial Sector Key Indicators and End-Use Consumption (Continued)**
(Quadrillion Btu per Year, Unless Otherwise Noted)

| Key Indicators and Consumption | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Electricity Related Losses** | **7.52** | **8.23** | **8.11** | **7.87** | **7.46** | **6.97** | **7.27** | **6.08** |
| **Total Energy Consumption by End-Use** | | | | | | | | |
| Space Heating | 1.91 | 1.88 | 1.87 | 1.83 | 1.76 | 1.68 | 1.72 | 1.45 |
| Space Cooling | 1.67 | 1.70 | 1.68 | 1.62 | 1.56 | 1.46 | 1.52 | 1.29 |
| Water Heating | 1.07 | 1.08 | 1.08 | 1.05 | 1.01 | 0.95 | 0.98 | 0.83 |
| Ventilation | 0.55 | 0.57 | 0.56 | 0.54 | 0.52 | 0.49 | 0.50 | 0.43 |
| Cooking | 0.28 | 0.30 | 0.30 | 0.29 | 0.28 | 0.27 | 0.28 | 0.23 |
| Lighting | 3.76 | 3.88 | 3.83 | 3.71 | 3.53 | 3.29 | 3.44 | 2.85 |
| Refrigeration | 0.45 | 0.47 | 0.47 | 0.47 | 0.46 | 0.45 | 0.46 | 0.43 |
| Office Equipment (PC) | 0.22 | 0.25 | 0.25 | 0.25 | 0.23 | 0.22 | 0.23 | 0.20 |
| Office Equipment (non-PC) | 0.63 | 0.78 | 0.77 | 0.75 | 0.71 | 0.68 | 0.70 | 0.60 |
| Other Uses[6] | 4.43 | 5.59 | 5.56 | 5.44 | 5.22 | 5.00 | 5.10 | 4.46 |
| **Total** | **14.98** | **16.51** | **16.37** | **15.96** | **15.29** | **14.49** | **14.93** | **12.77** |
| **Non-Marketed Renewable Fuels** | | | | | | | | |
| Solar[7] | 0.01 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| **Total** | **0.01** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** |

## Table A5. Commercial Sector Key Indicators and End-Use Consumption (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **8.39** | **7.60** | **7.63** | **6.38** | **6.38** | **5.64** | **5.67** | **8.39** | **6.90** | **6.95** | **6.06** | **6.10** | **5.88** | **6.05** |
| 1.89 | 1.78 | 1.79 | 1.59 | 1.60 | 1.31 | 1.34 | 1.85 | 1.66 | 1.66 | 1.52 | 1.53 | 1.33 | 1.39 |
| 1.66 | 1.53 | 1.53 | 1.34 | 1.33 | 1.19 | 1.20 | 1.58 | 1.36 | 1.36 | 1.24 | 1.24 | 1.19 | 1.22 |
| 1.08 | 1.01 | 1.01 | 0.89 | 0.89 | 0.75 | 0.76 | 1.06 | 0.93 | 0.93 | 0.85 | 0.85 | 0.76 | 0.79 |
| 0.56 | 0.52 | 0.52 | 0.45 | 0.44 | 0.39 | 0.39 | 0.54 | 0.46 | 0.46 | 0.41 | 0.41 | 0.39 | 0.40 |
| 0.31 | 0.29 | 0.29 | 0.25 | 0.25 | 0.21 | 0.21 | 0.31 | 0.27 | 0.27 | 0.24 | 0.25 | 0.21 | 0.22 |
| 3.85 | 3.49 | 3.51 | 2.96 | 2.98 | 2.54 | 2.58 | 3.73 | 3.08 | 3.10 | 2.74 | 2.76 | 2.52 | 2.62 |
| 0.48 | 0.46 | 0.46 | 0.43 | 0.43 | 0.42 | 0.42 | 0.47 | 0.44 | 0.44 | 0.41 | 0.41 | 0.42 | 0.42 |
| 0.27 | 0.25 | 0.25 | 0.22 | 0.22 | 0.20 | 0.20 | 0.30 | 0.26 | 0.26 | 0.24 | 0.24 | 0.24 | 0.24 |
| 0.85 | 0.79 | 0.79 | 0.69 | 0.70 | 0.62 | 0.63 | 0.98 | 0.86 | 0.86 | 0.79 | 0.79 | 0.77 | 0.79 |
| 6.12 | 5.73 | 5.77 | 5.12 | 5.16 | 4.52 | 4.61 | 6.74 | 5.99 | 6.02 | 5.56 | 5.59 | 5.24 | 5.39 |
| **17.08** | **15.86** | **15.93** | **13.94** | **14.00** | **12.16** | **12.34** | **17.57** | **15.31** | **15.37** | **14.00** | **14.08** | **13.06** | **13.47** |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** |

[1]Includes miscellaneous uses, such as service station equipment, district services, automated teller machines, telecommunications equipment, and medical equipment.

[2]Excludes estimated consumption from independent power producers.

[3]Includes miscellaneous uses, such as district services, pumps, lighting, emergency electric generators, and manufacturing performed in commercial buildings.

[4]Includes miscellaneous uses, such as cooking, district services, and emergency electric generators.

[5]Includes residual fuel oil, liquefied petroleum gas, coal, motor gasoline, and kerosene.

[6]Includes miscellaneous uses, such as service station equipment, district services, automated teller machines, telecommunications equipment, medical equipment, pumps, lighting, emergency electric generators, 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 water heaters.

Btu = British thermal unit.

PC = Personal computer.

Note: Totals may not equal sum of components due to independent rounding. Consumption values of 0.000 are values that round to 0.00, because they are less than 0.005.

**Sources:** 1996 Energy Information Administration, *Short-Term Energy Outlook, August 1997*, Online. http://www.eia.doe.gov/emeu/steo/ pub/upd/aug97/index.html (August 21, 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A6. Industrial Sector Key Indicators and Consumption

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Key Indicators and Consumption | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Key Indicators** | | | | | | | | | |
| **Value of Gross Output (billion 1987 dollars)** | | | | | | | | | |
| Manufacturing | 3030 | 3798 | 3797 | 3733 | 3756 | 3700 | 3736 | 3641 |
| Nonmanufacturing | 774 | 896 | 895 | 881 | 883 | 871 | 877 | 856 |
| **Total** | **3805** | **4694** | **4692** | **4614** | **4639** | **4571** | **4613** | **4496** |
| **Energy Prices (1996 dollars per million Btu)** | | | | | | | | |
| Electricity | 13.37 | 11.57 | 11.83 | 12.92 | 14.61 | 16.15 | 15.56 | 20.39 |
| Natural Gas | 2.96 | 2.80 | 2.88 | 3.22 | 3.93 | 4.64 | 4.36 | 6.89 |
| Steam Coal | 1.46 | 1.30 | 1.42 | 2.10 | 3.27 | 4.38 | 3.96 | 7.84 |
| Residual Oil | 2.99 | 2.75 | 2.84 | 3.32 | 4.34 | 5.18 | 4.90 | 7.95 |
| Distillate Oil | 5.50 | 5.43 | 5.53 | 5.93 | 6.87 | 7.62 | 7.38 | 10.11 |
| Liquefied Petroleum Gas | 7.80 | 6.70 | 6.83 | 7.06 | 7.80 | 8.36 | 8.24 | 10.18 |
| Motor Gasoline | 9.86 | 8.77 | 8.94 | 9.27 | 10.21 | 10.88 | 10.71 | 13.05 |
| Metallurgical Coal | 1.77 | 1.63 | 1.76 | 2.43 | 3.60 | 4.70 | 4.28 | 8.16 |
| **Energy Consumption** | | | | | | | | |
| **Consumption**[1] | | | | | | | | |
| Purchased Electricity | 3.46 | 4.05 | 4.03 | 3.93 | 3.92 | 3.75 | 3.85 | 3.58 |
| Natural Gas[2] | 9.96 | 10.97 | 10.97 | 10.76 | 11.11 | 10.96 | 11.14 | 11.03 |
| Steam Coal | 1.55 | 1.69 | 1.67 | 1.51 | 1.24 | 1.07 | 1.15 | 0.86 |
| Metallurgical Coal and Coke[3] | 0.85 | 0.92 | 0.92 | 0.90 | 0.89 | 0.86 | 0.88 | 0.83 |
| Residual Fuel | 0.34 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.34 | 0.31 |
| Distillate | 1.17 | 1.33 | 1.33 | 1.31 | 1.33 | 1.31 | 1.33 | 1.33 |
| Liquefied Petroleum Gas | 2.12 | 2.28 | 2.28 | 2.23 | 2.25 | 2.22 | 2.24 | 2.22 |
| Petrochemical Feedstocks | 1.28 | 1.39 | 1.39 | 1.35 | 1.36 | 1.34 | 1.35 | 1.31 |
| Other Petroleum[4] | 4.31 | 4.78 | 4.77 | 4.72 | 4.67 | 4.54 | 4.58 | 4.30 |
| Renewables[5] | 1.82 | 2.11 | 2.11 | 2.09 | 2.10 | 2.10 | 2.09 | 2.08 |
| **Delivered Energy** | **26.87** | **29.87** | **29.82** | **29.14** | **29.21** | **28.46** | **28.95** | **27.83** |
| Electricity Related Losses | 7.72 | 8.52 | 8.39 | 8.12 | 7.91 | 7.34 | 7.71 | 6.71 |
| **Total** | **34.59** | **38.39** | **38.22** | **37.26** | **37.12** | **35.80** | **36.66** | **34.54** |
| **Consumption per Unit of Output**[1] **(thousand Btu per 1987 dollars)** | | | | | | | | |
| Purchased Electricity | 0.91 | 0.86 | 0.86 | 0.85 | 0.84 | 0.82 | 0.83 | 0.80 |
| Natural Gas[2] | 2.62 | 2.34 | 2.34 | 2.33 | 2.39 | 2.40 | 2.41 | 2.45 |
| Steam Coal | 0.41 | 0.36 | 0.36 | 0.33 | 0.27 | 0.23 | 0.25 | 0.19 |
| Metallurgical Coal and Coke[3] | 0.22 | 0.20 | 0.20 | 0.19 | 0.19 | 0.19 | 0.19 | 0.18 |
| Residual Fuel | 0.09 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| Distillate | 0.31 | 0.28 | 0.28 | 0.28 | 0.29 | 0.29 | 0.29 | 0.30 |
| Liquefied Petroleum Gas | 0.56 | 0.49 | 0.49 | 0.48 | 0.49 | 0.48 | 0.49 | 0.49 |
| Petrochemical Feedstocks | 0.34 | 0.30 | 0.30 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 |
| Other Petroleum[4] | 1.13 | 1.02 | 1.02 | 1.02 | 1.01 | 0.99 | 0.99 | 0.96 |
| Renewables[5] | 0.48 | 0.45 | 0.45 | 0.45 | 0.45 | 0.46 | 0.45 | 0.46 |
| **Delivered Energy** | **7.06** | **6.36** | **6.36** | **6.31** | **6.30** | **6.23** | **6.27** | **6.19** |
| Electricity Related Losses | 2.03 | 1.82 | 1.79 | 1.76 | 1.71 | 1.61 | 1.67 | 1.49 |
| **Total** | **9.09** | **8.18** | **8.15** | **8.07** | **8.00** | **7.83** | **7.95** | **7.68** |

## Table A6. Industrial Sector Key Indicators and Consumption (Continued)

(Quadrillion Btu per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 4316 | 4262 | 4247 | 4188 | 4250 | 4026 | 4142 | 4954 | 4850 | 4788 | 4797 | 4818 | 4751 | 4616 |
| 967 | 952 | 961 | 937 | 955 | 906 | 940 | 1061 | 1044 | 1047 | 1035 | 1035 | 1036 | 1027 |
| **5283** | **5214** | **5208** | **5126** | **5205** | **4932** | **5083** | **6015** | **5894** | **5835** | **5832** | **5853** | **5786** | **5644** |
| 11.28 | 13.86 | 13.59 | 17.12 | 16.59 | 21.51 | 20.49 | 10.31 | 13.83 | 13.79 | 15.38 | 15.19 | 17.67 | 16.90 |
| 2.98 | 3.96 | 3.87 | 5.74 | 5.60 | 8.65 | 8.30 | 3.25 | 5.06 | 5.03 | 6.35 | 6.24 | 8.50 | 7.80 |
| 1.26 | 2.96 | 2.83 | 5.37 | 5.03 | 10.03 | 9.21 | 1.18 | 3.67 | 3.59 | 4.72 | 4.62 | 8.83 | 7.86 |
| 2.94 | 4.17 | 4.03 | 5.96 | 5.66 | 9.65 | 8.83 | 3.16 | 4.97 | 4.82 | 5.74 | 5.53 | 8.91 | 7.99 |
| 5.68 | 6.76 | 6.66 | 8.35 | 8.09 | 11.70 | 10.90 | 5.86 | 7.40 | 7.22 | 8.10 | 7.88 | 10.97 | 10.06 |
| 7.01 | 7.79 | 7.73 | 8.76 | 8.52 | 11.37 | 10.79 | 6.99 | 8.12 | 7.72 | 8.47 | 8.42 | 10.87 | 9.99 |
| 9.13 | 10.26 | 10.10 | 11.57 | 11.35 | 14.50 | 13.74 | 9.33 | 10.78 | 10.53 | 11.36 | 11.09 | 13.83 | 12.92 |
| 1.58 | 3.28 | 3.15 | 5.69 | 5.35 | 10.36 | 9.54 | 1.51 | 4.00 | 3.92 | 5.05 | 4.95 | 9.19 | 8.22 |
| 4.30 | 4.13 | 4.11 | 3.95 | 4.00 | 3.67 | 3.78 | 4.51 | 4.27 | 4.23 | 4.13 | 4.13 | 3.98 | 3.88 |
| 11.43 | 11.47 | 11.39 | 11.54 | 11.50 | 11.12 | 11.06 | 11.78 | 11.65 | 11.55 | 11.31 | 11.23 | 11.37 | 10.84 |
| 1.74 | 1.36 | 1.37 | 1.07 | 1.12 | 0.83 | 0.86 | 1.79 | 1.36 | 1.35 | 1.26 | 1.26 | 0.90 | 0.92 |
| 0.90 | 0.87 | 0.86 | 0.83 | 0.81 | 0.81 | 0.79 | 0.85 | 0.76 | 0.75 | 0.73 | 0.71 | 0.72 | 0.69 |
| 0.35 | 0.35 | 0.35 | 0.36 | 0.36 | 0.41 | 0.43 | 0.35 | 0.37 | 0.37 | 0.50 | 0.52 | 0.44 | 0.44 |
| 1.42 | 1.41 | 1.41 | 1.43 | 1.44 | 1.44 | 1.47 | 1.52 | 1.52 | 1.53 | 1.55 | 1.55 | 1.58 | 1.55 |
| 2.44 | 2.40 | 2.38 | 2.38 | 2.41 | 2.37 | 2.43 | 2.52 | 2.47 | 2.44 | 2.46 | 2.47 | 2.47 | 2.52 |
| 1.48 | 1.45 | 1.43 | 1.41 | 1.43 | 1.35 | 1.38 | 1.52 | 1.46 | 1.44 | 1.44 | 1.44 | 1.41 | 1.37 |
| 5.03 | 4.92 | 4.93 | 4.84 | 4.87 | 4.44 | 4.68 | 5.34 | 5.34 | 5.34 | 5.41 | 5.35 | 5.08 | 5.04 |
| 2.25 | 2.25 | 2.25 | 2.23 | 2.29 | 2.17 | 2.27 | 2.35 | 2.39 | 2.39 | 2.39 | 2.40 | 2.40 | 2.39 |
| **31.35** | **30.60** | **30.50** | **30.04** | **30.23** | **28.61** | **29.15** | **32.53** | **31.59** | **31.39** | **31.19** | **31.06** | **30.34** | **29.63** |
| 8.65 | 7.92 | 7.88 | 6.85 | 6.87 | 6.28 | 6.37 | 8.37 | 7.05 | 7.01 | 6.23 | 6.24 | 6.20 | 6.10 |
| **40.00** | **38.52** | **38.38** | **36.89** | **37.11** | **34.88** | **35.52** | **40.89** | **38.64** | **38.40** | **37.42** | **37.30** | **36.55** | **35.74** |
| 0.81 | 0.79 | 0.79 | 0.77 | 0.77 | 0.74 | 0.74 | 0.75 | 0.73 | 0.72 | 0.71 | 0.71 | 0.69 | 0.69 |
| 2.16 | 2.20 | 2.19 | 2.25 | 2.21 | 2.26 | 2.18 | 1.96 | 1.98 | 1.98 | 1.94 | 1.92 | 1.97 | 1.92 |
| 0.33 | 0.26 | 0.26 | 0.21 | 0.21 | 0.17 | 0.17 | 0.30 | 0.23 | 0.23 | 0.22 | 0.22 | 0.16 | 0.16 |
| 0.17 | 0.17 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.14 | 0.13 | 0.13 | 0.13 | 0.12 | 0.12 | 0.12 |
| 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 | 0.06 | 0.06 | 0.09 | 0.09 | 0.08 | 0.08 |
| 0.27 | 0.27 | 0.27 | 0.28 | 0.28 | 0.29 | 0.29 | 0.25 | 0.26 | 0.26 | 0.27 | 0.26 | 0.27 | 0.27 |
| 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.48 | 0.48 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.43 | 0.45 |
| 0.28 | 0.28 | 0.28 | 0.27 | 0.27 | 0.27 | 0.27 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.24 | 0.24 |
| 0.95 | 0.94 | 0.95 | 0.94 | 0.94 | 0.90 | 0.92 | 0.89 | 0.91 | 0.92 | 0.93 | 0.91 | 0.88 | 0.89 |
| 0.43 | 0.43 | 0.43 | 0.44 | 0.44 | 0.44 | 0.45 | 0.39 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.42 |
| **5.93** | **5.87** | **5.86** | **5.86** | **5.81** | **5.80** | **5.73** | **5.41** | **5.36** | **5.38** | **5.35** | **5.31** | **5.24** | **5.25** |
| 1.64 | 1.52 | 1.51 | 1.34 | 1.32 | 1.27 | 1.25 | 1.39 | 1.20 | 1.20 | 1.07 | 1.07 | 1.07 | 1.08 |
| **7.57** | **7.39** | **7.37** | **7.20** | **7.13** | **7.07** | **6.99** | **6.80** | **6.56** | **6.58** | **6.42** | **6.37** | **6.32** | **6.33** |

[1]Fuel consumption includes consumption for cogeneration.

[2]Includes lease and plant fuel.

[3]Includes net coke coal imports.

[4]Includes petroleum coke, asphalt, road oil, lubricants, motor gasoline, still gas, and miscellaneous petroleum products.

[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.

**Sources:** 1996 prices for gasoline and distillate are based on prices in various issues of Energy Information Administration (EIA), *Petroleum Marketing Monthly*, DOE/EIA-0380(96/03-97/04) (Washington, DC, 1996 - 97). 1996 coal prices: EIA, *Monthly Energy Review*, DOE/EIA-0035(97/08) (Washington, DC, August 1997). 1996 electricity prices: EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A. Other 1996 prices derived from EIA, *State Energy Data Report 1994*. Online. ftp://ftp.eia.doe.gov/pub/state.data/021494.pdf (August 26, 1997). Other 1996 values: EIA, *Short-Term Energy Outlook, August 1997*. Online. http://www.eia.doe.gov/emeu/steo/pub/upd/aug97/index.html (August 21, 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A7. Transportation Sector Key Indicators and Delivered Energy Consumption

| Key Indicators and Consumption | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Key Indicators** | | | | | | | | | |
| Level of Travel (billions) | | | | | | | | | |
| Light-Duty Vehicles <8,500 lbs. (VMT) | 2276 | 2668 | 2665 | 2656 | 2639 | 2586 | 2622 | 2453 |
| Commercial Light Trucks (VMT)[1] | 67 | 80 | 80 | 79 | 79 | 78 | 78 | 75 |
| Freight Trucks >10,000 lbs. (VMT) | 162 | 212 | 212 | 209 | 210 | 208 | 208 | 205 |
| Air (seat miles available) | 999 | 1472 | 1471 | 1450 | 1453 | 1402 | 1431 | 1281 |
| Rail (ton miles traveled) | 1218 | 1529 | 1499 | 1450 | 1379 | 1291 | 1311 | 1108 |
| Marine (ton miles traveled) | 779 | 862 | 859 | 841 | 841 | 821 | 831 | 796 |
| **Energy Efficiency Indicators** | | | | | | | | | |
| New Car (miles per gallon)[2] | 28.2 | 29.8 | 29.9 | 30.5 | 30.7 | 32.1 | 31.0 | 33.8 |
| New Light Truck (miles per gallon)[2] | 20.9 | 20.0 | 20.1 | 20.5 | 20.6 | 21.4 | 20.8 | 22.4 |
| Light-Duty Fleet (miles per gallon)[3] | 20.2 | 20.3 | 20.3 | 20.4 | 20.3 | 20.7 | 20.3 | 21.0 |
| New Commercial Light Truck (MPG)[1] | 20.2 | 19.3 | 19.4 | 19.8 | 19.9 | 20.7 | 20.1 | 21.8 |
| Stock Commercial Light Truck (MPG)[1] | 14.5 | 14.8 | 14.8 | 14.9 | 14.9 | 15.1 | 14.9 | 15.2 |
| Aircraft Efficiency (seat miles per gallon) | 50.6 | 53.9 | 53.9 | 53.8 | 53.9 | 53.8 | 53.8 | 53.6 |
| Freight Truck Efficiency (miles per gallon) | 5.6 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 |
| Rail Efficiency (ton miles per thousand Btu) | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| Domestic Shipping Efficiency (ton miles per thousand Btu) | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| **Energy Use by Mode (quadrillion Btu)** | | | | | | | | | |
| Light-Duty Vehicles | 13.95 | 16.51 | 16.49 | 16.31 | 16.29 | 15.64 | 16.16 | 14.59 |
| Commercial Light Trucks[1] | 0.58 | 0.67 | 0.67 | 0.66 | 0.66 | 0.64 | 0.66 | 0.62 |
| Freight Trucks | 4.04 | 4.93 | 4.93 | 4.86 | 4.89 | 4.81 | 4.88 | 4.74 |
| Air | 3.32 | 4.40 | 4.40 | 4.35 | 4.35 | 4.22 | 4.30 | 3.92 |
| Rail | 0.53 | 0.63 | 0.62 | 0.60 | 0.58 | 0.54 | 0.55 | 0.48 |
| Marine | 1.43 | 1.70 | 1.70 | 1.69 | 1.70 | 1.68 | 1.69 | 1.67 |
| Pipeline Fuel | 0.73 | 0.80 | 0.83 | 0.81 | 0.82 | 0.83 | 0.83 | 0.89 |
| Other[4] | 0.24 | 0.28 | 0.28 | 0.27 | 0.28 | 0.27 | 0.28 | 0.26 |
| **Total** | **24.73** | **29.81** | **29.81** | **29.45** | **29.45** | **28.55** | **29.22** | **27.06** |

## Table A7. Transportation Sector Key Indicators and Delivered Energy Consumption (Continued)

| Projections | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | |
| 2895 | 2857 | 2877 | 2752 | 2789 | 2505 | 2597 | 3247 | 3191 | 3223 | 3147 | 3172 | 2960 | 3050 | |
| 87 | 86 | 87 | 84 | 85 | 79 | 82 | 98 | 97 | 97 | 96 | 96 | 93 | 93 | |
| 232 | 229 | 230 | 226 | 230 | 220 | 227 | 250 | 247 | 246 | 245 | 246 | 246 | 243 | |
| 1753 | 1729 | 1738 | 1638 | 1685 | 1434 | 1530 | 2285 | 2232 | 2254 | 2197 | 2207 | 2060 | 2108 | |
| 1644 | 1499 | 1506 | 1266 | 1285 | 1084 | 1105 | 1784 | 1457 | 1462 | 1242 | 1244 | 1113 | 1099 | |
| 916 | 889 | 890 | 863 | 866 | 818 | 827 | 965 | 913 | 910 | 884 | 878 | 846 | 834 | |
| 30.6 | 32.0 | 32.1 | 33.6 | 33.2 | 36.4 | 35.3 | 31.6 | 33.1 | 33.5 | 33.6 | 34.2 | 35.6 | 35.6 | |
| 20.4 | 21.2 | 21.5 | 22.1 | 22.1 | 23.7 | 23.3 | 21.8 | 22.7 | 23.4 | 23.0 | 23.8 | 24.1 | 24.7 | |
| 20.5 | 20.7 | 20.9 | 21.2 | 21.5 | 21.7 | 22.4 | 21.4 | 22.2 | 22.5 | 22.6 | 23.0 | 24.0 | 24.2 | |
| 19.5 | 20.4 | 20.6 | 21.3 | 21.2 | 22.9 | 22.5 | 20.4 | 21.3 | 22.0 | 21.7 | 22.5 | 22.8 | 23.3 | |
| 15.0 | 15.1 | 15.2 | 15.3 | 15.5 | 15.5 | 15.9 | 15.4 | 15.8 | 16.1 | 16.0 | 16.4 | 16.6 | 17.0 | |
| 55.6 | 55.6 | 55.8 | 55.6 | 55.8 | 55.4 | 55.7 | 59.4 | 59.7 | 59.8 | 59.8 | 59.9 | 59.9 | 60.0 | |
| 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.2 | 6.3 | 6.3 | 6.3 | 6.5 | 6.5 | 6.6 | 6.7 | |
| 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 17.75 | 17.29 | 17.25 | 16.27 | 16.24 | 14.39 | 14.49 | 19.04 | 18.09 | 17.93 | 17.49 | 17.27 | 15.54 | 15.84 | |
| 0.73 | 0.71 | 0.71 | 0.69 | 0.69 | 0.64 | 0.64 | 0.80 | 0.77 | 0.75 | 0.75 | 0.73 | 0.70 | 0.68 | |
| 5.21 | 5.15 | 5.17 | 5.07 | 5.13 | 4.92 | 5.02 | 5.41 | 5.31 | 5.30 | 5.17 | 5.14 | 5.09 | 4.95 | |
| 5.03 | 4.96 | 4.97 | 4.73 | 4.83 | 4.23 | 4.45 | 6.00 | 5.84 | 5.88 | 5.74 | 5.76 | 5.41 | 5.52 | |
| 0.66 | 0.61 | 0.61 | 0.53 | 0.54 | 0.46 | 0.47 | 0.69 | 0.58 | 0.58 | 0.51 | 0.51 | 0.46 | 0.46 | |
| 1.91 | 1.90 | 1.90 | 1.89 | 1.90 | 1.86 | 1.89 | 2.25 | 2.24 | 2.25 | 2.23 | 2.23 | 2.23 | 2.23 | |
| 0.87 | 0.90 | 0.89 | 0.96 | 0.99 | 0.95 | 0.95 | 0.98 | 1.05 | 1.05 | 1.10 | 1.10 | 1.05 | 1.05 | |
| 0.30 | 0.30 | 0.30 | 0.29 | 0.30 | 0.27 | 0.29 | 0.32 | 0.32 | 0.33 | 0.32 | 0.32 | 0.33 | 0.33 | |
| **32.35** | **31.70** | **31.70** | **30.30** | **30.49** | **27.60** | **28.07** | **35.37** | **34.08** | **33.96** | **33.19** | **32.95** | **30.69** | **30.95** | |

[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.
[4]Includes lubricants and aviation gasoline.
Btu = British thermal unit.
VMT=Vehicle miles traveled.
MPG = Miles per gallon.
Lbs. = Pounds.
Note: Totals may not equal sum of components due to independent rounding.
**Sources:** 1996: Federal Aviation Administration (FAA), *FAA Aviation Forecasts Fiscal Years 1996-2007*, (Washington, DC, February 1995); Energy Information Administration (EIA), *Short-Term Energy Outlook, August 1997*, Online. http://ww.eia.doe.gov/emeu/steo/pub/upd /aug97/index.html (August 21, 1997); EIA, *Fuel Oil and Kerosene Sales 1996*, DOE/EIA-0535(96) (Washington, DC, September 1997); and United States Department of Defense, Defense Fuel Supply Center. **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A8. Electricity Supply, Disposition, and Prices

(Billion Kilowatthours, Unless Otherwise Noted)

| Supply, Disposition, and Prices | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Generation by Fuel Type** | | | | | | | | |
| **Electric Generators**[1] | | | | | | | | |
| Coal | 1758 | 2019 | 1949 | 1865 | 1681 | 1400 | 1504 | 765 |
| Petroleum | 80 | 42 | 41 | 38 | 36 | 32 | 35 | 38 |
| Natural Gas | 288 | 612 | 671 | 664 | 777 | 922 | 863 | 1274 |
| Nuclear Power | 675 | 651 | 683 | 683 | 683 | 689 | 698 | 698 |
| Pumped Storage | -2 | -3 | -3 | -3 | -3 | -3 | -3 | -3 |
| Renewable Sources[2] | 392 | 369 | 379 | 378 | 385 | 385 | 401 | 424 |
| **Total** | **3191** | **3690** | **3720** | **3625** | **3559** | **3425** | **3498** | **3196** |
| Non-Utility Generation for Own Use | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 6 |
| **Cogenerators**[3] | | | | | | | | |
| Coal | 51 | 51 | 51 | 51 | 50 | 50 | 50 | 49 |
| Petroleum | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Natural Gas | 196 | 214 | 214 | 215 | 222 | 221 | 224 | 228 |
| Other Gaseous Fuels[4] | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Renewable Sources[2] | 42 | 47 | 47 | 46 | 46 | 46 | 46 | 46 |
| Other[5] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Total** | **305** | **329** | **329** | **329** | **335** | **334** | **337** | **340** |
| Sales to Utilities | 156 | 161 | 161 | 161 | 162 | 161 | 162 | 162 |
| Generation for Own Use | 149 | 168 | 168 | 168 | 174 | 173 | 175 | 178 |
| **Net Imports**[6] | **38** | **67** | **21** | **21** | **21** | **21** | **21** | **21** |
| **Electricity Sales by Sector** | | | | | | | | |
| Residential | 1079 | 1271 | 1265 | 1233 | 1210 | 1174 | 1193 | 1107 |
| Commercial | 988 | 1147 | 1143 | 1117 | 1084 | 1044 | 1064 | 950 |
| Industrial | 1014 | 1188 | 1183 | 1152 | 1149 | 1099 | 1129 | 1049 |
| Transportation | 17 | 24 | 24 | 24 | 24 | 24 | 24 | 23 |
| **Total** | **3098** | **3630** | **3615** | **3527** | **3467** | **3341** | **3410** | **3129** |
| **End-Use Prices (1996 cents per kilowatthour)**[7] | | | | | | | | |
| Residential | 8.3 | 7.4 | 7.5 | 8.0 | 9.1 | 9.9 | 9.6 | 12.4 |
| Commercial | 7.5 | 6.6 | 6.7 | 7.3 | 8.3 | 9.1 | 8.8 | 11.6 |
| Industrial | 4.6 | 3.9 | 4.0 | 4.4 | 5.0 | 5.5 | 5.3 | 7.0 |
| Transportation | 5.2 | 4.6 | 4.6 | 4.7 | 4.8 | 4.9 | 4.8 | 5.3 |
| **All Sectors Average** | **6.8** | **6.0** | **6.1** | **6.6** | **7.4** | **8.2** | **7.9** | **10.3** |

## Table A8. Electricity Supply, Disposition, and Prices (Continued)

(Billion Kilowatthours, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 2075 | 1709 | 1723 | 977 | 973 | 385 | 361 | 2186 | 1297 | 1319 | 508 | 522 | 27 | 28 |
| 36 | 30 | 30 | 25 | 23 | 40 | 38 | 29 | 19 | 21 | 64 | 113 | 40 | 51 |
| 868 | 1050 | 1040 | 1518 | 1548 | 1708 | 1743 | 1362 | 1858 | 1831 | 2243 | 2188 | 2138 | 2072 |
| 578 | 626 | 626 | 654 | 665 | 693 | 689 | 356 | 474 | 468 | 552 | 554 | 694 | 671 |
| -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 |
| 373 | 389 | 388 | 409 | 408 | 466 | 535 | 383 | 437 | 425 | 571 | 566 | 857 | 943 |
| **3928** | **3801** | **3803** | **3581** | **3613** | **3288** | **3362** | **4312** | **4081** | **4061** | **3935** | **3941** | **3752** | **3762** |
| 6 | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 |
| 51 | 50 | 50 | 50 | 50 | 49 | 49 | 51 | 50 | 50 | 49 | 49 | 49 | 49 |
| 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 9 | 7 | 7 |
| 222 | 227 | 223 | 233 | 228 | 240 | 233 | 217 | 222 | 221 | 228 | 222 | 234 | 228 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 50 | 50 | 50 | 49 | 51 | 48 | 50 | 51 | 53 | 53 | 53 | 53 | 53 | 53 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **339** | **343** | **340** | **349** | **345** | **353** | **349** | **336** | **341** | **341** | **348** | **344** | **353** | **347** |
| 163 | 163 | 163 | 164 | 163 | 165 | 164 | 162 | 163 | 163 | 164 | 163 | 165 | 164 |
| 177 | 180 | 178 | 185 | 182 | 189 | 186 | 174 | 178 | 178 | 184 | 180 | 188 | 183 |
| **64** | **10** | **10** | **10** | **10** | **10** | **10** | **59** | **4** | **4** | **4** | **4** | **4** | **4** |
| 1354 | 1296 | 1297 | 1228 | 1234 | 1150 | 1164 | 1552 | 1456 | 1451 | 1414 | 1414 | 1363 | 1375 |
| 1221 | 1161 | 1167 | 1078 | 1088 | 966 | 987 | 1328 | 1227 | 1227 | 1177 | 1182 | 1104 | 1127 |
| 1260 | 1210 | 1205 | 1157 | 1172 | 1075 | 1109 | 1323 | 1253 | 1238 | 1210 | 1209 | 1165 | 1137 |
| 30 | 30 | 30 | 29 | 29 | 27 | 28 | 37 | 36 | 36 | 36 | 36 | 34 | 34 |
| **3865** | **3696** | **3698** | **3492** | **3523** | **3219** | **3287** | **4240** | **3972** | **3953** | **3837** | **3842** | **3665** | **3673** |
| 7.3 | 8.7 | 8.6 | 10.7 | 10.3 | 13.3 | 12.6 | 6.9 | 9.0 | 9.0 | 10.0 | 9.8 | 11.4 | 10.9 |
| 6.4 | 7.9 | 7.7 | 9.8 | 9.5 | 12.4 | 11.8 | 6.0 | 8.1 | 8.0 | 8.9 | 8.8 | 10.3 | 9.8 |
| 3.8 | 4.7 | 4.6 | 5.8 | 5.7 | 7.3 | 7.0 | 3.5 | 4.7 | 4.7 | 5.2 | 5.2 | 6.0 | 5.8 |
| 4.5 | 4.7 | 4.7 | 5.0 | 4.9 | 5.4 | 5.2 | 4.2 | 4.4 | 4.4 | 4.5 | 4.4 | 4.5 | 4.5 |
| **5.9** | **7.1** | **7.0** | **8.8** | **8.5** | **11.0** | **10.4** | **5.6** | **7.3** | **7.3** | **8.1** | **8.0** | **9.3** | **8.9** |

[1]Includes grid-connected generation at all utilities and nonutilities except for cogenerators. Includes small power producers, exempt wholesale generators, and generators at industrial and commercial facilities which provide electricity for on-site use and for sales to utilities.

[2]Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power.

[3]Cogenerators produce electricity and other useful thermal energy. Includes sales to utilities and generation for own use.

[4]Other gaseous fuels include refinery and still gas.

[5]Other includes hydrogen, sulfur, batteries, chemicals, fish oil, and spent sulfite liquor.

[6]In 1996 approximately two-thirds of the U.S. electricity imports were provided by renewable sources (hydroelectricity); EIA does not project future proportions.

[7]Prices represent average revenue per kilowatthour.

Kwh = kilowatthour.

Note: Totals may not equal sum of components due to independent rounding.

**Sources:** 1996 commercial and transportation sales derived from: Total transportation plus commercial sales come from Energy Information Administration (EIA), *State Energy Data Report 1994.* Online. ftp://ftp.eia.doe.gov/pub/state.data/021494.pdf (August 26, 1997), but individual sectors do not match because sales taken from commercial and placed in transportation, according to Oak Ridge National Laboratories, *Transportation Energy Data Book 16* (July 1996) which indicates the transportation value should be higher. 1996 generation by electric utilities, nonutilities, and cogenerators, net electricity imports, residential sales, and industrial sales: EIA, *Annual Energy Review 1996*, DOE/EIA-0384(96) (Washington, DC, July 1997). 1996 residential electricity prices derived from EIA, *Short Term Energy Outlook, August 1997*, Online. http://www.eia.doe.gov/emeu/ teo/pub/upd/aug97/index.html (August 21, 1997). **1996 electricity prices for commercial, industrial, and transportation; price components; and projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A9. Electricity Generating Capability
(Thousand Megawatts)

| Net Summer Capability[1] | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Electric Generators[2]** | | | | | | | | | |
| **Capability** | | | | | | | | | |
| Coal Steam | 303.7 | 305.3 | 302.1 | 301.7 | 302.1 | 290.9 | 301.9 | 287.6 |
| Other Fossil Steam[3] | 136.6 | 128.2 | 126.0 | 120.4 | 125.4 | 103.8 | 124.4 | 119.8 |
| Combined Cycle | 15.2 | 50.7 | 61.6 | 61.4 | 74.7 | 94.8 | 78.5 | 125.3 |
| Combustion Turbine/Diesel | 61.6 | 123.9 | 115.6 | 107.8 | 99.0 | 85.6 | 96.2 | 79.1 |
| Nuclear Power | 100.8 | 89.6 | 94.1 | 94.1 | 94.1 | 94.9 | 96.1 | 96.1 |
| Pumped Storage | 19.9 | 19.9 | 19.9 | 19.2 | 19.9 | 19.5 | 19.9 | 19.9 |
| Fuel Cells | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Renewable Sources[4] | 87.8 | 91.1 | 91.3 | 91.3 | 93.1 | 93.7 | 97.0 | 106.6 |
| **Total** | **725.5** | **808.8** | **810.5** | **795.9** | **808.2** | **783.2** | **814.0** | **834.4** |
| **Cumulative Planned Additions[5]** | | | | | | | | |
| Coal Steam | 2.1 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| Other Fossil Steam[3] | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Combined Cycle | 2.0 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| Combustion Turbine/Diesel | 3.8 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |
| Nuclear Power | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Pumped Storage | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Fuel Cells | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Renewable Sources[4] | 0.7 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| **Total** | **11.1** | **16.3** | **16.3** | **16.3** | **16.3** | **16.3** | **16.3** | **16.3** |
| **Cumulative Unplanned Additions[5]** | | | | | | | | |
| Coal Steam | 0.0 | 3.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Fossil Steam[3] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Combined Cycle | 0.0 | 34.2 | 45.1 | 44.9 | 58.2 | 78.3 | 62.0 | 108.7 |
| Combustion Turbine/Diesel | 5.7 | 68.4 | 59.6 | 51.5 | 43.3 | 29.9 | 40.4 | 23.2 |
| Nuclear Power | 0.0 | 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 | 0.0 |
| Fuel Cells | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Renewable Sources[4] | 0.8 | 1.4 | 1.6 | 1.6 | 3.4 | 4.0 | 7.3 | 16.9 |
| **Total** | **6.6** | **107.1** | **106.2** | **98.0** | **104.9** | **112.2** | **109.7** | **148.8** |
| **Cumulative Total Additions** | **17.7** | **123.4** | **122.5** | **114.3** | **121.2** | **128.5** | **126.0** | **165.2** |
| **Cumulative Retirements[6]** | **15.2** | **40.1** | **37.5** | **43.9** | **38.5** | **70.9** | **37.5** | **56.3** |

## Table A9. Electricity Generating Capability (Continued)

(Thousand Megawatts)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 307.8 | 299.9 | 296.3 | 275.8 | 254.6 | 258.9 | 164.5 | 313.6 | 270.5 | 274.6 | 197.5 | 205.9 | 77.8 | 83.7 |
| 123.1 | 104.2 | 104.1 | 92.7 | 81.5 | 108.0 | 110.7 | 109.3 | 73.7 | 79.1 | 49.7 | 46.1 | 71.1 | 69.6 |
| 90.1 | 117.1 | 120.5 | 186.7 | 199.5 | 191.3 | 217.1 | 182.9 | 244.3 | 237.8 | 318.0 | 323.0 | 321.4 | 318.9 |
| 152.1 | 121.8 | 118.4 | 100.1 | 87.2 | 97.9 | 84.7 | 186.6 | 137.4 | 136.7 | 109.3 | 96.5 | 116.9 | 112.5 |
| 76.0 | 83.2 | 83.2 | 88.8 | 89.2 | 95.4 | 94.1 | 47.9 | 62.9 | 62.1 | 73.8 | 74.6 | 93.4 | 90.2 |
| 19.5 | 19.2 | 19.2 | 19.5 | 19.5 | 19.9 | 19.9 | 19.2 | 19.2 | 19.2 | 19.5 | 19.5 | 19.5 | 19.9 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 91.8 | 93.7 | 93.4 | 100.1 | 100.9 | 114.9 | 137.8 | 93.6 | 107.7 | 104.4 | 140.3 | 140.2 | 191.0 | 211.7 |
| **860.5** | **839.2** | **835.2** | **863.7** | **832.5** | **886.2** | **828.8** | **953.1** | **915.7** | **913.8** | **908.2** | **906.0** | **891.1** | **906.5** |
| 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |
| 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** | **16.7** |
| 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 73.4 | 100.3 | 103.8 | 169.9 | 182.7 | 174.5 | 200.4 | 166.2 | 227.8 | 221.2 | 301.5 | 306.5 | 305.1 | 302.6 |
| 97.9 | 67.3 | 63.4 | 45.6 | 32.2 | 43.4 | 29.1 | 132.4 | 83.2 | 82.5 | 55.2 | 41.8 | 62.7 | 58.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.2 | 4.1 | 3.8 | 10.5 | 11.3 | 25.2 | 48.2 | 4.5 | 18.5 | 15.2 | 51.1 | 51.1 | 101.8 | 122.6 |
| **179.2** | **171.8** | **171.0** | **226.0** | **226.2** | **243.1** | **277.7** | **317.1** | **329.5** | **319.0** | **407.8** | **399.4** | **469.6** | **483.2** |
| **195.8** | **188.4** | **187.7** | **242.7** | **242.9** | **259.8** | **294.3** | **333.8** | **346.1** | **335.6** | **424.5** | **416.0** | **486.3** | **499.9** |
| **60.9** | **73.7** | **76.9** | **104.5** | **135.4** | **99.1** | **191.1** | **106.3** | **155.0** | **146.3** | **241.8** | **235.1** | **320.2** | **318.4** |

## Table A9. Electricity Generating Capability (Continued)
(Thousand Megawatts)

| Net Summer Capability[1] | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Cogenerators[7]** | | | | | | | | |
| **Capability** | | | | | | | | |
| Coal | 9.2 | 9.9 | 9.9 | 9.9 | 9.9 | 9.8 | 9.8 | 9.8 |
| Petroleum | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Natural Gas | 31.4 | 34.9 | 35.0 | 35.0 | 36.0 | 35.9 | 36.2 | 36.8 |
| Other Gaseous Fuels | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Renewable Sources[4] | 5.9 | 6.9 | 6.9 | 6.8 | 6.8 | 6.8 | 6.8 | 6.7 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **48.8** | **54.2** | **54.2** | **54.1** | **55.0** | **54.9** | **55.3** | **55.7** |
| **Cumulative Additions[5]** | **18.2** | **23.6** | **23.6** | **23.5** | **24.4** | **24.2** | **24.6** | **25.1** |

## Table A9. Electricity Generating Capability (Continued)

(Thousand Megawatts)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 10.0 | 10.0 | 10.0 | 9.9 | 9.9 | 9.8 | 9.9 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 9.9 | 9.9 |
| 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| 36.0 | 36.6 | 36.2 | 37.5 | 36.9 | 38.4 | 37.6 | 35.4 | 36.1 | 36.0 | 37.0 | 36.5 | 37.8 | 37.0 |
| 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 7.1 | 7.1 | 7.2 | 7.1 | 7.2 | 6.9 | 7.1 | 7.3 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **55.6** | **56.1** | **55.7** | **56.9** | **56.4** | **57.5** | **57.0** | **55.2** | **56.0** | **55.9** | **56.9** | **56.3** | **57.6** | **56.8** |
| **24.9** | **25.5** | **25.1** | **26.3** | **25.8** | **26.9** | **26.4** | **24.6** | **25.4** | **25.3** | **26.2** | **25.7** | **27.0** | **26.2** |

[1]Net summer capability 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 grid-connected utilities and nonutilities except for cogenerators. Includes small power producers, exempt wholesale generators, and generators at industrial and commercial facilities which produce electricity for on-site use and sales to utilities.

[3]Includes oil-, gas-, and dual-fired capability.

[4]Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar and wind power.

[5]Cumulative additions after December 31, 1995. Non-zero utility planned additions in 1995 indicate units operational in 1995 but not supplying power to the grid.

[6]Cumulative total retirements from 1990.

[7]Nameplate capacity is reported for nonutilities on Form EIA-867, "Annual Power Producer Report." Nameplate capacity is designated by the manufacturer. The nameplate capacity has been converted to the net summer capability based on historic relationships.

N/A = Not applicable.

Notes: Totals may not equal sum of components due to independent rounding. Net summer capability has been estimated for nonutility generators for AEO98. Net summer capacity is used to be consistent with electric utility capacity estimates. Data for electric utility capacity are the most recent data available as of August 25, 1997. Therefore, capacity estimates may differ from other Energy Information Administration sources.

**Sources:** 1996 net summer capability at electric utilities and planned additions: Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report." Net summer capability for nonutilities and cogeneration in 1996 and planned additions estimated based on EIA, Form EIA-867, "Annual Nonutility Power Producer Report." **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A10. Electricity Trade

(Billion Kilowatthours, Unless Otherwise Noted)

| Electricity Trade | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Interregional Electricity Trade** | | | | | | | | |
| Gross Domestic Firm Power Sales | 173.4 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 |
| Gross Domestic Economy Sales | 54.7 | 66.3 | 77.5 | 61.6 | 49.8 | 43.0 | 51.8 | 21.9 |
| **Gross Domestic Trade** | **228.1** | **205.5** | **216.7** | **200.9** | **189.0** | **182.2** | **191.0** | **161.1** |
| Gross Domestic Firm Power Sales (million 1996 dollars) | 8050.2 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 |
| Gross Domestic Economy Sales (million 1996 dollars) | 1283.9 | 1551.5 | 1801.0 | 1766.7 | 1914.1 | 1992.3 | 2204.0 | 1629.4 |
| **Gross Domestic Sales (million 1996 dollars)** | **9334.1** | **8014.3** | **8263.9** | **8229.6** | **8377.0** | **8455.1** | **8666.9** | **8092.3** |
| **International Electricity Trade** | | | | | | | | |
| Firm Power Imports From Canada and Mexico[1] | 26.1 | 51.4 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| Economy Imports From Canada and Mexico[1] | 20.7 | 35.8 | 35.8 | 35.9 | 35.9 | 35.8 | 35.8 | 35.7 |
| **Gross Imports From Canada and Mexico[1]** | **46.8** | **87.2** | **41.5** | **41.5** | **41.5** | **41.5** | **41.5** | **41.4** |
| Firm Power Exports To Canada and Mexico | 2.8 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 |
| Economy Exports To Canada and Mexico | 6.4 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| **Gross Exports To Canada and Mexico** | **9.3** | **20.3** | **20.3** | **20.3** | **20.3** | **20.3** | **20.3** | **20.3** |

## Table A10. Electricity Trade (Continued)

(Billion Kilowatthours, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 | 139.2 |
| 66.2 | 54.8 | 52.9 | 27.2 | 28.7 | 39.6 | 39.6 | 81.5 | 63.3 | 57.1 | 44.2 | 47.0 | 64.5 | 63.1 |
| **205.4** | **194.0** | **192.1** | **166.4** | **168.0** | **178.8** | **178.8** | **220.7** | **202.5** | **196.3** | **183.4** | **186.2** | **203.7** | **202.3** |
| 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 | 6462.9 |
| 1567.0 | 1918.0 | 1807.1 | 1467.6 | 1434.5 | 3356.4 | 2753.0 | 1831.8 | 2478.3 | 2217.4 | 2013.1 | 2031.7 | 3901.1 | 3528.6 |
| **8029.9** | **8380.9** | **8270.0** | **7930.5** | **7897.4** | **9819.3** | **9215.8** | **8294.7** | **8941.2** | **8680.3** | **8475.9** | **8494.6** | **10364.0** | **9991.5** |
| 51.4 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 50.3 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| 33.4 | 25.5 | 25.5 | 25.5 | 25.5 | 25.2 | 25.1 | 30.1 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 |
| **84.8** | **31.1** | **31.2** | **31.1** | **31.1** | **30.8** | **30.7** | **80.4** | **25.2** | **25.2** | **25.2** | **25.2** | **25.2** | **25.2** |
| 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 |
| 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 |
| **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** | **21.0** |

[1]Historically electric imports were primarily from renewable resources, principally hydroelectric.

Note: Totals may not equal sum of components due to independent rounding. 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:** 1996 interregional electricity trade data: Energy Information Administration (EIA), Bulk Power Data System. 1996 international electricity trade data: DOE Form FE-718R, "Annual Report of International Electrical Export/Import Data." Firm/economy share: National Energy Board, *Annual Report 1993*. Planned interregional and international firm power sales: DOE Form IE-411, "Coordinated Bulk Power Supply Program Report," April 1995. **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A .

## Table A11. Petroleum Supply and Disposition Balance

(Million Barrels per Day, Unless Otherwise Noted)

| Supply and Disposition | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Crude Oil** | | | | | | | | |
| Domestic Crude Production[1] | 6.48 | 6.02 | 6.01 | 5.97 | 6.00 | 5.95 | 6.00 | 5.90 |
| Alaska | 1.40 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Lower 48 States | 5.08 | 5.09 | 5.07 | 5.04 | 5.07 | 5.01 | 5.07 | 4.97 |
| Net Imports | 7.40 | 9.81 | 9.80 | 9.80 | 9.72 | 9.45 | 9.63 | 9.14 |
| Gross Imports | 7.51 | 9.91 | 9.90 | 9.90 | 9.82 | 9.60 | 9.73 | 9.29 |
| Exports | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 | 0.15 | 0.10 | 0.15 |
| Other Crude Supply[2] | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total Crude Supply** | **13.87** | **15.83** | **15.81** | **15.77** | **15.73** | **15.40** | **15.63** | **15.04** |
| **Natural Gas Plant Liquids** | **1.83** | **1.95** | **1.97** | **1.93** | **2.00** | **2.03** | **2.01** | **2.16** |
| **Other Inputs[3]** | **0.39** | **0.28** | **0.28** | **0.24** | **0.23** | **0.24** | **0.23** | **0.24** |
| **Refinery Processing Gain[4]** | **0.84** | **0.86** | **0.84** | **0.84** | **0.81** | **0.81** | **0.82** | **0.75** |
| **Net Product Imports[5]** | **1.10** | **2.08** | **2.07** | **1.91** | **1.87** | **1.55** | **1.75** | **0.89** |
| Gross Refined Prod. Imports | 1.39 | 2.07 | 2.16 | 2.02 | 1.94 | 1.65 | 1.85 | 1.19 |
| Unfinished Oil Imports | 0.37 | 0.82 | 0.72 | 0.68 | 0.68 | 0.62 | 0.66 | 0.31 |
| Ethers Imported | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 |
| Blending Components Imported | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Exports | 0.87 | 0.85 | 0.86 | 0.85 | 0.80 | 0.78 | 0.81 | 0.65 |
| **Total Primary Supply[6]** | **18.03** | **21.00** | **20.96** | **20.68** | **20.63** | **20.02** | **20.45** | **19.08** |
| **Refined Petroleum Products Supplied** | | | | | | | | |
| Motor Gasoline[7] | 7.99 | 9.12 | 9.11 | 9.01 | 9.00 | 8.65 | 8.93 | 8.10 |
| Jet Fuel[8] | 1.58 | 2.11 | 2.10 | 2.08 | 2.08 | 2.02 | 2.06 | 1.87 |
| Distillate Fuel[9] | 3.32 | 3.87 | 3.84 | 3.78 | 3.77 | 3.69 | 3.73 | 3.58 |
| Residual Fuel | 0.90 | 0.83 | 0.84 | 0.82 | 0.81 | 0.79 | 0.81 | 0.79 |
| Other[10] | 4.66 | 5.13 | 5.12 | 5.04 | 5.03 | 4.92 | 4.97 | 4.78 |
| **Total** | **18.45** | **21.05** | **21.01** | **20.74** | **20.69** | **20.07** | **20.49** | **19.12** |
| **Refined Petroleum Products Supplied** | | | | | | | | |
| Residential and Commercial | 1.13 | 1.05 | 1.05 | 1.04 | 1.01 | 0.99 | 1.00 | 0.93 |
| Industrial[11] | 4.87 | 5.33 | 5.33 | 5.23 | 5.24 | 5.13 | 5.18 | 5.00 |
| Transportation | 12.12 | 14.48 | 14.46 | 14.30 | 14.28 | 13.82 | 14.16 | 13.04 |
| Electric Generators[12] | 0.33 | 0.19 | 0.18 | 0.16 | 0.15 | 0.14 | 0.15 | 0.16 |
| **Total** | **18.45** | **21.05** | **21.01** | **20.74** | **20.69** | **20.07** | **20.49** | **19.12** |
| **Discrepancy[13]** | **-0.42** | **-0.05** | **-0.05** | **-0.05** | **-0.05** | **-0.05** | **-0.04** | **-0.05** |
| **World Oil Price (1996 dollars per barrel)[14]** | **20.48** | **20.26** | **20.12** | **19.71** | **19.96** | **19.32** | **19.89** | **18.72** |
| **Import Share of Product Supplied** | **0.46** | **0.56** | **0.56** | **0.56** | **0.56** | **0.55** | **0.56** | **0.52** |
| **Net Expenditures for Imported Crude Oil and Petroleum Products (billion 1996 dollars)** | **62.27** | **89.00** | **88.36** | **85.29** | **85.69** | **78.10** | **83.98** | **68.51** |
| **Domestic Refinery Distillation Capacity** | **15.4** | **16.7** | **16.7** | **16.6** | **16.6** | **16.3** | **16.4** | **16.2** |
| **Capacity Utilization Rate (percent)** | **94.0** | **95.0** | **95.1** | **95.2** | **95.3** | **94.8** | **95.3** | **93.0** |

## Table A11. Petroleum Supply and Disposition Balance (Continued)

(Million Barrels per Day, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 5.86 | 5.82 | 5.74 | 5.74 | 5.63 | 5.67 | 5.50 | 5.18 | 5.00 | 4.93 | 4.93 | 4.88 | 4.73 | 4.60 |
| 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.46 |
| 5.11 | 5.07 | 4.99 | 4.99 | 4.89 | 4.93 | 4.76 | 4.70 | 4.53 | 4.46 | 4.46 | 4.41 | 4.27 | 4.13 |
| 10.17 | 10.13 | 10.22 | 10.03 | 9.91 | 9.24 | 9.78 | 11.34 | 11.22 | 11.33 | 11.32 | 11.37 | 11.12 | 11.07 |
| 10.17 | 10.17 | 10.22 | 10.10 | 10.01 | 9.35 | 9.88 | 11.39 | 11.27 | 11.38 | 11.36 | 11.42 | 11.12 | 11.07 |
| 0.00 | 0.04 | 0.00 | 0.08 | 0.10 | 0.11 | 0.10 | 0.05 | 0.05 | 0.04 | 0.04 | 0.05 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **16.03** | **15.95** | **15.96** | **15.77** | **15.54** | **14.91** | **15.28** | **16.52** | **16.23** | **16.26** | **16.25** | **16.25** | **15.85** | **15.66** |
| **2.15** | **2.18** | **2.17** | **2.35** | **2.35** | **2.33** | **2.33** | **2.43** | **2.56** | **2.54** | **2.67** | **2.64** | **2.51** | **2.46** |
| **0.29** | **0.25** | **0.26** | **0.28** | **0.28** | **0.43** | **0.41** | **0.29** | **0.28** | **0.29** | **0.31** | **0.28** | **0.49** | **0.47** |
| **0.82** | **0.79** | **0.80** | **0.78** | **0.76** | **0.72** | **0.74** | **0.77** | **0.70** | **0.70** | **0.66** | **0.62** | **0.69** | **0.60** |
| **3.14** | **2.74** | **2.73** | **1.86** | **2.25** | **1.09** | **1.14** | **3.96** | **3.37** | **3.27** | **2.99** | **3.11** | **1.74** | **2.27** |
| 2.96 | 2.80 | 2.80 | 1.93 | 2.28 | 1.49 | 1.55 | 3.58 | 3.09 | 2.99 | 2.81 | 2.98 | 1.74 | 2.39 |
| 0.95 | 0.74 | 0.75 | 0.70 | 0.68 | 0.30 | 0.31 | 1.04 | 0.93 | 0.93 | 0.88 | 0.83 | 0.74 | 0.63 |
| 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.00 | 0.00 | 0.11 | 0.10 | 0.10 | 0.07 | 0.07 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.84 | 0.87 | 0.87 | 0.82 | 0.77 | 0.70 | 0.72 | 0.77 | 0.76 | 0.75 | 0.77 | 0.77 | 0.74 | 0.74 |
| **22.42** | **21.92** | **21.91** | **21.04** | **21.17** | **19.48** | **19.89** | **23.98** | **23.14** | **23.06** | **22.88** | **22.90** | **21.28** | **21.47** |
| 9.66 | 9.41 | 9.39 | 8.88 | 8.86 | 7.89 | 7.94 | 10.20 | 9.70 | 9.61 | 9.38 | 9.27 | 8.37 | 8.51 |
| 2.40 | 2.37 | 2.38 | 2.26 | 2.31 | 2.02 | 2.12 | 2.87 | 2.79 | 2.81 | 2.74 | 2.75 | 2.58 | 2.64 |
| 4.06 | 3.96 | 3.97 | 3.84 | 3.88 | 3.70 | 3.77 | 4.23 | 4.07 | 4.07 | 4.12 | 4.26 | 3.92 | 3.90 |
| 0.89 | 0.87 | 0.87 | 0.85 | 0.84 | 0.90 | 0.90 | 0.98 | 0.95 | 0.96 | 0.99 | 0.99 | 0.97 | 0.96 |
| 5.47 | 5.36 | 5.35 | 5.26 | 5.33 | 5.01 | 5.19 | 5.75 | 5.67 | 5.65 | 5.68 | 5.67 | 5.47 | 5.49 |
| **22.47** | **21.97** | **21.96** | **21.09** | **21.22** | **19.51** | **19.93** | **24.02** | **23.18** | **23.10** | **22.92** | **22.94** | **21.31** | **21.50** |
| 1.04 | 1.00 | 1.02 | 0.96 | 0.97 | 0.87 | 0.89 | 1.01 | 0.96 | 0.98 | 0.95 | 0.96 | 0.86 | 0.89 |
| 5.65 | 5.55 | 5.53 | 5.49 | 5.54 | 5.30 | 5.49 | 5.91 | 5.85 | 5.82 | 5.94 | 5.92 | 5.76 | 5.75 |
| 15.63 | 15.29 | 15.29 | 14.54 | 14.62 | 13.18 | 13.40 | 16.97 | 16.29 | 16.22 | 15.81 | 15.69 | 14.56 | 14.69 |
| 0.16 | 0.13 | 0.13 | 0.11 | 0.09 | 0.17 | 0.15 | 0.13 | 0.08 | 0.09 | 0.22 | 0.37 | 0.14 | 0.17 |
| **22.47** | **21.97** | **21.96** | **21.09** | **21.22** | **19.51** | **19.93** | **24.02** | **23.18** | **23.10** | **22.92** | **22.94** | **21.31** | **21.50** |
| **-0.05** | **-0.05** | **-0.05** | **-0.05** | **-0.05** | **-0.03** | **-0.03** | **-0.04** | **-0.04** | **-0.04** | **-0.04** | **-0.04** | **-0.04** | **-0.02** |
| **20.77** | **19.99** | **19.60** | **18.72** | **18.49** | **17.54** | **16.85** | **21.69** | **20.14** | **19.65** | **19.73** | **19.40** | **18.38** | **17.71** |
| **0.59** | **0.59** | **0.59** | **0.56** | **0.57** | **0.53** | **0.55** | **0.64** | **0.63** | **0.63** | **0.62** | **0.63** | **0.60** | **0.62** |
| **103.21** | **96.11** | **94.89** | **81.85** | **82.54** | **65.92** | **66.90** | **123.11** | **108.06** | **105.23** | **103.12** | **102.12** | **85.88** | **85.45** |
| **16.9** | **16.8** | **16.8** | **16.6** | **16.4** | **16.4** | **16.2** | **17.5** | **17.1** | **17.2** | **17.2** | **17.2** | **16.7** | **16.5** |
| **95.1** | **95.2** | **95.2** | **95.0** | **95.0** | **90.9** | **94.5** | **95.1** | **95.2** | **95.2** | **95.1** | **95.2** | **95.2** | **95.0** |

[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 alcohols, ethers, petroleum product stock withdrawals, domestic sources of blending components, and other hydrocarbons.
[4]Represents volumetric gain in refinery distillation and cracking processes.
[5]Includes net imports of finished petroleum products, unfinished oils, other hydrocarbons, alcohols, ethers, and blending components.
[6]Total crude supply plus natural gas plant liquids, other inputs, refinery processing gain, and net petroleum imports.
[7]Includes ethanol and ethers blended into gasoline.
[8]Includes naphtha and kerosene types.
[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 consumption by cogenerators.
[12]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[13]Balancing item. Includes unaccounted for supply, losses and gains.
[14]Average refiner acquisition cost for imported crude oil.
Note: Totals may not equal sum of components due to independent rounding.
**Sources:** 1996 expenditures for imported crude oil and petroleum products based on internal calculations. Other 1996 data: Energy Information Administration (EIA), *Petroleum Supply Annual 1996*, DOE/EIA-0340(96) (Washington, DC, June 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A12. Petroleum Product Prices

(1996 Cents per Gallon Unless Otherwise Noted)

| Sector and Fuel | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **World Oil Price (1996 dollars per barrel)** | **20.48** | **20.26** | **20.12** | **19.71** | **19.96** | **19.32** | **19.89** | **18.72** |
| **Delivered Sector Product Prices** | | | | | | | | |
| **Residential** | | | | | | | | |
| Distillate Fuel | 98.4 | 105.3 | 106.5 | 111.9 | 124.8 | 135.3 | 132.0 | 170.4 |
| Liquefied Petroleum Gas | 100.0 | 104.5 | 105.5 | 107.5 | 114.1 | 118.9 | 117.9 | 134.7 |
| **Commercial** | | | | | | | | |
| Distillate Fuel | 73.1 | 74.5 | 75.8 | 81.2 | 94.2 | 104.6 | 101.4 | 139.5 |
| Residual Fuel | 48.4 | 46.0 | 47.8 | 54.8 | 70.0 | 82.4 | 78.5 | 124.6 |
| Residual Fuel (1996 dollars per barrel) | 20.35 | 19.31 | 20.09 | 23.02 | 29.39 | 34.61 | 32.95 | 52.31 |
| **Industrial**[1] | | | | | | | | |
| Distillate Fuel | 76.3 | 75.3 | 76.7 | 82.3 | 95.2 | 105.7 | 102.4 | 140.2 |
| Liquefied Petroleum Gas | 67.3 | 57.9 | 58.9 | 60.9 | 67.3 | 72.1 | 71.1 | 87.8 |
| Residual Fuel | 44.8 | 41.1 | 42.6 | 49.7 | 64.9 | 77.5 | 73.4 | 119.0 |
| Residual Fuel (1996 dollars per barrel) | 18.81 | 17.28 | 17.88 | 20.89 | 27.27 | 32.55 | 30.84 | 49.98 |
| **Transportation** | | | | | | | | |
| Diesel Fuel (distillate)[2] | 123.5 | 117.4 | 119.5 | 124.4 | 137.2 | 147.4 | 144.1 | 180.4 |
| Jet Fuel[3] | 74.6 | 72.5 | 74.4 | 79.1 | 91.6 | 100.4 | 98.0 | 131.6 |
| Motor Gasoline[4] | 122.5 | 123.0 | 125.1 | 128.9 | 140.6 | 148.7 | 146.8 | 175.6 |
| Liquefied Petroleum Gas | 109.0 | 112.1 | 113.1 | 114.9 | 121.5 | 126.1 | 125.2 | 141.7 |
| Residual Fuel | 38.2 | 40.5 | 41.8 | 48.9 | 64.3 | 76.7 | 72.5 | 118.5 |
| Residual Fuel (1996 dollars per barrel) | 16.04 | 17.00 | 17.58 | 20.53 | 27.00 | 32.20 | 30.45 | 49.77 |
| E85 | 141.7 | 146.2 | 146.5 | 146.8 | 149.2 | 148.1 | 150.1 | 162.4 |
| M85 | 89.6 | 91.8 | 92.3 | 94.5 | 100.9 | 104.8 | 104.2 | 120.2 |
| **Electric Generators**[5] | | | | | | | | |
| Distillate Fuel | 68.1 | 68.9 | 70.7 | 76.3 | 89.5 | 100.3 | 96.9 | 134.2 |
| Residual Fuel | 45.9 | 46.4 | 47.2 | 55.0 | 70.4 | 83.8 | 79.1 | 125.2 |
| Residual Fuel (1996 dollars per barrel) | 19.28 | 19.49 | 19.81 | 23.09 | 29.58 | 35.20 | 33.23 | 52.59 |
| **Refined Petroleum Product Prices**[6] | | | | | | | | |
| Distillate Fuel | 108.7 | 107.0 | 109.0 | 114.0 | 126.9 | 137.2 | 133.9 | 170.6 |
| Jet Fuel[3] | 74.6 | 72.5 | 74.4 | 79.1 | 91.6 | 100.4 | 98.0 | 131.6 |
| Liquefied Petroleum Gas | 73.6 | 68.1 | 69.2 | 71.4 | 77.5 | 82.5 | 81.3 | 97.8 |
| Motor Gasoline[4] | 122.5 | 122.8 | 124.9 | 128.7 | 140.4 | 148.5 | 146.6 | 175.4 |
| Residual Fuel | 42.5 | 42.0 | 43.3 | 50.5 | 65.8 | 78.3 | 74.1 | 120.1 |
| Residual Fuel (1996 dollars per barrel) | 17.87 | 17.64 | 18.20 | 21.20 | 27.63 | 32.87 | 31.13 | 50.45 |
| **Average** | **102.8** | **101.9** | **103.7** | **107.8** | **119.0** | **127.0** | **125.0** | **153.7** |

## Table A12. Petroleum Product Prices (Continued)

(1996 Cents per Gallon Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **20.77** | **19.99** | **19.60** | **18.72** | **18.49** | **17.54** | **16.85** | **21.69** | **20.14** | **19.65** | **19.73** | **19.40** | **18.38** | **17.71** |
| 107.9 | 122.9 | 121.6 | 145.2 | 141.3 | 192.0 | 180.9 | 108.5 | 130.9 | 129.3 | 141.6 | 138.6 | 181.2 | 168.6 |
| 107.9 | 114.7 | 114.0 | 123.1 | 120.8 | 144.9 | 139.6 | 107.8 | 117.5 | 114.5 | 120.7 | 119.9 | 141.5 | 133.1 |
| 77.3 | 92.3 | 91.0 | 114.5 | 110.7 | 161.2 | 150.1 | 78.5 | 100.5 | 98.5 | 110.7 | 107.7 | 150.5 | 137.9 |
| 47.6 | 66.3 | 64.0 | 93.8 | 88.4 | 150.0 | 137.5 | 50.5 | 78.3 | 76.1 | 90.7 | 87.3 | 139.6 | 124.6 |
| 20.01 | 27.86 | 26.88 | 39.38 | 37.15 | 63.01 | 57.75 | 21.23 | 32.90 | 31.97 | 38.08 | 36.66 | 58.65 | 52.33 |
| 78.7 | 93.7 | 92.4 | 115.8 | 112.2 | 162.2 | 151.2 | 81.3 | 102.7 | 100.1 | 112.3 | 109.3 | 152.1 | 139.6 |
| 60.5 | 67.2 | 66.7 | 75.6 | 73.5 | 98.1 | 93.1 | 60.3 | 70.0 | 66.7 | 73.1 | 72.7 | 93.8 | 86.2 |
| 44.0 | 62.5 | 60.4 | 89.2 | 84.7 | 144.5 | 132.2 | 47.3 | 74.4 | 72.1 | 85.9 | 82.8 | 133.4 | 119.5 |
| 18.47 | 26.23 | 25.36 | 37.47 | 35.58 | 60.70 | 55.53 | 19.86 | 31.26 | 30.28 | 36.10 | 34.79 | 56.04 | 50.20 |
| 117.8 | 132.9 | 131.7 | 155.1 | 151.5 | 199.5 | 189.1 | 114.0 | 135.2 | 132.4 | 144.6 | 141.6 | 185.1 | 172.4 |
| 75.8 | 90.3 | 88.7 | 110.1 | 106.4 | 151.1 | 141.3 | 77.8 | 98.9 | 97.0 | 108.2 | 105.3 | 144.9 | 133.4 |
| 125.4 | 139.3 | 137.2 | 155.5 | 152.7 | 191.6 | 182.5 | 124.0 | 142.0 | 139.1 | 149.3 | 146.0 | 180.2 | 169.1 |
| 113.7 | 120.4 | 119.6 | 128.6 | 126.4 | 149.8 | 144.8 | 110.1 | 119.8 | 117.1 | 123.2 | 122.5 | 143.4 | 135.4 |
| 43.5 | 62.3 | 60.2 | 89.2 | 84.7 | 144.7 | 132.5 | 46.1 | 73.6 | 71.6 | 85.3 | 82.8 | 134.1 | 120.6 |
| 18.25 | 26.17 | 25.30 | 37.45 | 35.59 | 60.76 | 55.64 | 19.35 | 30.93 | 30.08 | 35.83 | 34.78 | 56.32 | 50.67 |
| 149.6 | 150.2 | 148.7 | 146.5 | 144.2 | 175.4 | 166.6 | 148.3 | 144.8 | 142.9 | 147.9 | 144.5 | 170.7 | 160.6 |
| 92.5 | 99.1 | 97.6 | 107.7 | 105.6 | 126.0 | 120.3 | 92.9 | 101.5 | 99.7 | 105.6 | 104.1 | 122.6 | 116.1 |
| 72.3 | 88.0 | 86.5 | 111.4 | 107.5 | 154.5 | 143.7 | 74.4 | 96.9 | 94.3 | 104.3 | 101.4 | 144.0 | 131.3 |
| 49.2 | 69.2 | 67.1 | 97.6 | 93.7 | 153.3 | 141.6 | 53.2 | 84.8 | 82.5 | 100.6 | 99.1 | 150.5 | 138.8 |
| 20.67 | 29.08 | 28.19 | 41.00 | 39.34 | 64.40 | 59.47 | 22.36 | 35.62 | 34.67 | 42.25 | 41.63 | 63.22 | 58.31 |
| 108.4 | 123.5 | 122.3 | 145.6 | 142.0 | 190.3 | 179.6 | 106.3 | 127.7 | 125.0 | 135.7 | 131.6 | 176.5 | 163.4 |
| 75.8 | 90.3 | 88.7 | 110.1 | 106.4 | 151.1 | 141.3 | 77.8 | 98.9 | 97.0 | 108.2 | 105.3 | 144.9 | 133.4 |
| 71.5 | 78.1 | 77.8 | 86.3 | 84.3 | 108.1 | 103.1 | 71.8 | 81.5 | 78.5 | 84.6 | 84.2 | 104.5 | 96.9 |
| 125.2 | 139.1 | 137.0 | 155.3 | 152.5 | 191.4 | 182.3 | 123.9 | 141.8 | 139.0 | 149.2 | 145.9 | 180.1 | 168.9 |
| 44.6 | 63.5 | 61.4 | 90.4 | 85.8 | 146.1 | 133.8 | 47.2 | 74.7 | 72.7 | 86.4 | 83.7 | 135.0 | 121.3 |
| 18.73 | 26.65 | 25.77 | 37.95 | 36.04 | 61.37 | 56.18 | 19.81 | 31.39 | 30.53 | 36.27 | 35.15 | 56.69 | 50.96 |
| **104.1** | **117.0** | **115.4** | **133.4** | **130.3** | **169.1** | **159.9** | **102.9** | **120.6** | **117.9** | **127.5** | **124.4** | **158.9** | **147.9** |

[1]Includes cogenerators. Includes Federal and State taxes while excluding county and state taxes.
[2] Low sulfur diesel fuel. Includes Federal and State taxes while excluding county and local taxes.
[3]Kerosene-type jet fuel.
[4]Sales weighted-average price for all grades. Includes Federal and State taxes while excluding county and local taxes.
[5]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[6]Weighted averages of end-use fuel prices are derived from the prices in each sector and the corresponding sectoral consumption.

**Sources**: 1996 prices for gasoline, distillate, and jet fuel are based on prices in various issues of Energy Information Administration, *Petroleum Marketing Monthly*, DOE/EIA-0380(96/03-97/04) (Washington, DC, 1996-97). 1996 prices for all other petroleum products are derived from EIA, *State Energy Price and Expenditures Report: 1994*, DOE/EIA-0376(94) (Washington, DC, June 1997). **Projections**: EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A13. Natural Gas Supply and Disposition

(Trillion Cubic Feet per Year)

| Supply, Disposition, and Prices | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Production** | | | | | | | | |
| Dry Gas Production[1] | 19.02 | 21.43 | 21.63 | 21.15 | 21.91 | 22.26 | 22.10 | 23.77 |
| Supplemental Natural Gas[2] | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Net Imports** | **2.72** | **4.49** | **4.63** | **4.56** | **4.68** | **4.79** | **5.07** | **5.39** |
| Canada | 2.76 | 4.36 | 4.32 | 4.25 | 4.37 | 4.48 | 4.50 | 4.82 |
| Mexico | -0.02 | -0.14 | 0.04 | 0.04 | 0.04 | 0.04 | 0.30 | 0.30 |
| Liquefied Natural Gas | -0.03 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| **Total Supply** | **21.86** | **26.03** | **26.37** | **25.82** | **26.70** | **27.16** | **27.28** | **29.27** |
| **Consumption by Sector** | | | | | | | | |
| Residential | 5.23 | 5.37 | 5.36 | 5.25 | 5.10 | 4.91 | 5.01 | 4.52 |
| Commercial | 3.20 | 3.53 | 3.52 | 3.45 | 3.33 | 3.18 | 3.24 | 2.75 |
| Industrial[3] | 8.43 | 9.23 | 9.23 | 9.05 | 9.35 | 9.19 | 9.37 | 9.19 |
| Electric Generators[4] | 2.98 | 5.28 | 5.60 | 5.49 | 6.27 | 7.22 | 6.95 | 10.03 |
| Lease and Plant Fuel[5] | 1.25 | 1.42 | 1.43 | 1.41 | 1.45 | 1.46 | 1.46 | 1.53 |
| Pipeline Fuel | 0.71 | 0.78 | 0.81 | 0.78 | 0.80 | 0.81 | 0.81 | 0.86 |
| Transportation[6] | 0.01 | 0.17 | 0.17 | 0.16 | 0.17 | 0.16 | 0.17 | 0.15 |
| **Total** | **21.82** | **25.80** | **26.13** | **25.59** | **26.46** | **26.93** | **27.01** | **29.04** |
| **Discrepancy[7]** | **0.04** | **0.23** | **0.24** | **0.22** | **0.24** | **0.23** | **0.27** | **0.23** |

## Table A13. Natural Gas Supply and Disposition (Continued)

(Trillion Cubic Feet per Year)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 23.67 | 24.11 | 23.91 | 25.94 | 25.94 | 25.78 | 25.69 | 26.91 | 28.26 | 28.09 | 29.44 | 29.11 | 27.74 | 27.20 |
| 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| **4.72** | **4.87** | **4.86** | **5.23** | **5.30** | **5.68** | **5.65** | **5.07** | **5.53** | **5.51** | **5.83** | **5.80** | **6.10** | **6.03** |
| 4.58 | 4.52 | 4.52 | 4.89 | 4.92 | 5.03 | 5.00 | 4.95 | 5.12 | 5.10 | 5.41 | 5.38 | 5.41 | 5.35 |
| -0.15 | 0.06 | 0.06 | 0.06 | 0.06 | 0.32 | 0.32 | -0.17 | 0.09 | 0.09 | 0.09 | 0.09 | 0.36 | 0.36 |
| 0.29 | 0.29 | 0.29 | 0.29 | 0.33 | 0.33 | 0.33 | 0.29 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 |
| **28.44** | **29.03** | **28.82** | **31.23** | **31.30** | **31.51** | **31.40** | **32.03** | **33.85** | **33.66** | **35.33** | **34.97** | **33.90** | **33.29** |
| 5.55 | 5.28 | 5.30 | 4.86 | 4.88 | 4.38 | 4.40 | 5.81 | 5.29 | 5.31 | 4.95 | 4.97 | 4.55 | 4.65 |
| 3.69 | 3.49 | 3.51 | 3.13 | 3.15 | 2.57 | 2.63 | 3.82 | 3.45 | 3.46 | 3.18 | 3.20 | 2.76 | 2.89 |
| 9.56 | 9.58 | 9.51 | 9.56 | 9.51 | 9.16 | 9.10 | 9.69 | 9.50 | 9.41 | 9.11 | 9.05 | 9.26 | 8.77 |
| 6.76 | 7.76 | 7.61 | 10.63 | 10.68 | 12.39 | 12.26 | 9.43 | 12.22 | 12.10 | 14.61 | 14.29 | 14.01 | 13.67 |
| 1.55 | 1.57 | 1.56 | 1.66 | 1.66 | 1.65 | 1.65 | 1.76 | 1.82 | 1.82 | 1.88 | 1.86 | 1.79 | 1.76 |
| 0.85 | 0.87 | 0.87 | 0.93 | 0.96 | 0.92 | 0.93 | 0.96 | 1.03 | 1.03 | 1.07 | 1.07 | 1.02 | 1.02 |
| 0.25 | 0.24 | 0.24 | 0.22 | 0.23 | 0.20 | 0.21 | 0.32 | 0.31 | 0.31 | 0.30 | 0.29 | 0.28 | 0.28 |
| **28.20** | **28.79** | **28.59** | **31.00** | **31.07** | **31.28** | **31.17** | **31.79** | **33.62** | **33.43** | **35.11** | **34.74** | **33.67** | **33.06** |
| **0.24** | **0.24** | **0.24** | **0.23** | **0.23** | **0.23** | **0.23** | **0.24** | **0.23** | **0.23** | **0.22** | **0.23** | **0.23** | **0.23** |

[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 consumption by cogenerators.
[4]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[5]Represents natural gas used in the field gathering and processing plant machinery.
[6]Compressed natural gas used as vehicle fuel.
[7]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, 1996 values include net storage injections.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Figures for 1996 may differ from published data due to internal conversion factors.
**Sources:** 1996 supplemental natural gas: Energy Information Administration (EIA), *Natural Gas Monthly*, DOE/EIA-0130(97/6) (Washington, DC, June 1997). 1996 imports and dry gas production derived from: EIA, *Natural Gas Annual 1996*, DOE/EIA-0131(96) (Washington, DC, November 1997). 1996 transportation sector consumption: EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D052199A, FD07BLW.D080398B, and EARLY07.D052199A Other 1996 consumption: EIA, *Short-Term Energy Outlook August 1997*. Online. http://www.eia.doe.gov/emeu/steo/pub/upd/aug97/index.html (August 21, 1997) with adjustments to end-use sector consumption levels for consumption of natural gas by electric wholesale generators based on EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D052199A, FD07BLW.D080398B, and EARLY07.D052199A. **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A14. Natural Gas Prices, Margins, and Revenue

(1996 Dollars per Thousand Cubic Feet, Unless Otherwise Noted)

| Prices, Margins, and Revenue | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Source Price** | | | | | | | | |
| Average Lower 48 Wellhead Price[1] | 2.24 | 2.20 | 2.18 | 2.15 | 2.21 | 2.26 | 2.24 | 2.57 |
| Average Import Price | 1.98 | 2.10 | 2.13 | 2.06 | 2.12 | 2.16 | 2.23 | 2.49 |
| **Average[2]** | **2.21** | **2.18** | **2.17** | **2.14** | **2.20** | **2.24** | **2.24** | **2.55** |
| **Delivered Prices** | | | | | | | | |
| Residential | 6.37 | 5.79 | 5.85 | 6.25 | 7.05 | 7.81 | 7.52 | 10.29 |
| Commercial | 5.43 | 4.87 | 4.93 | 5.31 | 6.11 | 6.87 | 6.58 | 9.37 |
| Industrial[3] | 3.05 | 2.88 | 2.96 | 3.31 | 4.04 | 4.78 | 4.49 | 7.09 |
| Electric Generators[4] | 2.70 | 2.68 | 2.75 | 3.10 | 3.82 | 4.58 | 4.33 | 7.01 |
| Transportation[5] | 5.57 | 5.99 | 6.06 | 6.45 | 7.18 | 7.91 | 7.62 | 10.25 |
| **Average[6]** | **4.26** | **3.82** | **3.88** | **4.24** | **4.93** | **5.62** | **5.36** | **7.87** |
| **Transmission and Distribution Margins[7]** | | | | | | | | |
| Residential | 4.17 | 3.61 | 3.68 | 4.11 | 4.85 | 5.58 | 5.28 | 7.73 |
| Commercial | 3.23 | 2.69 | 2.76 | 3.18 | 3.91 | 4.63 | 4.34 | 6.82 |
| Industrial[3] | 0.84 | 0.70 | 0.79 | 1.18 | 1.85 | 2.54 | 2.25 | 4.53 |
| Electric Generators[4] | 0.49 | 0.50 | 0.58 | 0.96 | 1.62 | 2.34 | 2.09 | 4.45 |
| Transportation[5] | 3.37 | 3.81 | 3.88 | 4.31 | 4.98 | 5.67 | 5.38 | 7.70 |
| **Average[6]** | **2.05** | **1.64** | **1.70** | **2.10** | **2.73** | **3.38** | **3.12** | **5.31** |
| **Transmission and Distribution Revenue (billion 1996 dollars)** | | | | | | | | |
| Residential | 21.81 | 19.42 | 19.74 | 21.57 | 24.76 | 27.38 | 26.47 | 34.92 |
| Commercial | 10.34 | 9.50 | 9.71 | 10.96 | 13.00 | 14.72 | 14.07 | 18.78 |
| Industrial[3] | 7.10 | 6.49 | 7.29 | 10.64 | 17.26 | 23.32 | 21.08 | 41.66 |
| Electric Generators[4] | 1.47 | 2.67 | 3.24 | 5.29 | 10.18 | 16.89 | 14.52 | 44.68 |
| Transportation[5] | 0.04 | 0.65 | 0.66 | 0.71 | 0.84 | 0.90 | 0.90 | 1.15 |
| **Total** | **40.76** | **38.72** | **40.64** | **49.16** | **66.04** | **83.21** | **77.04** | **141.18** |

## Table A14. Natural Gas Prices, Margins, and Revenue (Continued)

(1996 Dollars per Thousand Cubic Feet, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 2.33 | 2.38 | 2.35 | 2.78 | 2.79 | 3.03 | 3.14 | 2.62 | 3.02 | 3.03 | 3.71 | 3.61 | 3.53 | 3.35 |
| 2.39 | 2.40 | 2.38 | 2.82 | 2.83 | 3.07 | 3.09 | 2.76 | 3.11 | 3.13 | 3.82 | 3.72 | 3.57 | 3.39 |
| **2.34** | **2.39** | **2.36** | **2.79** | **2.80** | **3.04** | **3.13** | **2.64** | **3.03** | **3.05** | **3.73** | **3.63** | **3.54** | **3.36** |
| 5.72 | 6.83 | 6.73 | 8.83 | 8.70 | 11.98 | 11.63 | 5.97 | 7.99 | 7.95 | 9.42 | 9.29 | 11.70 | 10.93 |
| 4.75 | 5.84 | 5.74 | 7.82 | 7.69 | 11.03 | 10.66 | 4.70 | 6.68 | 6.65 | 8.10 | 7.97 | 10.42 | 9.63 |
| 3.06 | 4.08 | 3.98 | 5.91 | 5.77 | 8.90 | 8.54 | 3.35 | 5.21 | 5.18 | 6.53 | 6.42 | 8.75 | 8.03 |
| 2.88 | 3.89 | 3.81 | 5.83 | 5.71 | 8.82 | 8.50 | 3.28 | 5.08 | 5.06 | 6.44 | 6.29 | 8.66 | 7.90 |
| 6.72 | 7.82 | 7.69 | 9.66 | 9.45 | 12.67 | 12.16 | 7.37 | 9.21 | 9.13 | 10.44 | 10.32 | 12.56 | 11.83 |
| **3.87** | **4.85** | **4.76** | **6.63** | **6.50** | **9.57** | **9.24** | **4.07** | **5.85** | **5.83** | **7.14** | **7.02** | **9.35** | **8.62** |
| 3.38 | 4.44 | 4.38 | 6.04 | 5.90 | 8.95 | 8.49 | 3.33 | 4.95 | 4.90 | 5.69 | 5.66 | 8.17 | 7.57 |
| 2.40 | 3.45 | 3.39 | 5.03 | 4.89 | 7.99 | 7.52 | 2.06 | 3.65 | 3.60 | 4.37 | 4.34 | 6.88 | 6.28 |
| 0.72 | 1.69 | 1.63 | 3.12 | 2.97 | 5.86 | 5.41 | 0.71 | 2.18 | 2.13 | 2.81 | 2.79 | 5.21 | 4.67 |
| 0.54 | 1.51 | 1.46 | 3.04 | 2.92 | 5.78 | 5.37 | 0.64 | 2.05 | 2.01 | 2.72 | 2.66 | 5.13 | 4.54 |
| 4.38 | 5.43 | 5.33 | 6.87 | 6.66 | 9.64 | 9.03 | 4.73 | 6.17 | 6.09 | 6.72 | 6.69 | 9.02 | 8.47 |
| **1.52** | **2.46** | **2.41** | **3.84** | **3.70** | **6.53** | **6.10** | **1.43** | **2.82** | **2.78** | **3.42** | **3.38** | **5.81** | **5.26** |
| 18.76 | 23.47 | 23.20 | 29.37 | 28.78 | 39.19 | 37.37 | 19.32 | 26.22 | 26.05 | 28.20 | 28.12 | 37.14 | 35.23 |
| 8.86 | 12.05 | 11.87 | 15.77 | 15.41 | 20.55 | 19.79 | 7.87 | 12.57 | 12.44 | 13.89 | 13.86 | 18.98 | 18.15 |
| 6.89 | 16.22 | 15.45 | 29.83 | 28.26 | 53.72 | 49.20 | 6.84 | 20.68 | 20.01 | 25.59 | 25.26 | 48.29 | 40.97 |
| 3.62 | 11.68 | 11.09 | 32.35 | 31.14 | 71.58 | 65.80 | 5.99 | 25.01 | 24.35 | 39.69 | 37.95 | 71.82 | 62.07 |
| 1.08 | 1.30 | 1.27 | 1.54 | 1.51 | 1.93 | 1.86 | 1.54 | 1.90 | 1.87 | 2.00 | 1.96 | 2.51 | 2.38 |
| **39.21** | **64.72** | **62.88** | **108.86** | **105.10** | **186.97** | **174.03** | **41.56** | **86.39** | **84.72** | **109.38** | **107.15** | **178.74** | **158.80** |

[1]Represents lower 48 onshore and offshore supplies.

[2]Quantity-weighted average of the average lower 48 wellhead price and the average price of imports at the U.S. border.

[3]Includes consumption by cogenerators.

[4]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.

[5]Compressed natural gas used as a vehicle fuel. Price includes estimated motor vehicle fuel taxes.

[6]Weighted average prices and margins. Weights used are the sectoral consumption values excluding lease, plant, and pipeline fuel.

[7]Within the table, "transmission and distribution" margins equal the difference between the delivered price and the source price (average of the wellhead price and the price of imports at the U.S. border) of natural gas and, thus, reflect the total cost of bringing natural gas to market. When the term "transmission and distribution" margins is used in today's natural gas market, it generally does not include the cost of independent natural gas marketers or costs associated with aggregation of supplies, provisions of storage, and other services. As used here, the term includes the cost of all services and the cost of pipeline fuel used in compressor stations.

Note: Totals may not equal sum of components due to independent rounding.

**Sources:** 1996 industrial delivered prices based on Energy Information Administration (EIA), *Manufacturing Energy Consumption Survey 1991*. 1996 residential and commercial delivered prices, average lower 48 wellhead price, and average import price: EIA, *Natural Gas Monthly*, DOE/EIA-0130(97/06) (Washington, DC, June 1997). **Other 1996 values, and projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A15. Oil and Gas Supply

| Production and Supply | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Crude Oil** | | | | | | | | |
| **Lower 48 Average Wellhead Price[1]** | | | | | | | | |
| **(1996 dollars per barrel)** | **19.41** | **19.78** | **19.69** | **19.21** | **19.44** | **18.65** | **19.31** | **17.84** |
| **Production (million barrels per day)[2]** | | | | | | | | |
| **U.S. Total** | **6.48** | **6.02** | **6.01** | **5.97** | **6.00** | **5.95** | **6.00** | **5.90** |
| Lower 48 Onshore | 3.76 | 3.39 | 3.39 | 3.36 | 3.38 | 3.34 | 3.38 | 3.31 |
| Conventional | 3.15 | 2.76 | 2.75 | 2.74 | 2.75 | 2.73 | 2.75 | 2.71 |
| Enhanced Oil Recovery | 0.61 | 0.63 | 0.63 | 0.63 | 0.63 | 0.61 | 0.63 | 0.60 |
| Lower 48 Offshore | 1.32 | 1.69 | 1.69 | 1.68 | 1.69 | 1.67 | 1.69 | 1.66 |
| Alaska | 1.40 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| **Lower 48 End of Year Reserves (billion barrels)** | **16.82** | **15.28** | **15.25** | **15.15** | **15.23** | **15.06** | **15.23** | **14.92** |
| **Natural Gas** | | | | | | | | |
| **Lower 48 Average Wellhead Price[1]** | | | | | | | | |
| **(1996 dollars per thousand cubic feet)** | **2.24** | **2.20** | **2.18** | **2.15** | **2.21** | **2.26** | **2.24** | **2.57** |
| **Production (trillion cubic feet)[3]** | | | | | | | | |
| **U.S. Total** | **19.01** | **21.43** | **21.63** | **21.15** | **21.91** | **22.26** | **22.10** | **23.77** |
| Lower 48 Onshore | 13.07 | 14.49 | 14.68 | 14.35 | 14.87 | 15.18 | 15.02 | 16.32 |
| Associated-Dissolved[4] | 1.84 | 1.53 | 1.52 | 1.52 | 1.52 | 1.52 | 1.52 | 1.51 |
| Non-Associated | 11.23 | 12.96 | 13.16 | 12.83 | 13.35 | 13.66 | 13.50 | 14.81 |
| Conventional | 7.96 | 9.09 | 9.17 | 8.96 | 9.34 | 9.45 | 9.43 | 10.18 |
| Unconventional | 3.27 | 3.88 | 3.99 | 3.87 | 4.02 | 4.21 | 4.07 | 4.63 |
| Lower 48 Offshore | 5.50 | 6.41 | 6.42 | 6.27 | 6.51 | 6.56 | 6.55 | 6.92 |
| Associated-Dissolved[4] | 0.80 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Non-Associated | 4.70 | 5.49 | 5.50 | 5.35 | 5.59 | 5.64 | 5.63 | 6.01 |
| Alaska | 0.43 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.52 |
| **Lower 48 End of Year Reserves (trillion cubic feet)** | **157.23** | **172.31** | **171.86** | **172.02** | **171.58** | **170.55** | **171.25** | **168.10** |
| **Supplemental Gas Supplies (trillion cubic feet)[5]** | **0.12** | **0.11** | **0.11** | **0.11** | **0.11** | **0.11** | **0.11** | **0.11** |
| **Total Lower 48 Wells (thousands)** | **22.07** | **28.12** | **28.06** | **27.62** | **28.04** | **27.79** | **28.15** | **28.78** |

## Table A15. Oil and Gas Supply (Continued)

| Projections | | | | | | | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **20.24** | **19.42** | **19.08** | **18.09** | **17.82** | **16.68** | **15.96** | **20.70** | **19.10** | **18.65** | **18.67** | **18.28** | **17.35** | **16.58** |
| **5.86** | **5.82** | **5.74** | **5.74** | **5.63** | **5.67** | **5.50** | **5.18** | **5.00** | **4.93** | **4.93** | **4.88** | **4.73** | **4.60** |
| 3.50 | 3.47 | 3.41 | 3.40 | 3.32 | 3.35 | 3.21 | 3.39 | 3.24 | 3.18 | 3.16 | 3.10 | 2.98 | 2.88 |
| 2.76 | 2.74 | 2.70 | 2.70 | 2.66 | 2.67 | 2.60 | 2.75 | 2.65 | 2.62 | 2.61 | 2.58 | 2.50 | 2.42 |
| 0.74 | 0.73 | 0.71 | 0.70 | 0.66 | 0.68 | 0.62 | 0.65 | 0.59 | 0.56 | 0.55 | 0.52 | 0.48 | 0.46 |
| 1.62 | 1.60 | 1.58 | 1.59 | 1.57 | 1.57 | 1.55 | 1.31 | 1.29 | 1.27 | 1.31 | 1.31 | 1.29 | 1.26 |
| 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.46 |
| **15.60** | **15.49** | **15.23** | **15.20** | **14.87** | **14.97** | **14.37** | **14.95** | **14.32** | **14.06** | **13.97** | **13.76** | **13.27** | **12.84** |
| **2.33** | **2.38** | **2.35** | **2.78** | **2.79** | **3.03** | **3.14** | **2.62** | **3.02** | **3.03** | **3.71** | **3.61** | **3.53** | **3.35** |
| **23.67** | **24.11** | **23.91** | **25.94** | **25.94** | **25.77** | **25.69** | **26.91** | **28.26** | **28.09** | **29.44** | **29.11** | **27.74** | **27.20** |
| 16.31 | 16.73 | 16.55 | 18.14 | 18.18 | 18.09 | 17.97 | 18.87 | 19.75 | 19.82 | 20.55 | 20.32 | 19.48 | 19.01 |
| 1.45 | 1.45 | 1.44 | 1.44 | 1.43 | 1.44 | 1.43 | 1.32 | 1.30 | 1.30 | 1.30 | 1.30 | 1.28 | 1.26 |
| 14.86 | 15.28 | 15.12 | 16.70 | 16.75 | 16.65 | 16.55 | 17.55 | 18.45 | 18.53 | 19.24 | 19.02 | 18.20 | 17.75 |
| 9.99 | 10.11 | 10.15 | 11.05 | 11.02 | 11.19 | 11.13 | 12.08 | 12.65 | 12.70 | 13.19 | 13.01 | 12.44 | 11.95 |
| 4.86 | 5.17 | 4.97 | 5.65 | 5.73 | 5.46 | 5.41 | 5.47 | 5.80 | 5.83 | 6.05 | 6.01 | 5.76 | 5.80 |
| 6.80 | 6.82 | 6.80 | 7.25 | 7.21 | 7.13 | 7.17 | 7.43 | 7.90 | 7.66 | 8.29 | 8.19 | 7.66 | 7.58 |
| 0.91 | 0.91 | 0.90 | 0.91 | 0.90 | 0.90 | 0.90 | 0.84 | 0.84 | 0.83 | 0.84 | 0.84 | 0.84 | 0.83 |
| 5.88 | 5.91 | 5.89 | 6.34 | 6.30 | 6.23 | 6.27 | 6.58 | 7.06 | 6.82 | 7.45 | 7.35 | 6.82 | 6.76 |
| 0.56 | 0.56 | 0.56 | 0.56 | 0.56 | 0.55 | 0.55 | 0.62 | 0.61 | 0.61 | 0.61 | 0.61 | 0.60 | 0.60 |
| **180.45** | **179.42** | **178.89** | **178.60** | **178.20** | **180.42** | **185.00** | **172.73** | **175.74** | **175.00** | **189.12** | **188.41** | **193.82** | **194.55** |
| **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.06** | **0.06** | **0.05** | **0.06** | **0.06** | **0.06** | **0.06** | **0.06** | **0.06** |
| **30.34** | **30.23** | **29.79** | **31.46** | **31.29** | **31.91** | **31.94** | **33.63** | **34.68** | **34.44** | **37.85** | **37.16** | **35.92** | **34.56** |

Ft. = feet.

[1]Represents lower 48 onshore and offshore supplies.

[2]Includes lease condensate.

[3]Market 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. Figures for 1996 may differ from published data due to internal conversion factors.

**Sources**: 1996 crude oil lower 48 average wellhead price: Energy Information Administration (EIA), Office of Integrated Analysis and Forecasting. 1996 total wells completed: EIA, Office of Integrated Analysis and Forecasting. 1996 lower 48 onshore, lower 48 offshore, Alaska crude oil production: EIA, *Petroleum Supply Annual 1996*, DOE/EIA-0340(96) (Washington, DC, June 1997). 1996 natural gas lower 48 average wellhead price, Alaska and total natural gas production, and supplemental gas supplies. EIA, *Natural Gas Monthly*, DOE/EIA-0130(97/06) (Washington, DC, June 1997). Other 1996 values: EIA, Office of Integrated Analysis and Forecasting. **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A16. Coal Supply, Disposition, and Prices

(Million Short Tons per Year, Unless Otherwise Noted)

| Supply, Disposition, and Prices | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Production**[1] | | | | | | | | |
| Appalachia | 452 | 465 | 451 | 444 | 415 | 369 | 378 | 274 |
| Interior | 173 | 148 | 147 | 143 | 142 | 123 | 129 | 63 |
| West | 439 | 629 | 584 | 538 | 432 | 342 | 360 | 150 |
| East of the Mississippi | 564 | 551 | 537 | 530 | 516 | 467 | 480 | 332 |
| West of the Mississippi | 500 | 691 | 645 | 595 | 473 | 367 | 387 | 156 |
| **Total** | **1064** | **1242** | **1182** | **1124** | **989** | **834** | **867** | **487** |
| **Net Imports** | | | | | | | | |
| Imports | 7 | 8 | 6 | 6 | 6 | 6 | 4 | 4 |
| Exports | 90 | 104 | 89 | 89 | 89 | 89 | 83 | 83 |
| **Total** | **-83** | **-96** | **-83** | **-83** | **-83** | **-83** | **-78** | **-78** |
| **Total Supply**[2] | **981** | **1146** | **1099** | **1041** | **906** | **750** | **789** | **409** |
| **Consumption by Sector** | | | | | | | | |
| Residential and Commercial | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 5 |
| Industrial[3] | 70 | 77 | 76 | 69 | 56 | 48 | 52 | 38 |
| Coke Plants | 32 | 28 | 28 | 27 | 28 | 25 | 28 | 24 |
| Electric Generators[4] | 896 | 1034 | 989 | 941 | 829 | 674 | 729 | 344 |
| **Total** | **1003** | **1146** | **1099** | **1043** | **918** | **753** | **814** | **412** |
| **Discrepancy and Stock Change**[5] | **-23** | **0** | **-0** | **-2** | **-12** | **-3** | **-25** | **-3** |
| **Average Minemouth Price** | | | | | | | | |
| (1996 dollars per short ton) | 18.50 | 15.03 | 15.39 | 15.42 | 16.10 | 16.51 | 16.36 | 18.20 |
| (1996 dollars per million Btu) | 0.87 | 0.72 | 0.74 | 0.74 | 0.76 | 0.76 | 0.76 | 0.80 |
| **Delivered Prices (1996 dollars per short ton)**[6] | | | | | | | | |
| Industrial | 32.28 | 28.68 | 31.28 | 46.23 | 72.61 | 97.49 | 87.93 | 175.48 |
| Coke Plants | 47.33 | 43.77 | 47.09 | 65.17 | 96.41 | 126.04 | 114.62 | 218.72 |
| Electric Generators | | | | | | | | |
| (1996 dollars per short ton) | 26.45 | 23.37 | 25.96 | 39.81 | 64.24 | 88.34 | 79.18 | 167.83 |
| (1996 dollars per million Btu) | 1.29 | 1.17 | 1.28 | 1.97 | 3.13 | 4.24 | 3.81 | 7.74 |
| **Average** | **27.52** | **24.23** | **26.87** | **40.91** | **65.73** | **90.21** | **80.95** | **171.60** |
| **Exports**[7] | **40.77** | **36.27** | **37.03** | **36.75** | **36.96** | **36.62** | **37.15** | **36.80** |

## Table A16. Coal Supply, Disposition, and Prices (Continued)

(Million Short Tons per Year, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 479 | 401 | 397 | 306 | 300 | 196 | 192 | 458 | 385 | 378 | 238 | 234 | 111 | 111 |
| 135 | 122 | 125 | 89 | 94 | 35 | 34 | 128 | 72 | 72 | 45 | 44 | 11 | 11 |
| 673 | 510 | 528 | 229 | 235 | 82 | 70 | 791 | 349 | 374 | 123 | 125 | 21 | 23 |
| 555 | 479 | 476 | 378 | 370 | 228 | 222 | 545 | 442 | 433 | 274 | 271 | 119 | 119 |
| 732 | 553 | 573 | 246 | 260 | 85 | 72 | 831 | 364 | 391 | 131 | 132 | 24 | 26 |
| **1287** | **1032** | **1050** | **624** | **630** | **313** | **295** | **1376** | **805** | **824** | **405** | **404** | **144** | **145** |
| 8 | 4 | 4 | 4 | 4 | 1 | 1 | 8 | 4 | 4 | 4 | 4 | 1 | 1 |
| 113 | 89 | 89 | 89 | 89 | 76 | 76 | 130 | 93 | 93 | 93 | 93 | 75 | 75 |
| **-105** | **-85** | **-85** | **-85** | **-85** | **-75** | **-75** | **-122** | **-89** | **-89** | **-89** | **-89** | **-74** | **-74** |
| **1181** | **948** | **965** | **539** | **545** | **238** | **220** | **1254** | **716** | **735** | **316** | **315** | **70** | **71** |
| 7 | 6 | 6 | 5 | 5 | 4 | 4 | 7 | 6 | 6 | 5 | 5 | 4 | 4 |
| 79 | 61 | 62 | 48 | 50 | 37 | 38 | 82 | 61 | 61 | 57 | 57 | 41 | 42 |
| 26 | 24 | 23 | 23 | 21 | 22 | 20 | 22 | 16 | 16 | 15 | 14 | 14 | 13 |
| 1065 | 854 | 871 | 460 | 465 | 172 | 158 | 1144 | 630 | 650 | 235 | 243 | 11 | 12 |
| **1177** | **946** | **963** | **537** | **541** | **235** | **220** | **1254** | **713** | **733** | **312** | **319** | **71** | **71** |
| **4** | **2** | **3** | **3** | **4** | **3** | **0** | **0** | **3** | **2** | **4** | **-4** | **-1** | **1** |
| 14.29 | 14.72 | 14.34 | 16.42 | 16.18 | 18.29 | 18.68 | 12.53 | 14.29 | 13.95 | 16.24 | 16.15 | 20.50 | 20.33 |
| 0.69 | 0.70 | 0.69 | 0.75 | 0.74 | 0.79 | 0.80 | 0.61 | 0.67 | 0.66 | 0.72 | 0.72 | 0.84 | 0.83 |
| 27.58 | 65.34 | 62.47 | 119.45 | 111.74 | 224.73 | 205.92 | 25.83 | 81.21 | 79.35 | 104.28 | 102.10 | 195.43 | 173.98 |
| 42.45 | 87.78 | 84.30 | 152.49 | 143.38 | 277.69 | 255.68 | 40.36 | 107.18 | 104.96 | 135.28 | 132.78 | 246.16 | 220.20 |
| 22.20 | 57.03 | 53.90 | 109.56 | 101.13 | 214.75 | 199.31 | 19.56 | 71.95 | 69.42 | 95.33 | 92.81 | 197.61 | 175.23 |
| 1.11 | 2.81 | 2.68 | 5.23 | 4.88 | 9.95 | 9.12 | 1.00 | 3.48 | 3.39 | 4.52 | 4.42 | 8.80 | 7.83 |
| **23.02** | **58.36** | **55.21** | **112.28** | **103.75** | **222.39** | **205.57** | **20.33** | **73.57** | **71.05** | **98.93** | **96.23** | **206.64** | **182.95** |
| **34.98** | **35.97** | **35.68** | **35.51** | **35.64** | **36.01** | **36.11** | **32.52** | **33.40** | **33.41** | **32.82** | **32.93** | **33.84** | **33.79** |

[1]Includes anthracite, bituminous coal, and lignite.
[2]Production plus net imports and net storage withdrawals.
[3]Includes consumption by cogenerators.
[4]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[5]Balancing item: the sum of production, net imports, and net storage minus total consumption.
[6]Sectoral prices weighted by consumption tonnage; weighted average excludes residential/ commercial prices and export free-alongside-ship (f.a.s.) prices.
[7] F.a.s. price at U.S. port of exit.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding.
**Sources:** 1996 data derived from: Energy Information Administration (EIA), *Coal Industry Annual 1996*, DOE/EIA-0584(96) (Washington, DC, November 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A17. Renewable Energy Generating Capability and Generation

(Thousand Megawatts, Unless Otherwise Noted)

| Capacity and Generation | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Electric Generators[1] (excluding cogenerators)** | | | | | | | | |
| **Net Summer Capability** | | | | | | | | |
| Conventional Hydropower | 77.66 | 79.73 | 79.73 | 79.73 | 79.74 | 79.74 | 80.70 | 80.72 |
| Geothermal[2] | 3.02 | 2.76 | 2.92 | 2.98 | 3.11 | 3.07 | 3.74 | 3.83 |
| Municipal Solid Waste[3] | 3.26 | 3.66 | 3.66 | 3.65 | 3.66 | 3.65 | 3.66 | 3.63 |
| Wood and Other Biomass[4] | 1.64 | 1.76 | 1.76 | 1.76 | 1.93 | 1.80 | 2.18 | 2.25 |
| Solar Thermal | 0.36 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 |
| Solar Photovoltaic | 0.01 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Wind | 1.85 | 2.75 | 2.75 | 2.72 | 4.22 | 4.97 | 6.27 | 15.73 |
| **Total** | **87.81** | **91.10** | **91.26** | **91.28** | **93.12** | **93.68** | **97.00** | **106.61** |
| **Generation (billion kilowatthours)** | | | | | | | | |
| Conventional Hydropower | 346.28 | 312.51 | 312.50 | 312.48 | 312.53 | 312.51 | 317.03 | 317.04 |
| Geothermal[2] | 15.70 | 16.12 | 17.25 | 17.66 | 18.61 | 18.32 | 23.01 | 23.60 |
| Municipal Solid Waste[3] | 18.85 | 24.54 | 24.54 | 24.47 | 24.53 | 24.44 | 24.53 | 24.34 |
| Wood and Other Biomass[4] | 7.27 | 8.72 | 17.72 | 16.51 | 18.30 | 16.27 | 19.51 | 16.74 |
| Solar Thermal | 0.82 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Solar Photovoltaic | 0.00 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Wind | 3.17 | 6.17 | 6.17 | 6.10 | 10.14 | 12.12 | 15.80 | 40.76 |
| **Total** | **392.09** | **369.22** | **379.33** | **378.37** | **385.27** | **384.81** | **401.04** | **423.64** |
| **Cogenerators[5]** | | | | | | | | |
| **Net Summer Capability** | | | | | | | | |
| Municipal Solid Waste | 0.43 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 |
| Biomass | 5.44 | 6.42 | 6.41 | 6.34 | 6.35 | 6.32 | 6.32 | 6.26 |
| **Total** | **5.87** | **6.86** | **6.85** | **6.78** | **6.80** | **6.76** | **6.77** | **6.70** |
| **Generation (billion kilowatthours)** | | | | | | | | |
| Municipal Solid Waste | 2.21 | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 |
| Biomass | 39.40 | 44.47 | 44.42 | 43.97 | 44.21 | 44.19 | 44.01 | 43.80 |
| **Total** | **41.61** | **46.74** | **46.69** | **46.24** | **46.48** | **46.46** | **46.28** | **46.07** |

## Table A17. Renewable Energy Generating Capability and Generation (Continued)

(Thousand Megawatts, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 79.78 | 79.78 | 79.78 | 79.80 | 79.80 | 81.84 | 80.78 | 79.78 | 79.79 | 79.79 | 79.80 | 79.80 | 81.92 | 81.62 |
| 2.80 | 2.98 | 3.01 | 3.51 | 3.35 | 4.75 | 5.50 | 3.02 | 3.77 | 3.77 | 4.95 | 4.65 | 7.81 | 7.51 |
| 4.02 | 4.01 | 4.01 | 3.99 | 4.02 | 3.95 | 3.99 | 4.42 | 4.42 | 4.43 | 4.41 | 4.41 | 4.44 | 4.43 |
| 1.76 | 1.80 | 1.76 | 2.70 | 2.16 | 5.32 | 7.14 | 1.76 | 2.74 | 1.93 | 11.95 | 11.52 | 43.99 | 52.65 |
| 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.39 | 0.39 | 0.56 | 0.56 | 0.56 | 0.56 | 0.56 | 0.91 | 0.91 |
| 2.75 | 4.47 | 4.21 | 9.44 | 10.97 | 18.17 | 39.60 | 3.52 | 15.87 | 13.40 | 38.08 | 38.75 | 51.37 | 64.07 |
| **91.77** | **93.71** | **93.44** | **100.10** | **100.95** | **114.85** | **137.84** | **93.60** | **107.68** | **104.40** | **140.29** | **140.23** | **190.97** | **211.74** |
| 313.01 | 312.97 | 312.97 | 312.96 | 312.98 | 321.93 | 317.52 | 313.15 | 313.10 | 313.09 | 313.12 | 313.12 | 322.35 | 321.31 |
| 16.79 | 18.04 | 18.23 | 21.72 | 20.61 | 30.37 | 35.65 | 19.87 | 25.08 | 25.05 | 33.35 | 31.24 | 53.35 | 51.27 |
| 27.05 | 26.96 | 26.99 | 26.78 | 27.00 | 26.49 | 26.82 | 29.83 | 29.76 | 29.83 | 29.75 | 29.74 | 29.88 | 29.83 |
| 8.72 | 17.64 | 17.34 | 21.01 | 16.76 | 36.40 | 49.01 | 8.72 | 22.52 | 16.99 | 83.07 | 80.01 | 305.05 | 365.64 |
| 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 |
| 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 1.01 | 1.01 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 2.30 | 2.30 |
| 6.17 | 11.20 | 10.48 | 24.73 | 28.45 | 48.87 | 103.57 | 8.70 | 43.58 | 37.16 | 108.33 | 109.35 | 142.77 | 171.43 |
| **373.50** | **388.56** | **387.76** | **408.95** | **407.55** | **466.22** | **534.73** | **383.19** | **436.96** | **425.04** | **570.54** | **566.38** | **857.17** | **943.26** |
| 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 |
| 6.70 | 6.68 | 6.71 | 6.60 | 6.74 | 6.44 | 6.65 | 6.84 | 6.96 | 6.97 | 6.93 | 6.95 | 6.94 | 6.91 |
| **7.14** | **7.13** | **7.16** | **7.05** | **7.19** | **6.89** | **7.10** | **7.29** | **7.41** | **7.42** | **7.38** | **7.40** | **7.39** | **7.36** |
| 2.30 | 2.30 | 2.30 | 2.29 | 2.30 | 2.29 | 2.29 | 2.32 | 2.32 | 2.32 | 2.32 | 2.32 | 2.32 | 2.31 |
| 47.26 | 47.40 | 47.63 | 46.94 | 48.31 | 45.62 | 47.65 | 48.89 | 50.23 | 50.31 | 50.20 | 50.46 | 50.49 | 50.24 |
| **49.56** | **49.69** | **49.92** | **49.23** | **50.61** | **47.91** | **49.94** | **51.21** | **52.55** | **52.63** | **52.51** | **52.77** | **52.80** | **52.56** |

[1]Includes grid-connected utilities and nonutilities other than cogenerators. These nonutility facilities include small power producers, exempt wholesale generators and generators at industrial and commercial facilities which do not produce steam for other uses.

[2]Includes hydrothermal resources only (hot water and steam).

[3]Includes landfill gas.

[4]Includes projections for energy crops after 2010.

[5]Cogenerators produce electricity and other useful thermal energy.

Notes: Totals may not equal sum of components due to independent rounding. Net summer capability has been estimated for nonutility generators for AEO98. Net summer capability is used to be consistent with electric utility capacity estimates. Data for electric utility capacity are the most recently available as of August 25, 1997. Additional retirements are also determined on the basis of the size and age of the units. Therefore, capacity estimates may differ from other Energy Information Administration sources.

**Sources:** 1996 electric utility capability: Energy Information Administration (EIA), Form EIA-860 "Annual Electric Utility Report," 1996 nonutility and cogenerator capability: Form EIA-867, "Annual Nonutility Power Producer Report." 1996 generation: EIA, *Annual Energy Review 1996*, DOE/EIA-0384(96) (Washington, DC, July 1997). **Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A18. Renewable Energy Consumption by Sector and Source[1]

(Quadrillion Btu per Year)

| Sector and Source | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Marketed Renewable Energy[2]** | | | | | | | | | |
| **Residential** | **0.61** | **0.61** | **0.61** | **0.61** | **0.61** | **0.61** | **0.61** | **0.62** |
| Wood | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.62 |
| **Commercial[3]** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| Biomass | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Industrial[4]** | **1.82** | **2.11** | **2.11** | **2.09** | **2.10** | **2.10** | **2.09** | **2.08** |
| Conventional Hydroelectric | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Municipal Solid Waste | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Biomass | 1.78 | 2.08 | 2.07 | 2.05 | 2.06 | 2.06 | 2.05 | 2.04 |
| **Transportation** | **0.10** | **0.18** | **0.18** | **0.13** | **0.13** | **0.13** | **0.13** | **0.13** |
| Ethanol used in E85[5] | 0.00 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 |
| Ethanol used in Gasoline Blending | 0.10 | 0.13 | 0.13 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| **Electric Generators[6]** | **4.40** | **4.22** | **4.33** | **4.33** | **4.42** | **4.41** | **4.68** | **4.93** |
| Conventional Hydroelectric | 3.56 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.26 | 3.26 |
| Geothermal | 0.43 | 0.46 | 0.49 | 0.51 | 0.54 | 0.53 | 0.68 | 0.70 |
| Municipal Solid Waste | 0.30 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 |
| Biomass | 0.06 | 0.08 | 0.16 | 0.15 | 0.16 | 0.14 | 0.17 | 0.15 |
| Solar Thermal | 0.01 | 0.01 | 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 | 0.00 |
| Wind | 0.03 | 0.06 | 0.06 | 0.06 | 0.10 | 0.12 | 0.16 | 0.42 |
| **Total Marketed Renewable Energy** | **6.94** | **7.12** | **7.23** | **7.16** | **7.26** | **7.25** | **7.51** | **7.76** |
| **Non-Marketed Renewable Energy[7]** | | | | | | | | |
| **Selected Consumption** | | | | | | | | |
| **Residential** | **0.02** | **0.02** | **0.02** | **0.03** | **0.02** | **0.03** | **0.02** | **0.03** |
| Solar Hot Water Heating | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Geothermal Heat Pumps | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| **Commercial** | **0.01** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** |
| Solar Thermal | 0.01 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

## Table A18. Renewable Energy Consumption by Sector and Source[1] (Continued)

(Quadrillion Btu per Year)

| Projections | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | |
| **0.61** | **0.61** | **0.61** | **0.62** | **0.62** | **0.63** | **0.64** | **0.62** | **0.63** | **0.63** | **0.64** | **0.64** | **0.67** | **0.68** | |
| 0.61 | 0.61 | 0.61 | 0.62 | 0.62 | 0.63 | 0.64 | 0.62 | 0.63 | 0.63 | 0.64 | 0.64 | 0.67 | 0.68 | |
| **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| **2.25** | **2.25** | **2.25** | **2.23** | **2.29** | **2.17** | **2.27** | **2.35** | **2.39** | **2.39** | **2.39** | **2.40** | **2.40** | **2.39** | |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 2.21 | 2.21 | 2.22 | 2.20 | 2.26 | 2.13 | 2.23 | 2.31 | 2.35 | 2.35 | 2.35 | 2.37 | 2.36 | 2.35 | |
| **0.23** | **0.19** | **0.19** | **0.22** | **0.23** | **0.53** | **0.51** | **0.31** | **0.29** | **0.29** | **0.40** | **0.38** | **0.69** | **0.69** | |
| 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.09 | 0.09 | 0.13 | 0.14 | 0.14 | 0.14 | 0.14 | 0.13 | 0.13 | |
| 0.13 | 0.09 | 0.10 | 0.12 | 0.13 | 0.45 | 0.42 | 0.18 | 0.15 | 0.15 | 0.26 | 0.24 | 0.56 | 0.56 | |
| **4.30** | **4.47** | **4.46** | **4.75** | **4.72** | **5.53** | **6.34** | **4.47** | **5.11** | **5.00** | **6.58** | **6.49** | **9.72** | **10.46** | |
| 3.22 | 3.22 | 3.22 | 3.22 | 3.22 | 3.31 | 3.26 | 3.22 | 3.22 | 3.22 | 3.22 | 3.22 | 3.31 | 3.30 | |
| 0.49 | 0.53 | 0.53 | 0.64 | 0.61 | 0.95 | 1.12 | 0.59 | 0.75 | 0.75 | 1.01 | 0.95 | 1.71 | 1.63 | |
| 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.42 | 0.43 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | |
| 0.08 | 0.16 | 0.15 | 0.19 | 0.15 | 0.32 | 0.44 | 0.08 | 0.20 | 0.15 | 0.74 | 0.71 | 2.72 | 3.26 | |
| 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | |
| 0.06 | 0.12 | 0.11 | 0.25 | 0.29 | 0.50 | 1.06 | 0.09 | 0.45 | 0.38 | 1.11 | 1.12 | 1.47 | 1.76 | |
| **7.39** | **7.52** | **7.52** | **7.83** | **7.86** | **8.87** | **9.75** | **7.75** | **8.42** | **8.31** | **10.01** | **9.92** | **13.47** | **14.21** | |
| **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.06** | **0.06** | |
| 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | |
| 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | |
| **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.03** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** | **0.04** | |
| 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | |

[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; see Table A8.

[3]Value is less than 0.005 quadrillion Btu per year and rounds to zero.

[4]Includes all electricity production by industrial and other cogenerators for the grid and for own use.

[5]Excludes motor gasoline component of E85.

[6]Includes renewable energy delivered to the grid from electric utilities and nonutilities. Renewable energy used in generating electricity for own use is included in the individual sectoral electricity energy consumption values.

[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.

Notes: Totals may not equal sum of components due to independent rounding.

**Sources:** 1996 electric generators: Energy Information Administration (EIA), Form EIA-860, "Annual Electric Utility Report" and EIA, Form EIA-867, "Annual Nonutility Power Producer Report." 1996 ethanol: EIA, *Petroleum Supply Annual 1996*, DOE/EIA-0340(96/1) (Washington, DC, June 1997). Other 1996: EIA, Office of Integrated Analysis and Forecasting.
**Projections:** EIA, AEO98 National Energy Modeling System runs KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A19. Carbon Emissions by Sector and Source

(Million Metric Tons per Year)

| Sector and Source | 1996 | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **Residential** | | | | | | | | |
| Petroleum | 27.3 | 24.0 | 24.0 | 23.7 | 23.1 | 22.4 | 22.8 | 21.0 |
| Natural Gas | 77.4 | 79.6 | 79.4 | 77.7 | 75.6 | 72.8 | 74.3 | 66.9 |
| Coal | 1.4 | 1.4 | 1.4 | 1.3 | 1.2 | 1.1 | 1.1 | 0.9 |
| Electricity | 179.9 | 217.6 | 212.3 | 202.6 | 187.5 | 166.3 | 174.4 | 122.6 |
| **Total** | **286.0** | **322.6** | **317.1** | **305.4** | **287.3** | **262.5** | **272.5** | **211.4** |
| **Commercial** | | | | | | | | |
| Petroleum | 15.3 | 12.6 | 12.6 | 12.4 | 12.0 | 11.7 | 11.8 | 10.7 |
| Natural Gas | 47.4 | 52.3 | 52.2 | 51.1 | 49.3 | 47.1 | 48.1 | 40.8 |
| Coal | 2.1 | 2.3 | 2.3 | 2.3 | 2.2 | 2.1 | 2.2 | 1.9 |
| Electricity | 164.8 | 196.4 | 191.7 | 183.6 | 168.0 | 147.9 | 155.5 | 105.2 |
| **Total** | **229.6** | **263.6** | **258.8** | **249.4** | **231.5** | **208.9** | **217.5** | **158.6** |
| **Industrial**[1] | | | | | | | | |
| Petroleum | 104.8 | 110.5 | 110.1 | 108.7 | 108.2 | 105.5 | 106.6 | 101.8 |
| Natural Gas[2] | 142.8 | 155.9 | 156.0 | 152.9 | 158.0 | 155.8 | 158.4 | 156.9 |
| Coal | 59.3 | 66.0 | 65.5 | 61.0 | 54.0 | 48.9 | 51.6 | 42.7 |
| Electricity | 169.2 | 203.4 | 198.4 | 189.4 | 178.0 | 155.7 | 164.9 | 116.1 |
| **Total** | **476.1** | **535.7** | **530.0** | **512.0** | **498.2** | **465.9** | **481.6** | **417.5** |
| **Transportation** | | | | | | | | |
| Petroleum[3] | 457.9 | 549.4 | 548.7 | 543.5 | 543.0 | 525.8 | 538.5 | 496.4 |
| Natural Gas[4] | 10.5 | 14.0 | 14.5 | 14.0 | 14.3 | 14.3 | 14.5 | 15.0 |
| Other[5] | 0.0 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 |
| Electricity | 2.8 | 4.2 | 4.1 | 4.0 | 3.7 | 3.4 | 3.5 | 2.5 |
| **Total**[3] | **471.2** | **569.0** | **568.7** | **563.0** | **562.5** | **544.9** | **557.9** | **515.3** |
| **Total Carbon Emissions**[6] | | | | | | | | |
| Petroleum[3] | 605.3 | 696.4 | 695.4 | 688.3 | 686.3 | 665.4 | 679.7 | 629.8 |
| Natural Gas | 278.1 | 301.9 | 302.1 | 295.9 | 297.2 | 290.0 | 295.2 | 279.6 |
| Coal | 62.8 | 69.7 | 69.2 | 64.6 | 57.4 | 52.1 | 54.8 | 45.6 |
| Other[5] | 0.0 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 |
| Electricity | 516.7 | 621.5 | 606.4 | 579.6 | 537.1 | 473.2 | 498.3 | 346.4 |
| **Total**[3] | **1462.9** | **1690.9** | **1674.6** | **1629.8** | **1579.5** | **1482.2** | **1529.6** | **1302.7** |
| **Electric Generators**[7] | | | | | | | | |
| Petroleum | 15.5 | 8.8 | 8.4 | 7.8 | 7.3 | 6.5 | 7.2 | 7.6 |
| Natural Gas | 40.3 | 77.8 | 82.5 | 80.8 | 92.3 | 106.3 | 102.3 | 147.7 |
| Coal | 460.9 | 534.9 | 515.5 | 491.0 | 437.5 | 360.4 | 388.9 | 191.1 |
| **Total** | **516.7** | **621.5** | **606.4** | **579.6** | **537.1** | **473.2** | **498.3** | **346.4** |
| **Total Carbon Emissions**[8] | | | | | | | | |
| Petroleum[3] | 620.8 | 705.2 | 703.8 | 696.1 | 693.6 | 671.9 | 686.9 | 637.4 |
| Natural Gas | 318.4 | 379.7 | 384.6 | 376.7 | 389.4 | 396.3 | 397.5 | 427.3 |
| Coal | 523.7 | 604.6 | 584.7 | 555.5 | 494.9 | 412.5 | 443.7 | 236.7 |
| Other[5] | 0.0 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 |
| **Total**[3] | **1462.9** | **1690.9** | **1674.6** | **1629.8** | **1579.5** | **1482.2** | **1529.6** | **1302.7** |
| **Carbon Emissions (tons per person)** | **5.5** | **5.9** | **5.8** | **5.7** | **5.5** | **5.2** | **5.3** | **4.5** |

## Table A19. Carbon Emissions by Sector and Source (Continued)

(Million Metric Tons per Year)

| Projections | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| 23.3 | 22.5 | 22.7 | 21.4 | 21.6 | 19.5 | 19.8 | 22.2 | 21.0 | 21.3 | 20.6 | 20.8 | 18.6 | 19.1 |
| 82.3 | 78.3 | 78.5 | 72.0 | 72.3 | 64.9 | 65.2 | 86.1 | 78.4 | 78.7 | 73.4 | 73.6 | 67.4 | 69.0 |
| 1.4 | 1.2 | 1.2 | 1.0 | 1.0 | 0.9 | 0.9 | 1.4 | 1.1 | 1.1 | 1.0 | 1.0 | 0.9 | 0.9 |
| 230.3 | 198.8 | 199.7 | 143.9 | 143.3 | 101.9 | 97.6 | 265.7 | 190.3 | 192.6 | 129.5 | 131.4 | 81.3 | 80.7 |
| **337.3** | **300.7** | **302.0** | **238.3** | **238.2** | **187.1** | **183.5** | **375.4** | **290.8** | **293.7** | **224.4** | **226.8** | **168.1** | **169.6** |
| 12.5 | 12.0 | 12.0 | 11.3 | 11.4 | 10.0 | 10.3 | 12.1 | 11.4 | 11.5 | 11.1 | 11.2 | 10.0 | 10.3 |
| 54.6 | 51.7 | 51.9 | 46.4 | 46.7 | 38.1 | 39.0 | 56.6 | 51.1 | 51.2 | 47.1 | 47.4 | 40.9 | 42.8 |
| 2.5 | 2.3 | 2.3 | 2.1 | 2.1 | 1.7 | 1.7 | 2.6 | 2.3 | 2.3 | 2.1 | 2.2 | 1.7 | 1.8 |
| 207.6 | 178.0 | 179.6 | 126.3 | 126.3 | 85.6 | 82.7 | 227.3 | 160.4 | 162.9 | 107.8 | 109.8 | 65.8 | 66.1 |
| **277.2** | **244.1** | **245.9** | **186.1** | **186.5** | **135.3** | **133.7** | **298.6** | **225.2** | **227.9** | **168.1** | **170.5** | **118.3** | **121.0** |
| 115.7 | 113.7 | 113.5 | 113.5 | 114.1 | 109.2 | 113.8 | 120.7 | 121.9 | 121.8 | 127.0 | 126.5 | 120.2 | 120.6 |
| 162.4 | 163.1 | 161.9 | 164.1 | 163.5 | 158.2 | 157.2 | 167.4 | 165.6 | 164.1 | 160.7 | 159.6 | 161.6 | 154.0 |
| 67.1 | 56.4 | 56.6 | 48.4 | 48.9 | 41.4 | 41.8 | 66.9 | 53.6 | 53.4 | 50.4 | 50.0 | 41.1 | 40.8 |
| 214.3 | 185.6 | 185.4 | 135.6 | 136.1 | 95.2 | 92.9 | 226.6 | 163.8 | 164.4 | 110.8 | 112.3 | 69.5 | 66.7 |
| **559.4** | **518.7** | **517.4** | **461.5** | **462.5** | **403.9** | **405.8** | **581.6** | **504.9** | **503.7** | **449.0** | **448.4** | **392.4** | **382.0** |
| 592.9 | 580.9 | 580.9 | 552.6 | 555.4 | 495.7 | 505.0 | 644.1 | 618.8 | 616.4 | 598.9 | 594.8 | 547.2 | 551.9 |
| 16.2 | 16.4 | 16.4 | 17.1 | 17.6 | 16.6 | 16.8 | 19.0 | 19.7 | 19.7 | 20.3 | 20.2 | 19.3 | 19.3 |
| 2.5 | 2.6 | 2.6 | 2.5 | 2.5 | 2.3 | 2.4 | 3.8 | 3.8 | 3.8 | 3.7 | 3.7 | 3.4 | 3.5 |
| 5.1 | 4.6 | 4.6 | 3.4 | 3.4 | 2.4 | 2.3 | 6.4 | 4.8 | 4.8 | 3.3 | 3.3 | 2.0 | 2.0 |
| **616.7** | **604.5** | **604.4** | **575.6** | **578.8** | **517.1** | **526.4** | **673.2** | **647.1** | **644.8** | **626.3** | **622.1** | **571.9** | **576.7** |
| 744.3 | 729.1 | 729.1 | 698.7 | 702.6 | 634.3 | 648.9 | 799.1 | 773.1 | 771.0 | 757.6 | 753.3 | 696.0 | 701.9 |
| 315.5 | 309.5 | 308.7 | 299.7 | 300.0 | 277.8 | 278.2 | 329.0 | 314.8 | 313.8 | 301.6 | 300.8 | 289.1 | 285.1 |
| 70.9 | 59.8 | 60.1 | 51.4 | 52.0 | 43.9 | 44.4 | 70.8 | 57.0 | 56.7 | 53.6 | 53.2 | 43.6 | 43.4 |
| 2.5 | 2.6 | 2.6 | 2.5 | 2.5 | 2.3 | 2.4 | 3.8 | 3.8 | 3.8 | 3.7 | 3.7 | 3.4 | 3.5 |
| 657.4 | 567.0 | 569.4 | 409.1 | 409.0 | 285.0 | 275.6 | 726.0 | 519.4 | 524.8 | 351.3 | 356.8 | 218.6 | 215.5 |
| **1790.6** | **1667.9** | **1669.8** | **1461.5** | **1466.0** | **1243.4** | **1249.4** | **1928.7** | **1668.0** | **1670.1** | **1467.8** | **1467.8** | **1250.8** | **1249.4** |
| 7.5 | 6.2 | 6.1 | 5.0 | 4.5 | 7.9 | 6.9 | 5.9 | 3.8 | 4.1 | 9.3 | 15.7 | 6.1 | 7.6 |
| 99.5 | 114.2 | 112.0 | 156.4 | 157.1 | 182.3 | 180.4 | 138.8 | 179.8 | 178.1 | 215.0 | 210.2 | 206.1 | 201.2 |
| 550.4 | 446.6 | 451.3 | 247.7 | 247.3 | 94.8 | 88.2 | 581.3 | 335.8 | 342.6 | 127.0 | 130.8 | 6.4 | 6.7 |
| **657.4** | **567.0** | **569.4** | **409.1** | **409.0** | **285.0** | **275.6** | **726.0** | **519.4** | **524.8** | **351.3** | **356.8** | **218.6** | **215.5** |
| 751.8 | 735.3 | 735.3 | 703.8 | 707.1 | 642.2 | 655.8 | 805.0 | 776.9 | 775.0 | 767.0 | 769.1 | 702.1 | 709.4 |
| 415.0 | 423.7 | 420.7 | 456.1 | 457.1 | 460.2 | 458.6 | 467.8 | 494.6 | 491.9 | 516.5 | 511.0 | 495.3 | 486.3 |
| 621.3 | 506.4 | 511.3 | 299.1 | 299.4 | 138.7 | 132.6 | 652.1 | 392.8 | 399.4 | 180.5 | 184.0 | 50.0 | 50.1 |
| 2.5 | 2.6 | 2.6 | 2.5 | 2.5 | 2.3 | 2.4 | 3.8 | 3.8 | 3.8 | 3.7 | 3.7 | 3.4 | 3.5 |
| **1790.6** | **1667.9** | **1669.8** | **1461.5** | **1466.0** | **1243.4** | **1249.4** | **1928.7** | **1668.0** | **1670.1** | **1467.8** | **1467.8** | **1250.8** | **1249.4** |
| **6.0** | **5.6** | **5.6** | **4.9** | **4.9** | **4.2** | **4.2** | **6.0** | **5.2** | **5.2** | **4.5** | **4.5** | **3.9** | **3.9** |

[1]Includes consumption by cogenerators.
[2]Includes lease and plant fuel.
[3]This includes international bunker fuels which, by convention, are excluded from the international accounting of carbon emissions. In the years from 1989 through 1996, international bunker fuels account for 22 to 24 million metric tons of carbon annually.
[4]Includes pipeline fuel natural gas and compressed natural gas used as vehicle fuel.
[5]Includes methanol and liquid hydrogen.
[6]Measured for delivered energy consumption.
[7]Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy.
[8]Measured for total energy consumption, with emissions for electric power generators distributed to the primary fuels.
Note: Totals may not equal sum of components due to independent rounding.

**Sources:** Carbon coefficients from Energy Information Administration, (EIA) *Emissions of Greenhouse Gases in the United States 1996,* DOE/EIA-0573(96) (Washington, DC, October 1997). 1996 consumption estimates based on: EIA, *Short Term Energy Outlook, August 1997*, Online. http://www.eia.doe.gov/emeu/steo/pub/upd/aug97/index.html (August 21, 1997).
**Projections:** EIA, AEO98 National Energy Modeling System run KYBASE.D080398A, FD24ABV.D080398B, EARLY24.D052099A, FD09ABV.D080398B, EARLY09.D053199A, FD07BLW.D080398B, and EARLY07.D052199A.

## Table A20. Macroeconomic Indicators

(Billion 1992 Chain-Weighted Dollars, Unless Otherwise Noted)

| Indicators | 1996 | Projections | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | | | | | |
| | | Reference | 1990+24% | | 1990+9% | | 1990-7% | |
| | | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start |
| **GDP Chain-Type Price Index (1992=1.000)** | **1.102** | **1.380** | **1.382** | **1.389** | **1.401** | **1.410** | **1.408** | **1.439** |
| **Real Gross Domestic Product** | **6928** | **8525** | **8520** | **8478** | **8474** | **8389** | **8454** | **8272** |
| Real Consumption | 4714 | 5738 | 5735 | 5715 | 5724 | 5676 | 5719 | 5624 |
| Real Investment | 1069 | 1513 | 1509 | 1498 | 1473 | 1469 | 1457 | 1428 |
| Real Government Spending | 1258 | 1386 | 1386 | 1380 | 1384 | 1366 | 1383 | 1351 |
| Real Exports | 857 | 1753 | 1753 | 1744 | 1746 | 1722 | 1744 | 1696 |
| Real Imports | 971 | 1859 | 1857 | 1858 | 1853 | 1856 | 1852 | 1853 |
| **Real Disposable Personal Income** | **5077** | **6206** | **6205** | **6181** | **6224** | **6148** | **6228** | **6113** |
| AA Utility Bond Rate (percent) | 7.57 | 7.14 | 7.17 | 7.17 | 7.55 | 7.28 | 7.70 | 7.49 |
| Real Yield on Government 10 Year Bonds (percent) | 4.99 | 3.78 | 3.79 | 3.78 | 3.97 | 3.88 | 4.04 | 3.96 |
| **Energy Intensity (thousand Btu per 1992 dollar of GDP)** | | | | | | | | |
| Delivered Energy | 10.14 | 9.36 | 9.36 | 9.23 | 9.18 | 9.00 | 9.11 | 8.68 |
| Total Energy | 13.54 | 12.42 | 12.37 | 12.16 | 12.00 | 11.66 | 11.86 | 11.10 |
| Consumer Price Index (1982-84=1.00) | 1.57 | 2.04 | 2.04 | 2.05 | 2.07 | 2.09 | 2.09 | 2.15 |
| Unemployment Rate (percent) | 5.38 | 5.70 | 5.72 | 5.94 | 5.87 | 6.39 | 5.94 | 6.97 |
| **Unit Sales of Light-Duty Vehicles (million)** | **15.10** | **15.69** | **15.60** | **15.47** | **14.91** | **14.98** | **14.64** | **14.33** |
| **Millions of People** | | | | | | | | |
| Population with Armed Forces Overseas | 266.1 | 287.1 | 287.1 | 287.1 | 287.1 | 287.1 | 287.1 | 287.1 |
| Population (aged 16 and over) | 204.2 | 223.8 | 223.8 | 223.8 | 223.8 | 223.8 | 223.8 | 223.8 |
| Labor Force | 133.9 | 149.7 | 149.7 | 149.5 | 149.6 | 149.1 | 149.6 | 148.5 |

**Table A20. Macroeconomic Indicators (Continued)**

(Billion 1992 Chain-Weighted Dollars, Unless Otherwise Noted)

| Projections | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | | | | | | 2020 | | | | | | | |
| Reference | 1990+24% | | 1990+9% | | 1990-7% | | Reference | 1990+24% | | 1990+9% | | 1990-7% | | |
| | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | | 2005 Start | Early Start | 2005 Start | Early Start | 2005 Start | Early Start | |
| **1.606** | **1.628** | **1.622** | **1.655** | **1.637** | **1.701** | **1.663** | **2.281** | **2.303** | **2.296** | **2.317** | **2.303** | **2.337** | **2.305** | |
| **9429** | **9333** | **9385** | **9241** | **9363** | **9032** | **9312** | **10865** | **10815** | **10820** | **10796** | **10803** | **10782** | **10812** | |
| 6347 | 6292 | 6327 | 6248 | 6330 | 6160 | 6338 | 7599 | 7573 | 7579 | 7583 | 7584 | 7636 | 7648 | |
| 1745 | 1714 | 1739 | 1719 | 1754 | 1662 | 1768 | 2100 | 2101 | 2103 | 2098 | 2102 | 2095 | 2102 | |
| 1499 | 1486 | 1490 | 1468 | 1481 | 1442 | 1469 | 1636 | 1622 | 1624 | 1622 | 1623 | 1621 | 1625 | |
| 2337 | 2318 | 2323 | 2283 | 2300 | 2215 | 2256 | 3333 | 3316 | 3313 | 3282 | 3284 | 3218 | 3225 | |
| 2519 | 2509 | 2529 | 2532 | 2559 | 2548 | 2620 | 4123 | 4153 | 4162 | 4195 | 4197 | 4290 | 4292 | |
| **6891** | **6835** | **6867** | **6783** | **6860** | **6719** | **6874** | **8192** | **8144** | **8151** | **8153** | **8158** | **8214** | **8228** | |
| 7.31 | 7.42 | 7.32 | 7.36 | 7.19 | 7.66 | 7.08 | 8.50 | 8.37 | 8.33 | 8.34 | 8.32 | 8.27 | 8.19 | |
| 3.58 | 3.55 | 3.63 | 3.71 | 3.74 | 3.95 | 3.96 | 4.10 | 4.15 | 4.11 | 4.20 | 4.15 | 4.33 | 4.23 | |
| 8.98 | 8.82 | 8.77 | 8.54 | 8.49 | 8.08 | 7.97 | 8.31 | 7.99 | 7.96 | 7.79 | 7.76 | 7.36 | 7.34 | |
| 11.80 | 11.42 | 11.35 | 10.78 | 10.69 | 10.16 | 10.00 | 10.78 | 10.05 | 10.03 | 9.62 | 9.59 | 9.17 | 9.16 | |
| 2.43 | 2.46 | 2.45 | 2.51 | 2.48 | 2.60 | 2.54 | 3.56 | 3.61 | 3.59 | 3.63 | 3.61 | 3.68 | 3.62 | |
| 5.58 | 6.06 | 5.73 | 6.51 | 5.71 | 7.49 | 5.74 | 5.78 | 5.90 | 5.88 | 5.94 | 5.88 | 5.85 | 5.71 | |
| **16.57** | **16.06** | **16.28** | **15.96** | **16.32** | **15.16** | **16.25** | **17.04** | **16.69** | **16.81** | **16.66** | **16.75** | **16.51** | **16.81** | |
| 298.9 | 298.9 | 298.9 | 298.9 | 298.9 | 298.9 | 298.9 | 323.5 | 323.5 | 323.5 | 323.5 | 323.5 | 323.5 | 323.5 | |
| 235.4 | 235.4 | 235.4 | 235.4 | 235.4 | 235.4 | 235.4 | 255.6 | 255.6 | 255.6 | 255.6 | 255.6 | 255.6 | 255.6 | |
| 156.5 | 156.0 | 156.2 | 155.4 | 156.0 | 154.4 | 155.7 | 162.2 | 162.0 | 162.0 | 161.9 | 161.9 | 161.8 | 161.9 | |

GDP = Gross domestic product.
Btu = British thermal unit.
**Source:** Simulations of the Data Resources, Inc. (DRI) Model of the U.S. Economy.

## Appendix B

# Letter from the Committee on Science

F. JAMES SENSENBRENNER, JR., Wisconsin, CHAIRMAN

GEORGE E. BROWN, JR., California
Ranking Minority Member

U.S. HOUSE OF REPRESENTATIVES

## COMMITTEE ON SCIENCE

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March 2, 1999

The Honorable Jay E. Hakes
Administrator
Energy Information Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Dr. Hakes:

On December 16, 1998, we formally requested that the Energy Information Administration undertake a study to analyze the impact of specific policies on reducing carbon emissions. The purpose of this letter is to ask you to analyze the impact of the President's Climate Change Technology Initiative, as defined for the 2000 budget, on reducing carbon emissions from the levels forecast in the *Annual Energy Outlook 1999* reference case. Also, in our previous letter we asked you to evaluate an earlier start date than 2005, which was the first year that the price signal was passed to consumers in your study of the Kyoto Protocol that you conducted at our request. We would like you to use a start date of 2000 and compare the annual and cumulative carbon price for complying with the Protocol for 3 of the cases you considered in the earlier study (24% above, 9% above, and 7% below 1990 levels) with the later start date of 2005.

We would appreciate these analyses in the next few months and may request further analyses as we evaluate other policies that the Administration is contemplating. Our staff will continue to work with your staff on any questions you may have relating to this request.

Sincerely,

F. JAMES SENSENBRENNER, JR
Chairman

GEORGE E. BROWN, JR
Ranking Minority Member