Forecasting the Benefits of DOE Programs for Advanced Fossil-Fuel Electricity Generating Technologies: The EIA High Fossil Electricity Technology Case

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October 2002

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List of Acronyms

AEO	Annual Energy Outlook Report
BART	Best Achievable Retrofit Technology
CAA	Clean Air Act
CAA90	Title IV of the Clean Air Act Amendments of 1990
C_N	capital cost of the Nth unit built
DOE-FE	U.S. Department of Energy Office of Fossil Energy
DRI-WEFA	Data Resources - Wharton Economic Forecasting Associates
EIA	DOE Energy Information Administration
EMM	Electricity Market Module of NEMS
F	learning factor representing the reduction in capital cost for every doubling of cumulative capacity (N)
FGD	Flue gas desulfurization
HFET	High Fossil Electricity Technology case
HHV	Higher heating value
IGCC	Intergrated Coal Gasification Combined Cycle
IFC	Indirect Fired Cycles
LEBS	Low Emission Boiler Systems
LHV	Lower heating value
kW	kilowatt
kWh	kilowatt-hour
MACT	Maximum Achievable Control Technology
MW	Megawatt
N	number of units in operation
NAAQS	National Ambient Air Quality Standards
NEMS	National Energy Modeling System
NERC	North America Electricity Reliability Council
NETL	National Energy Technology Laboratory
NGCC	Natural Gas Combined Cycle
NSR	New Source Review
O&M	operating and maintenance costs
PFBC	Pressurized Fluidized Bed Combustors

Executive Summary

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Each year the DOE Energy Information Administration (EIA) produces forecasts of U.S. energy activities for the next twenty to twenty-five years. The forecasts are generated with the EIA's National Energy Modeling System (NEMS) and are published in the EIA's Annual Energy Outlook (AEO) report. The AEO report is based on a business-as-usual forecast, called the Reference case, of what is most likely to happen given existing legislation and known trends for economic, technological, and demographic growth. After producing the Reference case forecast, the EIA reruns the Reference case with selected changes in the assumptions. These reruns, called "alternate" cases, selectively vary assumptions for economic growth, fuel supplies, and rates of improvements in energy technologies.

Many of the alternate cases are designed to forecast the benefits of certain DOE R&D programs. For example, the "High Renewables" alternate case assumes the goals of DOE R&D programs are met for renewable energy technologies. The "Electricity: Advanced Nuclear Cost" case assumes the goals of DOE R&D programs are met for nuclear electricity generating technologies.

Another of the side cases, called the “High Fossil Electricity Technology" (HFET) case, assumes the goals of fossil energy R&D programs are met for the following fossil-fuel electricity generating technologies: advanced single-cycle combustion turbines, advanced natural-gas combined cycle (NGCC), and integrated coal gasification combined cycle (IGCC). Programs for these technologies are administered by the DOE Office of Fossil Energy (DOE-FE) and its National Energy Technology Laboratory (NETL).

This report provides a detailed discussion of the EIA HFET case. Extensive tables of forecast data are included in the Appendices. These tables are similar to those found in the EIA's AEO reports and can be used for further detailed analyses of the impacts and benefits of DOE-FE programs.

The EIA HFET case predicts that if the goals of DOE R&D programs are met for advanced fossil-fuel electricity generating technologies, these technologies will capture the majority (62%, 230 GW) of the market for new electricity generating plants over the next twenty years. Because these technologies generate electricity at lower costs, they will produce cumulative benefits exceeding $100 billion (year 2000 dollars) in electricity cost savings for U.S. consumers by the year 2020.

Under the HFET case, by the year 2020 use of natural gas for electricity generation is 22% lower and natural gas prices are 9% lower than in the AEO Reference case. Use of coal for electricity generation increases 4% by 2020 under the HFET case. Despite the reduced use of natural gas and increased use of coal for electricity generation under the HFET case, emissions of SO_2, NO_X, CO_2, and Hg do not increase (as compared to the Reference case) because of the higher generating efficiency and better pollution controls of advanced fossil-fuel electricity technologies.

Introduction

Introduction

The Federal government is moving towards the use of uniform, quantitative, objective methods to measure how well Federal organizations are meeting their goals and how much these goals will benefit the U.S. in the future.

The mission of the DOE Office of Fossil Energy (DOE/FE) and its National Energy Technology Laboratory (NETL) is to develop technologies that assure U.S. fossil energy resources can meet increasing demand for affordable energy without compromising the quality of life for future generations of Americans. This mission includes research and development (R&D) programs for advanced fossil-fuel based electricity generating technologies that will produce electricity at lower costs while reducing emissions.

To forecast the impacts and benefits of DOE/FE programs a model is needed to predict how DOE/FE technologies will affect U.S. energy activities in the future. Parameters of interest include market penetration, fossil-fuel use, cost of electricity, and emissions. To provide a common basis for comparison and to avoid conflicting claims between programs, it is advisable that the DOE use the same model to evaluate all of its programs.

Predicting future energy activities requires a comprehensive model of the U.S. energy markets, environmental regulations, and the U.S. macro-economy. To be of use to the DOE/FE, the model must describe the fossil-fuel production and conversion sectors and must include detailed descriptions of advanced electricity generating technologies. The model must simulate electricity markets (both regulated and deregulated) and compliance with emissions regulations.

The most comprehensive model of U.S. energy activities is the National Energy Modeling System (NEMS) developed by the DOE Energy Information Administration (EIA) [1-2]. NEMS has been is use by the EIA since 1993, and is built upon knowledge and experience with energy modeling dating back to 1973.

The U.S. Congress has established and funded the EIA as the sole, independent organization of the federal government with authority for energy information collection, analysis, and forecasting [3-5].

The EIA is bound by law to be neutral on policy issues and does not receive funding from DOE R&D program [3-5]. This makes the EIA a neutral, objective, and credible third party with the expertise and tools to forecast the benefits of all DOE R&D programs.

Since 1977, the U.S. Congress has mandated the EIA to publish annual forecasts of energy trends in the United States [3-5]. The EIA uses NEMS to produce these forecasts. The forecasts are published each year in the EIA's Annual Energy Outlook (AEO) reports [6-7].

The AEO report is based on a business-as-usual forecast called the Reference case. The Reference case is a prediction of what is most likely to happen given known technological, economic, and demographic trends. The Reference case assumes that current Federal, State, and local laws and regulations remain in place. Pending legislation and existing legislation requiring funds that have not been appropriated are not included in the AEO Reference case.

The Reference case assumes that improvements in the cost and performance of energy supply, conversion, and consumption technologies follow gradual, historic, market-based trends over the next twenty to twenty-five years. The cost and performance of most energy technologies in the AEO Reference case do not meet the goals of DOE programs, including electricity generating technologies under development by the DOE/FE.

After producing the Reference case forecast, the EIA reruns the Reference case with selected changes in the assumptions. These reruns, called "alternate cases" or "side cases," selectively vary assumptions for economic growth, fuel supplies, and rates of improvements in energy technologies. The EIA produces a total of twenty-nine alternate cases (see Appendix B for a list of the alternate cases).

Many of the alternate cases are already designed to forecast the benefits of DOE R&D programs. For example, the "High Renewables" alternate case assumes the goals of DOE R&D programs are met for renewable energy technologies. The "Electricity: Advanced Nuclear Cost" case assumes the goals of DOE R&D programs are met for nuclear electricity generating technologies.

Another of the alternate cases, called the "Electricity: High Fossil Technology" case, (hereafter referred to as the "High Fossil Electricity Technology" or HFET case) reruns the AEO Reference case assuming the goals of DOE/FE R&D programs are met for advanced fossil-fuel electricity generating technologies. The HFET case is the subject of this report.

The HFET case includes only the goals of DOE/FE programs for advanced fossil-fuel electricity generating technologies. The cost and performance of all other technologies are the same as in the Reference case. The HFET case does not include the goals of DOE programs that will produce other advanced electricity generating technologies such as nuclear, renewables, or hydro. Thus, the HFET case provides a specific, targeted forecast of the benefits of DOE/FE programs only.

The HFET case uses DOE/FE R&D program goals for the cost and performance of the following technologies:

- advanced single-cycle combustion turbines
- advanced natural-gas combined cycle (NGCC)
- integrated coal gasification combined cycle (IGCC)

Cost and performance specifications used in the HFET case for these technologies are provided to the EIA by the DOE Office of Fossil Energy.

Table 1 shows the capital cost[1] and efficiency[2] of advanced fossil-fuel electricity generating technologies in the AEO 2002 Reference case and the HFET case. In the AEO 2002 Reference case, the efficiency of advanced fossil-fuel electricity generating technologies reaches a maximum in the year 2010 and does not increase thereafter.

In the HFET case, the efficiencies of all technologies are improved significantly to meet the goals of DOE/FE programs. Only the capital cost of IGCC was improved for the HFET case.

The EIA publishes a brief description of each of its twenty-nine alternate AEO cases. The EIA publishes only a few paragraphs and one page of results for the HFET case [8]. This report provides a detailed description of the HFET case. Important results are discussed and extensive output data is included in Appendix A.

Appendix A of this report is a reproduction of Appendix A of the EIA's AEO report, but data for the HFET case is shown side-by-side with output data for the AEO Reference case. HFET data that differs from the Reference data by more than 1% is emphasized for easy identification.

The AEO Reference and HFET cases of NEMS were obtained and rerun by the NETL Office of Systems and Policy Support for this study. As explained and where indicated, the HFET case was also rerun with changes in certain assumptions for technologies under development by the DOE/FE.

Table 1. Capital costs and efficiencies of advanced fossil-fuel electricity generating technologies in the AEO Reference and High Fossil Electricity cases[1,2].

	IGCC						Advanced Single-Cycle Turbines						Advanced NGCC					
	Capital Cost ($/kW)			Efficiency (%)			Capital Cost ($/kW)			Efficiency (%)			Capital Cost ($/kW)			Efficiency (%)		
	Today	2010	2020	Today	2010	2020	Today	2010	2020	Today	2010	2020	Today	2010	2020	Today	2010	2020
Reference	$1377	$1331	$1225	43.9%	49.0%	49.0%	$450	$410	$410	38.3%	46.9%	46.9%	$620	$590	$560	50.1%	59.1%	59.1%
HFET	$1377	$1034	$983	43.9%	50.7%	60.0%	$450	$410	$410	38.3%	55.2%	55.2%	$620	$590	$560	50.1%	66.2%	75.7%

[1] All costs in this report are in terms of year 2000 dollars.

[2] In this report, to follow industry convention, efficiencies quoted for coal systems are based on the higher heating value (HHV) and efficiencies quoted for natural-gas turbine systems are based on the lower heating value (LHV), unless stated otherwise.

The Electricity Market Module of NEMS

The Electricity Market Module of NEMS

The National Energy Modeling System (NEMS) is a large computer modeling system consisting of more than 300,000 lines of Fortran code divided into several hundred files and subroutines. The EIA has invested hundreds of person-years in the development of NEMS since 1990 [1-2].

NEMS is made up of twelve separate "modules" (Figure 1) that can be developed and run independently. Each module simulates a different energy supply, conversion, or demand sector. NEMS simulates energy markets (regulated or deregulated) by explicitly representing the economic decision making processes involved in the production, conversion, and consumption of energy products. National macroeconomic activity and the interaction between energy markets and the national economy are predicted within the Macroeconomic Activity Module of NEMS using proprietary DRI-WEFA macroeconomic models [9].

The Electricity Market Module (EMM) of NEMS is of particular interest to the DOE-FE because it predicts the fuels and types of electricity generators that will be used to meet the U.S.'s increasing electricity demand over the next twenty to twenty-five years. The EMM divides the U.S. into thirteen regions based on North America Electricity Reliability Council (NERC) regions and sub-regions (Figure 2). The EMM models each region separately as an independent entity generating and consuming electricity. Energy (fuels and electricity) can be transferred (bought and sold) between regions and from Canada and Mexico.

The United States has more than 1000 individual electricity generating plants. Because many electricity generating plants have the same or similar cost and performance specifications, NEMS does not identify each individual plant and location. Rather, electricity plants are grouped into categories by technology characteristics. This significantly reduces computation time and complexity without sacrificing accuracy in prediction of regional and national parameters.

Each region is assumed to have a capacity of each type of electricity generator. The capacities for each region are derived from data received in mandatory surveys of electricity generators by the EIA and

Figure 1. NEMS modules and data flow between modules.

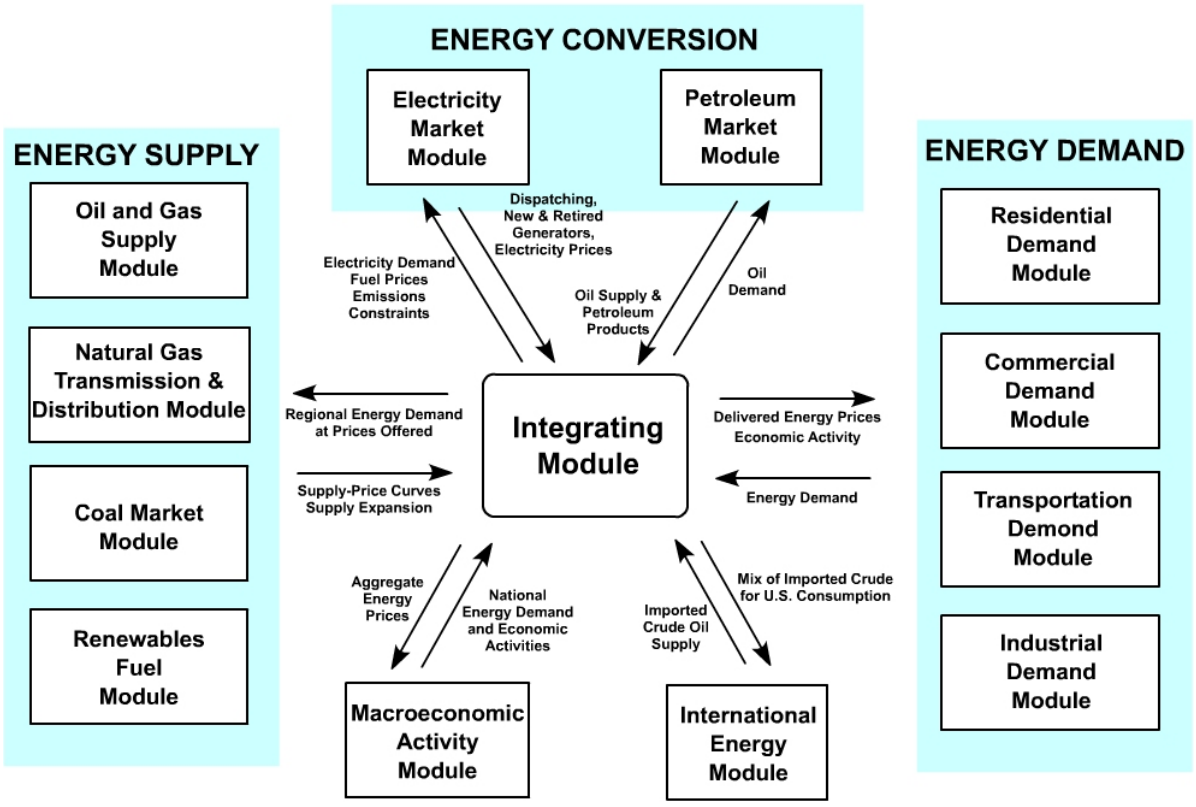
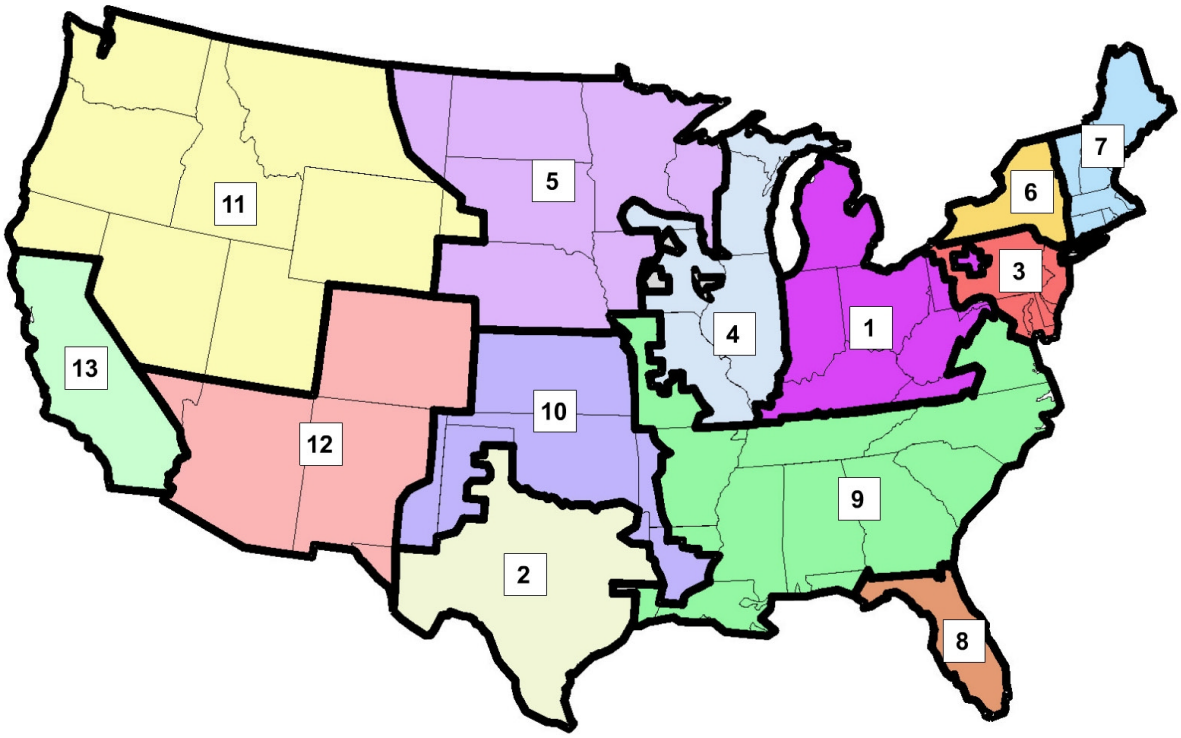


Figure 2. Regions modeled by the Electricity Market Module.



1 East Central Area Reliability Coordination Agreement (ECAR)
2 Electric Reliability Council of Texas (ERCOT)
3 Mid-Atlantic Area Council (MAAC)
4 Mid-America Interconnected Network (MAIN)
5 Mid-Continent Area Power Pool (MAAP)
6 Northeast Power Coordinating Council/New York (NY)
7 Northeast Power Coordinating Council/New England (NE)
8 Florida Reliability Coordinating Council (FL)
9 Southeastern Electric Reliability Council, excluding Florida (STV)
10 Southwest Power Pool (SPP)
11 Western Systems Coordinating Council/Northwest Power Pool (NWP)
12 Rocky Mountain, Arizona, New Mexico, Southern Nevada (WSCC/RA)
13 California (WSCC/CNV)

discussions with industry and government sources [10-11]. Table 2 shows the types of electricity generators in NEMS. For each region, each type of electricity generator competes to meet the region's electricity demand.

When NEMS is run, the EMM receives predicted values of the following for each region:

- electricity demand from the NEMS demand modules (represented by load curves which vary by region, season, and time of day)
- fuel prices from the NEMS fuel supply modules
- macroeconomic parameters from the NEMS macroeconomic module.

The EMM then predicts the actions taken by electric utilities and non-utilities to meet present and future electricity demand in the most economical manner while complying with emissions regulations. The EMM returns predictions of electricity prices to the demand modules, fuel consumption to the fuel supply modules, emissions to the integrating module, and capital requirements to the macroeconomic module. The other NEMS modules then recalculate their predictions and send revised values to the EMM. This iterative process continues until a solution is converged (values of variables no longer change) for each region and model year.

Electricity demand is met by operating (dispatching) the combination of plants that minimizes cost (costs include fuel, variable operating and maintenance (O&M), and environmental costs) while complying with environmental regulations. The decision to build new plants to meet increasing electricity demand, and the choice of technology to build is determined by the least-cost combination of all costs, including capital costs. For technologies with long construction times, time-dependent parameters are averaged (e.g., fuel costs) over a planning horizon six-years into the future.

The EMM consists of four sub-modules:

- Electricity Capacity Planning Submodule
- Load and Demand Side Management Submodule
- Electricity Fuel Dispatching Submodule
- Electricity Finance and Pricing Submodule

The solution sequence of the EMM submodules can be summarized as follows:

1. The Load and Demand Side Management submodule takes electricity demand data and constructs load curves that vary by region, season, and time of day.

2. The Electricity Capacity Planning submodule predicts:
   - construction of new generating plants
   - retirement (if appropriate) of existing plants
   - addition of retrofit equipment (e.g., SO_2 scrubbers, NOx controls, activated carbon injection for mercury control) for environmental compliance

3. The Electricity Fuel Dispatch submodule dispatches the available generating units, both utility and non-utility, allowing surplus capacity in selected regions to be dispatched for another region's needs.

4. The Electricity Finance and Pricing submodule calculates total revenue requirements for electricity generating plants and computes average and marginal-cost based electricity prices.

Electricity Generating Technologies Represented in the EMM

Table 2 lists the types of electricity generating technologies that are represented in the EMM. The existing fleet of coal-fired plants is represented by thirty-two technology categories based on the type of pollution control equipment used. To represent newer coals-fired plants, a separate category is also available for pulverized-coal plants with moderately higher efficiencies (34.4% in 2002) and with wet flue-gas desulfurization. To represent the most advanced coal-fired plants, technology categories are available for IGCC plants with and without carbon sequestration. However, sequestration technologies are not made available in AEO 2002 cases because the EIA believes that, given existing R&D efforts, sequestration will not be commercially viable within the forecasting horizon (through 2020) of AEO 2002 cases.

Turbine technologies are represented by categories for existing, conventional and advanced single-cycle and combined-cycles, each with a different efficiency. Large, grid-connected fuel cells (typical unit size of 10 MW) are also available as a separate electricity generating technology. Nuclear plants are available in conventional and advanced categories. Eight categories of renewable energy sources are available.

Distributed generation in the EMM is considered to be connected to the main distribution grid. Distributed generators not connected to the grid are modeled in the Residential and Commercial Demand modules of NEMS. In the EMM, distributed generators are represented by two generic categories: one for base load service and one for peak load service.

The cost and performance for each generic distributed generation category is a weighted average based of the present market share of existing distributed generation technologies. The lowest costs are for the diesel cycle/compression ignition engines operated with natural gas. This technology represents 40 percent of the generic technology for peaking distributed generators. Combustion turbines and compression ignition engines make up about one-half of the base-load category. See Appendix C for more information on distributed generators and fuel cells in NEMS.

It should be noted that not all of the advanced coal-fired electricity generating technologies under development by the DOE-FE are represented explicitly in NEMS. Low Emission Boiler Systems (LEBS), Pressurized Fluidized Bed Combustors (PFBC), and Indirect Fired Cycles (IFC) are not represented, although some would be represented by the generic category for coal-fired plants at 34.4% efficiency today and with low sulfur emissions. "Repowering" of existing power plants is not represented in NEMS.

Table 2. Electricity Generating Technologies in NEMS

Average efficiency of each technology (based on HHV) in the year 2001 is shown in parentheses.

Fossil Fuel Technologies

- Existing coal plants: 32 types with different combinations of pollution control equipment: baghouses, dry scrubbers, wet scrubbers, SCR, cold-side ESP, hot-side ESP, activated carbon injection with fabric filter, activated carbon injection with spray cooling (28.5%)
- Generic PC plant with wet flue gas desulfurization (34.4%)
- IGCC (41.4%)
- IGCC with carbon sequestration (not available)
- Gas/Oil Steam Turbine (35.9%)
- Combustion Turbines:
  - Existing (28.5%)
  - Conventional (28.5%)
  - Advanced (36.1%)
- Combined Cycle Turbine Systems:
  - Existing Gas/Oil (42.6%)
  - Conventional Gas/Oil (42.6%)
  - Advanced Gas/Oil (47.2%)
  - Advanced with Sequestration (not available)
- Fuel Cells (56.4%)

Nuclear

- Conventional Nuclear (31.6%)
- Advanced Nuclear (32.8%)

Renewables

- Biomass (Wood)
- Geothermal
- Municipal Solid Waste
- Hydroelectric
- Pumped Storage
- Wind
- Solar Thermal
- Photovoltaic

Distributed Generation

- Base load: represents heavy-duty micro-turbines, combustion turbines, compression ignition engines, small fuel cells (31.5%)
- Peak load: represented micro-turbines, frame-type combustion turbines operating on natural gas, and three types of reciprocating engines (32.1%)

Emissions Regulations for Electricity Generators

For the AEO cases, NEMS simulates only existing environmental laws and regulations. State, Federal, and local environmental legislation and regulations that were in effect by September 1, 2001, were included in the AEO 2002 cases.

The EIA occasionally uses NEMS to evaluate proposed legislation. These studies are usually done at the request of the U.S. Congress or the Secretary of Energy. In 1998 and 1999 the EIA used NEMS to evaluate the impacts of the Kyoto Protocol. In 2002 the EIA used NEMS to evaluate legislation to simultaneously reduce emissions of SO_2, NOx, Hg and CO_2 and to evaluate Renewable Portfolio Standards [12-14].

NEMS simulates the competition between different types of electricity generators based on the cost of generating electricity. The cost of complying with environmental regulations, whether by adding pollution control equipment, fuel switching, or purchasing emissions permits, is included in the cost of generating electricity.

NEMS simulates the emissions regulations affecting electricity generating plants under the Clean Air Act (CAA). Table 3 shows a list of existing and proposed emissions regulations under the CAA for electricity generating plants.

The list in Table 3 could change significantly if legislation for the Clear Skies Initiative (CSI) is passed into law and enforced by the EPA. The CSI proposes to establish a market-based, top-down approach to achieve national caps for SO_2, NO_X, and Hg emissions from electric generating facilities. The CSI's top-down approach is intended to replace the most of the bottom-up, plant-by-plant, "command-and-control" regulatory approaches now in use under the Clean Air Act. The CSI was proposed in January of 2002 -- it is not included in any of the AEO 2002 cases, including those discussed in this report.

Table 3. Summary of Emissions Regulations Affecting Power Plants.

Regulation	Purpose	Compliance Dates	Modeled in NEMS
Acid Rain Program	Reduce national SO_2 emissions to 50 percent below 1980 levels. Target emission level is about 9 million tons annually by 2000.	Phase I SO_2 reductions, 1995; Phase II SO_2 reductions, 2000.	Yes
NO_X Regional Transport Rule	Reduce NO_X emissions by 2 million tons by 2000.	Phase I NO_X reductions, 1995; Phase II NO_X reductions, 2000.	Yes
National Ambient Air Quality Standards (NAAQS)	Reduce criteria pollutant emissions. The targeted criteria pollutants are ozone, particulate matter, carbon monoxide, SO_2, NO_X, and lead.	Reduce NO_X emissions to attain the existing 0.12 ppm, 1-hour-average ozone NAAQS under the NO_X SIP-Call in 19 eastern states and DC in 2004, and to comply with the revised 0.08ppm, 8-hour-average ozone standard throughout the country by 2009. SO_2 and NO_X emission reductions to attain the PM2.5 NAAQS by 2010.	Partially
Regional Haze Best Achievable Retrofit Technology (BART)	Mitigate visibility problems due to pollution in several national parks and wilderness areas.	Attainment area SIPs due 2004-2006. Nonattainment area SIPs due 2006-2008.	No
Maximum Achievable Control Technology (MACT) Standards for Hazardous Air Pollutants (HAPs)	EPA reported to Congress that it intends to regulate mercury emissions from electricity generating power plants. EPA is developing regulations for reducing HAPs emissions, including Hg.	Proposed Hg regulations are to cap Hg emissions at 5 tons in 2008.	No
New Source Review (NSR)	Improve overall plant performance and reduce emissions by requiring plants undergoing major operations changes to comply with new regulations, similar to if the plant were a newly constructed facility	EPA has proposed reforms that will streamline the NSR process.	No

Simulation of the CAA in NEMS (Acid Rain Program, NO_X Regional Transport Rule, and NAAQS) is further discussed in the following sections.

Simulation of SO_2 Regulations and Control

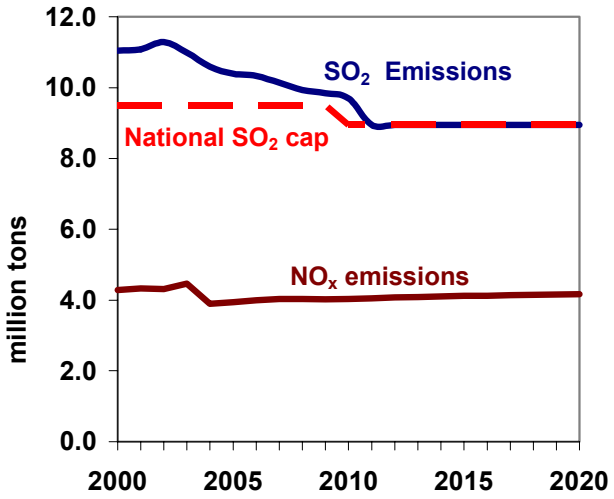
SO_2 emissions regulations under Title IV of the CAA of 1990 (CAAA90), also known as the Acid Rain Program, are fully simulated in NEMS. The Acid Rain Program is a market-based "cap-and-trade" system in which the EPA distributes emissions allowances to individual power plants allowing them to emit a specified amount of SO_2 each year. The total number of allowances distributed to all power plants in the U.S. equals the national SO_2 emissions cap. Power plants are allowed to trade allowances or bank unused allowances for later use. No further emission or technology requirements are imposed on power plants – they are free to choose the method of compliance, whether it be through adding pollution controls, purchasing allowances from others, switching to lower sulfur fuels, or reducing power plant utilization. NEMS simulates the choice of compliance method.

Figure 3 shows the national emissions of SO_2 used in NEMS and the national SO_2 emission cap. The CAAA90 set a goal of reducing annual SO_2 emissions by 50 percent below 1980 levels, resulting in a national emissions cap of about 9 million tons per year. Actual emissions exceed the national caps from 2000-2009 because of the large number (about 10 million tons in 2000) of allowances that have been banked. The area between the blue and red lines for SO_2 emissions represents the bank of emissions available prior to 2000.

To achieve these reductions, the CAAA90 required a two-phase tightening of the restrictions placed on fossil-fuel-fired power plants. Phase I began in 1995 and targeted high-emitting (>2.5 lb/mmbtu SO_2), large (>100 MW) power plants units. Phase I directly affected 263 units in 110 coal-burning electric utility plants in the east and midwest; another 182 units were used as substitute units, thus the total affected units during Phase I was 445. Phase II began in the 2000 and applies to virtually all coal-fired power plants. Phase II tightened the Phase I emissions allowances for the large, higher emitting plants and set restrictions on smaller coal, oil, and natural gas plants, for a total of 2,000 facilities. The program affects existing utilities with greater than 25 MW capacity, and all new units.

NEMS simulates the choice of compliance method, whether it be via FGD retrofits, transferring or purchasing SO_2 emission allowances, fuel switching to low sulfur content fuels, and operating high-sulfur coal units at a lower capacity utilization rate. The average costs of FGD retrofits used in AEO 2002 cases are $400/kW for units under 500 MW and $234/kW for units over 500 MW.

Figure 3. National levels of SO_2 and NO_x emissions in the NEMS AEO 2002 Reference case.



Simulation of NO_X Regulation and Control

The CAAA90 also called for a 2 million ton reduction in NO_X emissions, carried out in two phases by 2000. NEMS simulates the implementation of Group 1 boilers to meet the Phase I and II requirements of NO_X reductions following the mandated emissions output per boiler type, summarized in Table 4. Permissible NO_X emissions for advanced coal, combined cycle, and combustion turbines are 0.11 lb/mmbtu, 0.02 lb/ mmbtu, and 0.08 lb/ mmbtu, respectively.

Table 4. NO_X Emissions Standards (lb/mmbtu)

Boiler Type	Number of Boilers	Phase I Limit	Phase II Limit
Group 1			
Dry Bottom Wall-Fired	284	0.50	0.45
Tangential	296	0.45	0.38
Group 2			
Cell Burner	35	NA	0.68
Cyclones	88	NA	0.94
Wet Bottom Wall-Fired	38	NA	0.86
Vertically Fired	29	NA	0.80
Fluidized Bed	5	NA	0.29

Simulation of NAAQS

NEMS models the summer restrictions on aggregate NO_X emissions called for under the NAAQS in 19 states and the District of Columbia (Table 5).

Table 5. Summer Season NOX Emissions Budgets for 2004 and Beyond (thousand tons per season)

State	Cap
Alabama	30.60
Connecticut	5.20
Delaware	5.00
District of Columbia	0.20
Illinois	36.60
Indiana	51.80
Kentucky	38.80
Maryland	13.00
Massachusetts	14.70
Michigan	29.50
New Jersey	8.20
New York	31.20
North Carolina	32.70
Ohio	51.50
Pennsylvania	46.00
Rhode Island	1.60
South Carolina	19.80
Tennessee	26.20
Virginia	21.00
West Virginia	24.05

The High Fossil Electricity Technology Case

The EIA's AEO Reference case is a "business-as-usual" forecast, a forecast of what is most likely to happen barring unexpected changes in economic, demographic, legislative and technology trends. In the Reference case, the cost and performance of energy supply, conversion, and consumption technologies improve gradually according to historical trends and the judgment of EIA experts. The goals of most DOE R&D programs are not met in the Reference case, including the goals of DOE-FE programs.

After producing the Reference case forecast, the EIA reruns the Reference case to produce alternative cases in which assumptions for economic growth, fuel supplies, and rates of improvements in energy supply, conversion and consumption technologies are systematically varied (see Appendix B for a list of the alternate cases). The alternate cases serve to evaluate the sensitivity of the Reference case forecast to its assumptions, including assumptions for DOE R&D programs.

The focus of this report is an alternate case called the "High Fossil Electricity Technology" (HFET) case. The HFET case is a rerun of the Reference case with the cost and performance goals of DOE-FE programs for advanced fossil-fuel electricity generators. All other things are held equal to the Reference case.

In the HFET case it is assumed that the goals of DOE R&D programs are met for the following technologies:

- advanced single-cycle combustion turbines
- advanced natural-gas combined cycle (NGCC) systems
- integrated coal gasification combined cycle systems (IGCC)

Improved cost and efficiency specifications for these technologies were provided by the DOE Office of Fossil Energy [15].

Capital Costs of Advanced Fossil-Fuel Electricity Generating Technologies

In the Reference case, improvements in the capital cost of each electricity generating technology are a function of market penetration (of the number of units in operation) using an equation of the following form [7,16]:

$$C_N = a\,N^{-b} \qquad \text{Equation (1)}$$

where C_N is the capital cost of the Nth unit built, N is the number of units in operation, a is a constant determined by the initial condition, and

$$b = \ln(1-f) / \ln(2) \qquad \text{Equation (2)}$$

The learning factor, f, represents the reduction in capital cost for every doubling of cumulative capacity (N) and is an exogenous variable (specified by the user) for each technology.

In the HFET case, Equation (1) is not used to set capital costs; rather, capital costs are specified exogenously as a constant for each year. Capital costs do not depend on market penetration in the HFET case. This approach is more representative of R&D programs that can produce technology improvements independent of the number of commercial units in operation.

Figures 4-6 show the capital costs of advanced fossil-fuel electricity generating technologies in the Reference and HFET cases. The values for the HFET case represent the goals of DOE-FE R&D programs. Capital costs for adv. single-cycle combustion turbines and adv. NGCC systems are the same in the Reference and HFET cases. Only the capital cost of IGCC is improved for the HFET case.

As shown in Figure 4, the capital cost of IGCC decreases from a national average of $1,377/kW today to $1,264/kW in the year 2020 for the Reference case. (All dollar values in this report are in terms of year 2000 dollars.) In the HFET case, the capital cost of IGCC improves linearly to $1,030 by 2010 and $980/kW by 2020.

The national average capital cost of adv. single-cycle combustion turbines improves from $450/kW today to $410/kW by the year 2020 (Figure 5). The capital cost of advanced NGCC systems improves from $620/kW today to $560/kW by the year 2020 (Figure 6).

Figure 4. Capital Cost for IGCC in the Reference and HFET cases.

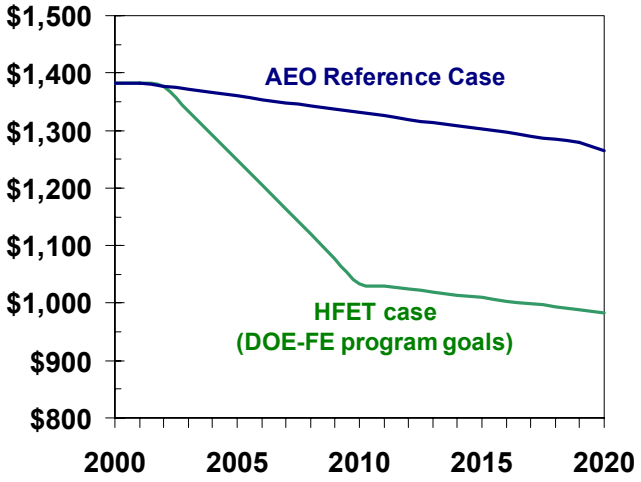
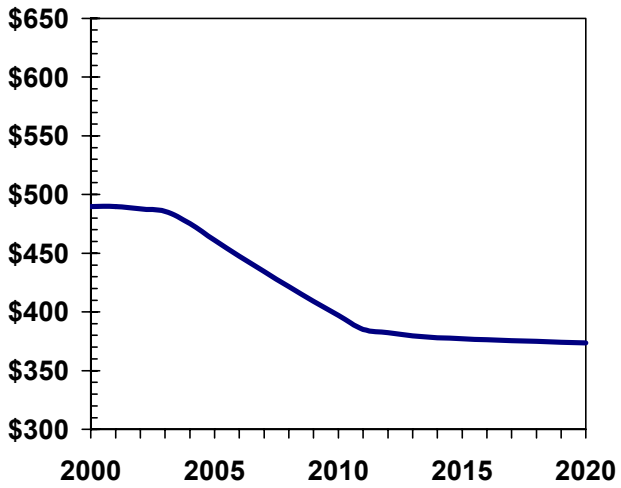


Figure 5. Capital Cost for Advanced Single-Cycle Combustion Turbines in the Reference and HFET



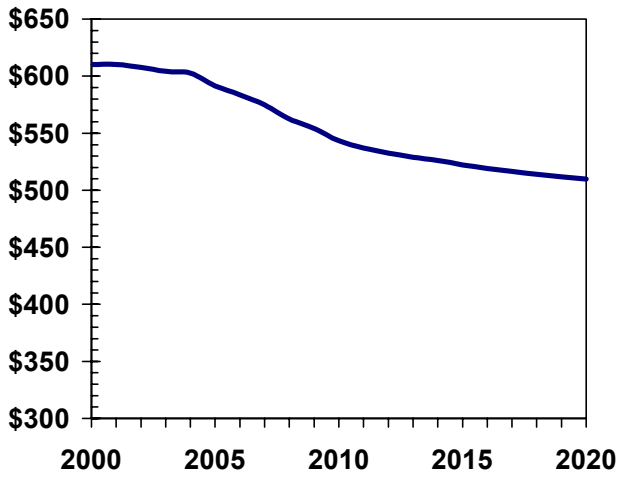
Regional Variations in Capital Cost

The capital costs shown above are averages of capital costs for the thirteen individual EMM regions. Capital costs vary by NERC region to account for differences in material and labor costs. Capital costs also vary by region to account for variations in ambient conditions (air temperature, humidity, and pressure) that can affect the size (and therefore capital cost) of a power plant required to produce the same electricity output. See Appendix D for more information on regional variations in capital cost.

The EIA's estimate of capital cost for IGCC is very close (within 1-2%) to that estimated by Parsons Energy and Chemicals Group in the report "Evaluation of Innovative Fossil Fuel Power Plant with CO2 Removal" [17]. This report was funded by the DOE-FE Gasification Program and EPRI. The Parsons estimate of the capital cost of an IGCC plant is $1,308/kW for a generic without regional adjustments. The EIA's capital cost for IGCC without regional adjustments is $1,338/kW, only 2% higher than that estimated by Parsons.

The EIA forecasts that the most likely region for IGCC plants to be built is the Southeastern Electric Reliability Council region (explained later in this report). In this region the capital cost in NEMS for an IGCC plant is $1,319/kW. This is within 1% of the capital cost estimated by Parsons. See Appendix E for more discussion of the capital cost estimates by the EIA and Parsons for IGCC.

Figure 6. Capital Cost for Advanced NGCC Turbine Systems in the Reference and HFET cases.



The Parsons report also provides capital cost estimates for state-of-the-art NGCC systems using either an "F" class turbine or an "H" class turbine. The Parsons estimate of capital cost for NGCC today is $522/kW with an "F" class turbine and $513/kW with an "H" class turbine (without regional adjustments). The capital cost of advanced NGCC used in NEMS for the year 2002 is $589/kW, about 15% higher than the Parsons estimates.

For NERC region 13, the California (CNV) region, NEMS imposes "externality" charges on IGCC for emissions of carbon, SO2, NOx and VOC's. To determine the effect of the externality charges, the HFET case was rerun by the NETL Office of Systems and Policy Support with and without externality charges. It was found that the externality

charges decrease by 50% the capacity of IGCC predicted to be built in the California region. See Appendix F for more information on externality charges on IGCC in the California region.

Efficiency of Advanced Fossil-Fuel Electricity Generating Technologies

In NEMS, the efficiency of each electricity generating technology is specified by the user as a constant for each year of the forecasting horizon. The HFET case assumes significant improvements in efficiency to meet DOE-FE program goals for advanced fossil-fuel electricity generating technologies.

Figures 7-9 show plant efficiencies for advanced fossil-fuel electricity generating technologies in the Reference and HFET cases. Following industry practice, efficiencies listed in this report for coal-fired IGCC are based on higher heating values (HHV) and efficiencies for natural-gas fired turbines on lower heating values (LHV). Efficiency improvements in the HFET case are attributed to DOE-FE R&D programs and the values were supplied by the DOE Office of Fossil Energy [15].

As may be seen in Figures 7-9, in the Reference case all efficiencies reach a maximum in the year 2010 and do not change thereafter. The efficiency of advanced single-cycle combustion turbines increases from 42.2% today to a maximum of 46.9% in 2010; advanced NGCC systems from 55.1% today to a maximum of 59.1% in 2010; and IGCC from 43.9% today to a maximum of 49.0% in 2010.

In the HFET case, the efficiency of advanced single-cycle combustion turbines increases from 42.1% today to a maximum of 55.2% in 2010; advanced NGCC systems from 55.1% today to a maximum of 75.7% in 2015; and IGCC from 43.9% today to a maximum of 60% in 2018.

In the study by Parsons [17], efficiencies were estimated at 43.1% for IGCC, 55.6% for adv. NGCC with an "F" class turbine and 59.5% for adv. NGCC with an "H" class turbine. These are in close agreement with the efficiencies used by the EIA in the Reference and HFET cases for the year 2002.

Figure 7. Efficiency of IGCC (based on HHV)

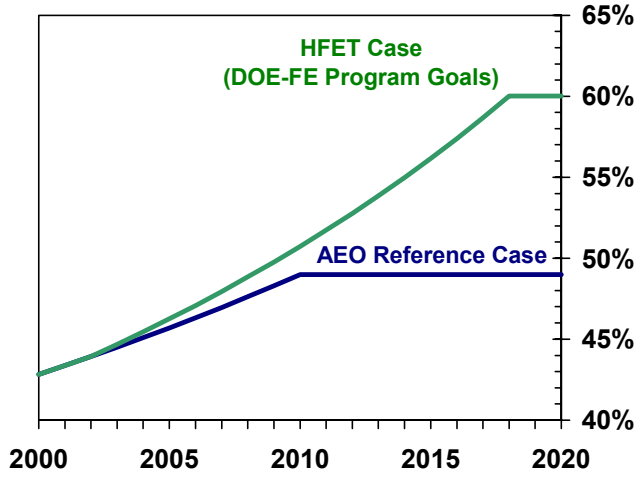


Figure 8. Efficiency of Advanced Single-Cycle Turbine Systems (based on LHV)

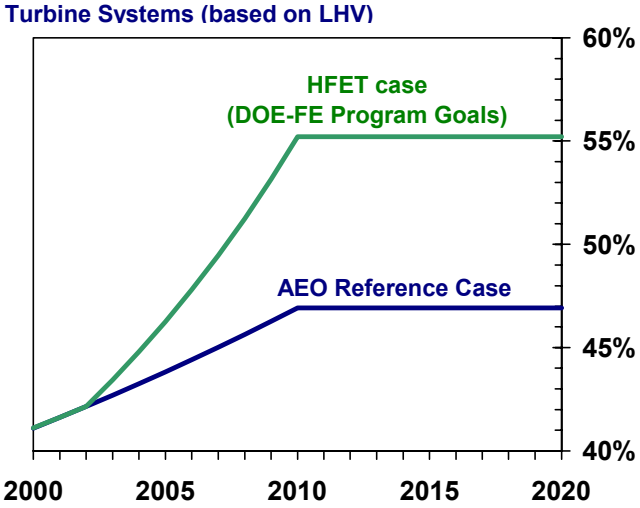
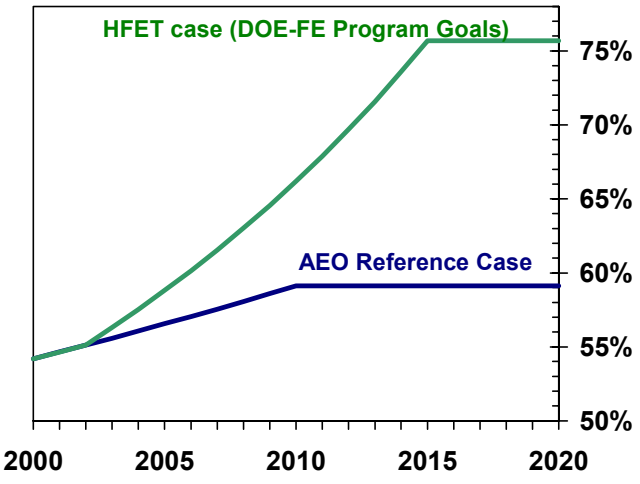


Figure 9. Efficiency of Advanced NGCC Turbine Systems (based on LHV)



Other important specifications for advanced fossil-fuel electricity generating technologies are listed in the Table 6. These specifications are the same in both the Reference and HFET cases.

According to the DOE-FE Gasification program and reports from commercial gasification plants, an SO2 removal rate of 95% is slightly lower than the typical SO2 removal rate for commercial IGCC plants, which is between 97% and 99% [18]. The NOx emission rate of 0.02 lb/mmbtu used by the EIA for IGCC and adv. NGCC is better than that estimated by Parsons, 0.028 lb/mmbtu [17].

Mercury removal efficiency is listed in Table 6 for IGCC even though mercury regulations are not in place for the AEO 2002 cases. The cost and efficiency of mercury removal becomes an important factor for IGCC if mercury emissions are regulated as planned under CAAA90 or as proposed under the Clear Skies Initiative. Recent studies by the DOE-FE Gasification Program indicate that a mercury removal rate of 90% can be achieved in an IGCC system using a fixed bed of carbon in the high-pressure, pre-combustion syngas stream without significantly increasing (<1%) the capital or operating costs of an IGCC plant [19].

TABLE 6. Additional Specifications of Advanced Fossil-Fuel Electricity Generating Technologies

IGCC:	**Advanced Single-Cycle Turbines:**	**Advanced NGCC Systems:**
Typical Plant size: 428 MW	Typical Plant size: 120 MW	Typical Plant size: 400 MW
Variable O&M cost: 0.088 ¢/kWh	Variable O&M cost: 0.011¢ /kWh	Variable O&M cost: 0.057 ¢/kWh
Fixed O&M cost: $36.0 /kW-yr	Fixed O&M cost: $10.09 /kW-yr	Fixed O&M cost: $15.93 /kW-yr
Emissions:	Emissions:	Emissions:
SO2: 95% removal	SO2: negligible	SO2: negligible
NOx: 0.02 lb/10^6 btu	NOx: 0.08 lb/10^6 btu	NOx: 0.02 lb/10^6 btu
Hg: 35% Hg removal	Hg: negligible	Hg: negligible

Results and Conclusions

Data Output from NEMS Cases

NEMS produces large volumes of output data – more than 100 Mbytes for the Electricity Market Module alone. NEMS also produces a smaller output file with 150 tables of key results in Microsoft Excel format. Appendix F lists the titles of the 150 tables of key results.

Twenty-one of the tables of key results make up Appendix A of the EIA's Annual Energy Outlook report [6]. Appendix A of this report contains the same twenty-one standard tables of key results (plus two additional tables), but the results of the HFET case are shown beside the results for the Reference case. Data for the HFET case that are more than 1% greater or less than corresponding data for the Reference case are highlighted (underlined and colored red). This enables the reader to easily identify which HFET results differ with the Reference case.

Readers can use the tables of Appendix A for additional analyses of DOE-FE programs. If data are needed that are not included in Appendix A of this report, contact the primary author of this report or the EIA.

The following sections summarize the key results for the HFET case.

Market Penetration of Advanced Fossil-Fuel Electricity Generating Technologies

Forecasts of new and retired electricity generating capacity are listed in Table A9. Growth in total electricity generating capacity of the U.S. is about the same in the Reference and HFET cases. Total generating capacity today is about 750 GW and is forecast to increase 42% to about 1065 GW by 2020.

The HFET case forecasts that if the goals of DOE-FE R&D programs are met for advanced fossil-fuel electricity generating technologies, these technologies will capture the majority (62%, 230 GW) of the market for new electricity generating plants over the next twenty years.

Figure 10 shows the growth in capacity of advanced fossil-fuel electricity generating technologies. Advanced NGCC plants begin to operate after 2005 and IGCC plants after 2010. The largest increase in capacity occurs for IGCC under the HFET case. IGCC capacity increases from 6.9 GW to 62.9 GW and advanced NGCC increases from 107.2 to 134.7 GW.

Figure 11 shows the forecast of capacities of all types of electricity generating technologies in the U.S. by the year 2020. Under the HFET case advanced NGCC and IGCC plants are built instead of conventional fossil-fuel plants.

Figure 12 and Table 7 show the EMM regions where new advanced fossil-fuel electricity plants are predicted to be built under the HFET case. The largest capacity increases are in the Southeastern Electric Reliability Council region with more than 54 GW of new advanced plants. Other regional data is available upon request.

About 6.3% (47.3 GW) of capacity existing today is forecast to be retired by 2020 under the Reference case. Under the HFET case this increases slightly to 7.3% (55.4 GW) due to additional retirements of nuclear and "other fossil steam[1]" plants. Retirement of existing coal plants is very low: only 2% of the coal-fired plants existing today are retired by 2020 under either the Reference or HFET cases.

[1] The "other fossil steam" category represents steam boilers fired with oil and/or natural gas.

Figure 10. Increase in advanced fossil-fuel electricity generating technologies.

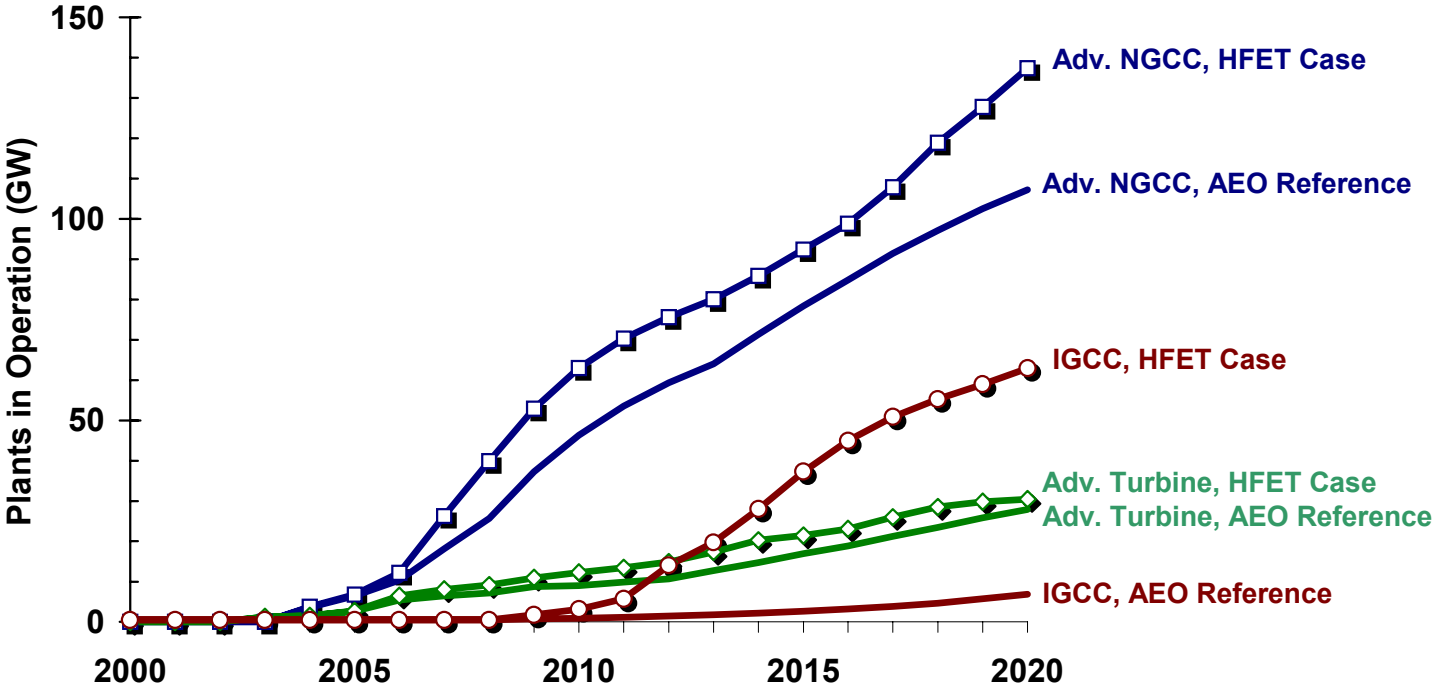


Figure 11. Capacity (GW) of new electricity generating plants built under the AEO 2002 Reference and HFET Cases by the year 2020.

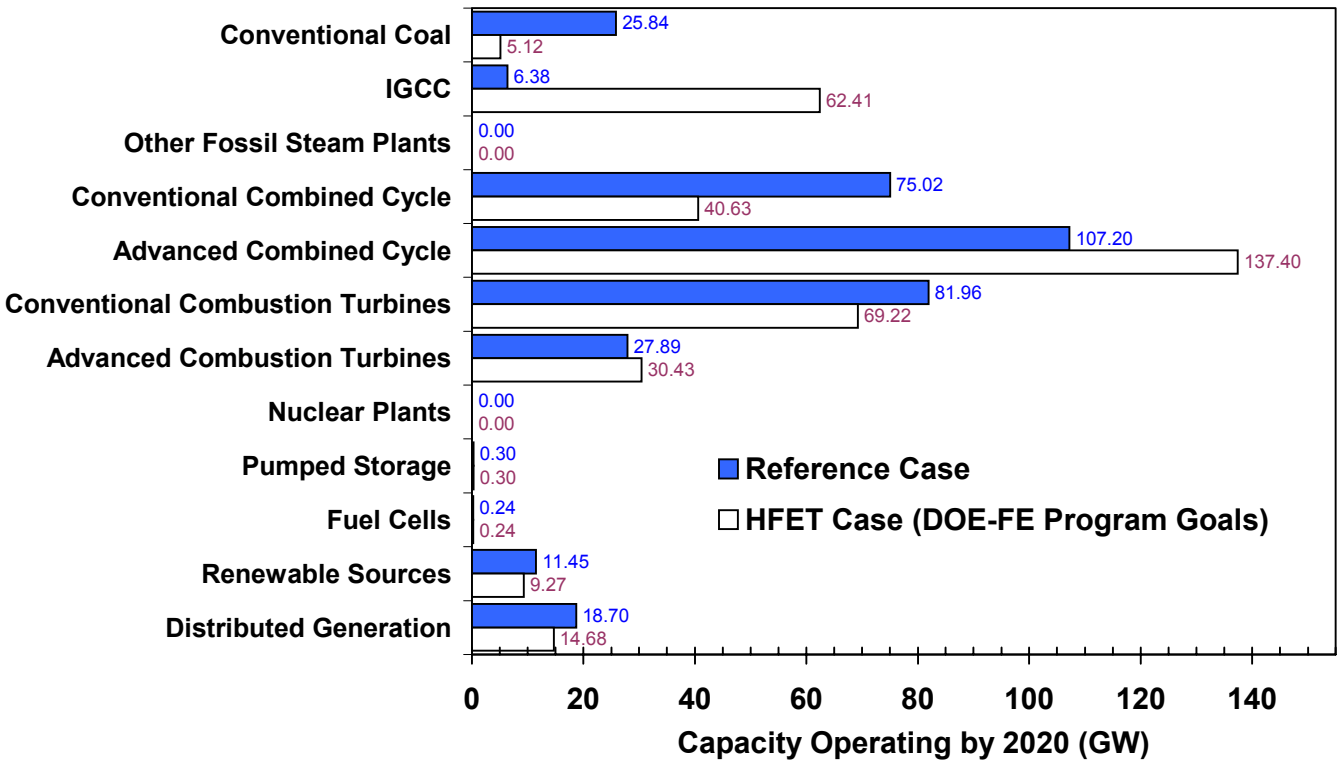


Figure 12. Capacity of advanced fossil-fuel electricity generating technologies predicted under the HFET case for each EMM region.

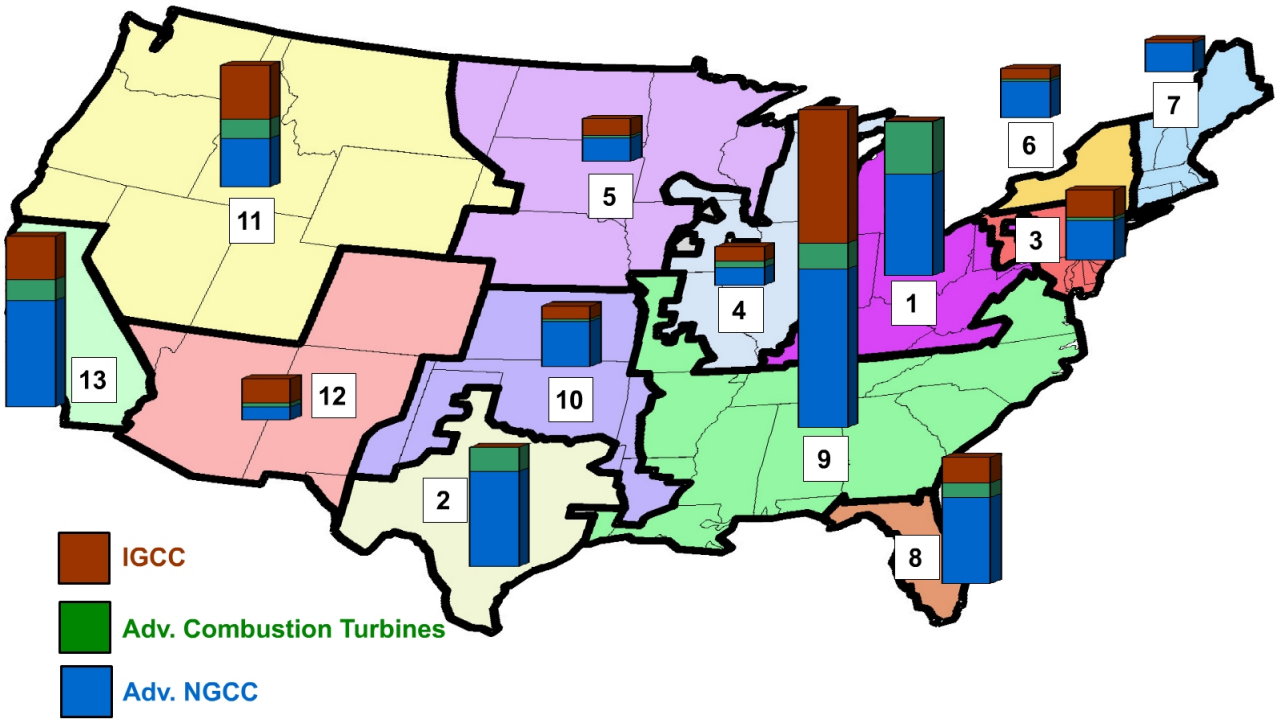


Table 7. New Plant Capacity by NERC Region by 2020.

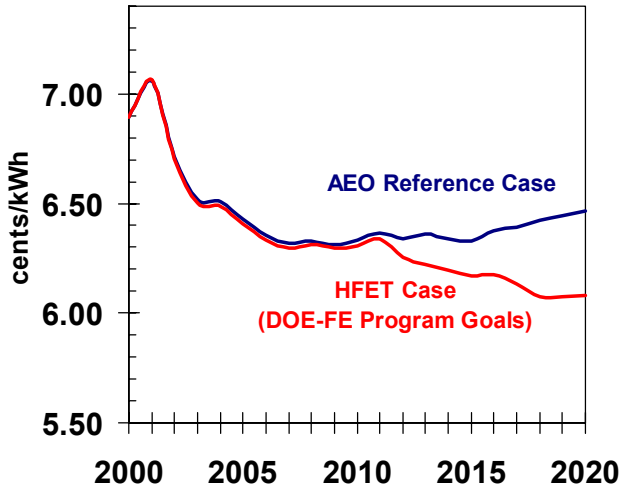
		New Capacity (GW)		
	EMM Region	IGCC	Adv. Combustion Turbines	Adv. NGCC
1	East Central Area Reliability Coordination Agreement (ECAR)	0.157	8.905	17.422
2	Electric Reliability Council of Texas (ERCOT)	0	4.184	16.281
3	Mid-Atlantic Area Council (MAAC)	4.563	0.607	6.826
4	Mid-America Interconnected Network (MAIN)	2.426	1.079	3.097
5	Mid-Continent Area Power Pool (MAAP)	2.811	0.386	4.065
6	Northeast Power Coordinating Council/New York (NY)	1.810	0.542	6.189
7	Northeast Power Coordinating Council/New England (NE)	0.500	0	5.020
8	Florida Reliability Coordinating Council (SERC/FL)	4.411	2.502	14.764
9	Southeastern Electric Reliability Council, excluding Florida (STV)	23.002	4.368	27.139
10	Southwest Power Pool (SPP)	2.343	0.308	7.792
11	Western Systems Coordinating Council/Northwest Power Pool (NWP)	9.196	3.299	8.342
12	Rocky Mountain, Arizona, New Mexico, Southern Nevada (RA)	4.191	0.741	2.203
13	California (CNV)	7.511	3.512	18.263

Electricity Generation and Prices

Electricity generation and prices are shown in Table A8 of Appendix A. Total generation of electricity in the U.S. is the about the same under the Reference and HFET cases, increasing from 3500 billion kWh today to about 5000 billion kWh by 2020.

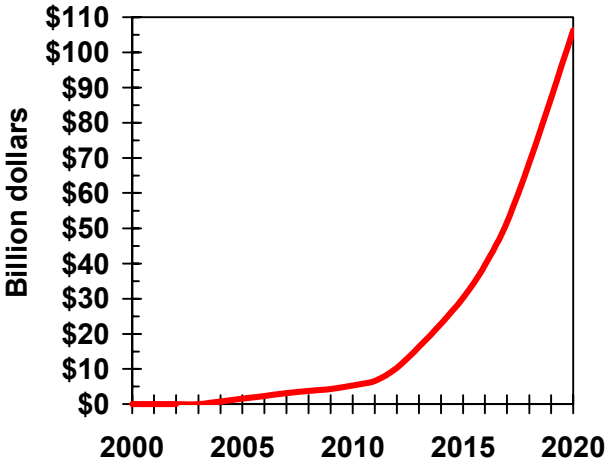
Advanced fossil-fuel electricity generating technologies developed under DOE-FE programs will generate electricity at lower prices. This will drive down the national average price of electricity. Figure 13 shows the national average price of electricity through the year 2020 under the Reference and HFET cases. Under the HFET case the average price of electricity will be 7% lower by the year 2020 than in the Reference case.

Figure 13. National average cost of electricity.



With 5000 billion kWh of electricity generated in the U.S. in the year 2020, the 7% drop in the national average cost of electricity translates into a national savings of $19 billion in electricity costs (in year 2000 dollars) in the year 2020. U.S. consumers will reap cumulative savings of more than $100 billion in electricity costs between 2010 and 2020 (Figure 14).

Figure 14. Cumulative savings in electricity costs under the HFET Case.



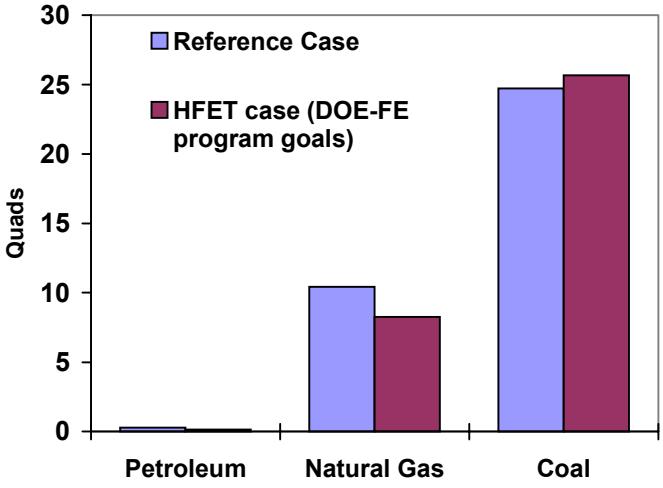
Fossil fuel use for electricity generation

Fossil fuel use for electricity generation is shown in Table A2 and Figure 14. One of the greatest impacts of DOE-FE programs is on the use of natural gas for electricity generation. Under the HFET case, use of natural gas for electricity generation is 22% lower than in the Reference case by the year 2020. Decreased demand for natural gas under the HFET case will drive prices 9% lower by 2020 than in the Reference case (see Table A3).

Total U.S. consumption of natural gas for all sectors decreases 7% by 2020 under the HFET case, from 34.5 Quads under the Reference case to 32.2 Quads under the HFET case (Table A1).

Total use of all fuels for electricity generation decreases by 4.5% by 2020 under the HFET case, from 48.3 Quads under the Reference case to 46.1 Quads under the HFET case. Use of renewables and nuclear fuels for electricity generation both decrease slightly under the HFET case. Total U.S. consumption of all fuels for all sectors decreases 2% by 2020 under the HFET case, from 130.8 Quads under the Reference case to 128.6 Quads under the HFET case (Table A1).

Figure 15. Fossil fuel use for electricity generation in the year 2020.



Emissions

U.S. emissions of CO_2 are listed in Table A19. Total U.S. emissions of CO_2 and emissions from the electricity generating sector are about the same in the Reference and HFET cases (Figure 16). Emissions from the electricity generating sector begin to decline slightly after 2015. The availability of higher efficiency fossil-fuel electricity technologies under the HFET case makes it possible to increase coal use for electricity generation without increasing national CO_2 emissions.

Figure 16. Carbon emissions from the electricity generating sector.

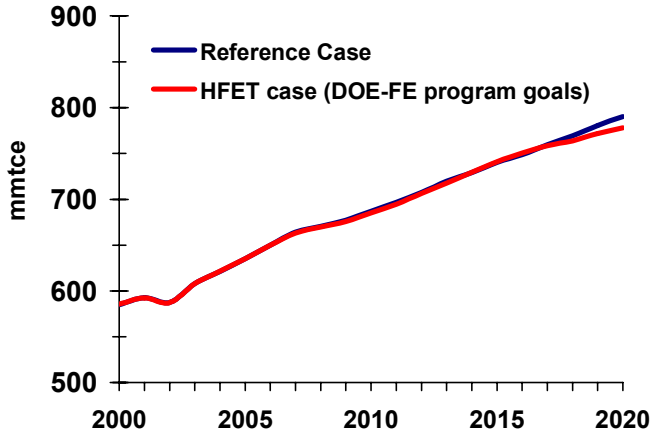


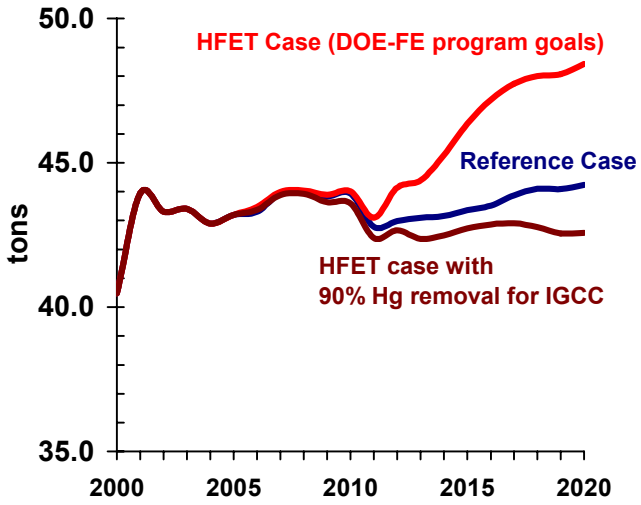
Table A117 shows emissions and allowance prices for SO_2 and NOx. As the bank of SO_2 allowances is expended between 2000 and 2010, national emissions of SO_2 decrease steadily to achieve the national cap of 8.95 million tons per year in 2010. Advanced technologies with lower SO_2 emissions developed under DOE-FE programs will cause a reduction in the market price of SO_2 allowance permits. The average SO_2 allowance price between 2000 and 2020 is predicted to be $230/ton under the Reference case and $187/ton under the HFET case.

Advanced technologies with lower NOx emissions developed under DOE-FE programs will create a slight (4.3%) reduction in national NOx emissions by 2020 and a 17.4% reduction in the price of NOx emissions allowances by 2020.

National emissions of mercury are forecast to increase by 10% under the HFET case. This can be attributed to the use of a 35% mercury removal rate for IGCC in the AEO 2002 cases.

Recent studies indicate that mercury removal can be achieved at 90% in IGCC using a fixed bed of carbon in the pre-combustion, high-pressure syngas stream without significant increases (<1%) in capital and operating costs [19]. The HFET case was rerun by the NETL Office of Systems and Policy Support using a 90% mercury removal for IGCC. This reduced national emissions of mercury by 4% as shown in Figure 17.

Figure 17. National mercury emissions.



Notes and References

Notes and References

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[2] "The National Energy Modeling System: An Overview 2000, DOE-EIA-0581." Available online at http://tonto.eia.doe.gov/FTPROOT/forecasting/05812000.pdf

[3] Federal Energy Administration (FEA) Act, (P.L. 93-275, 15 USC 761), 1974

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[5] Department of Energy (DOE) Organization Act (P.L. 95-91, 42 USC 7135), 1977

[6] "Annual Energy Outlook 2002 with Projections to 2020," DOE/EIA-0383(2002). Available online at www.eia.doe.gov/oiaf/aeo/index.html

[7] "Assumptions to the Annual Energy Outlook 2002," DOE/EIA-0554(2002). Available online at www.eia.doe.gov/oiaf/aeo/assumption/contents.html

[8] The High Fossil Electricity Technology case is discussed in a few paragraphs (see pages 78 and 240) and one page of results (Table F7) of Reference [6]. Reference [7] also has a few paragraphs describing assumptions in the HFET case (see pages 76-77).

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Appendix A: Tables of Key Results for the Reference and HFET Cases

Table A1. Total Energy Supply and Disposition Summary

(Quadrillion Btu per Year, Unless Otherwise Noted)

Supply, Disposition, & Prices	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Production										
Crude Oil & Lease Condensate	12.33	12.33	11.38	11.38	10.76	10.76	11.77	11.76	11.93	11.85
Natural Gas Plant Liquids	2.71	2.71	3.02	3.02	3.37	3.35	3.74	3.57	4.02	3.78
Dry Natural Gas	19.59	19.59	21.32	21.29	24.10	23.97	26.99	25.82	29.17	27.43
Coal	22.58	22.58	24.92	24.96	26.30	26.23	26.94	27.93	28.14	29.03
Nuclear Power	8.03	8.03	8.10	8.10	7.87	7.87	7.55	7.37	7.49	7.21
Renewable Energy 1	6.46	6.46	7.37	7.37	7.89	7.88	8.46	8.36	8.93	8.66
Other 2	1.10	1.10	0.65	0.68	0.85	0.86	1.03	1.06	0.93	1.02
Total	**72.80**	72.80	**76.75**	76.79	**81.14**	80.91	**86.47**	85.87	**90.62**	88.98
Imports										
Crude Oil 3	19.69	19.69	22.65	22.64	24.37	24.36	24.03	24.09	24.46	24.51
Petroleum Products 4	4.73	4.73	5.69	5.67	7.84	7.83	10.31	10.39	12.69	12.77
Natural Gas	3.85	3.85	5.02	5.01	5.64	5.60	6.04	5.68	6.21	5.62
Other Imports 5	0.76	0.76	1.07	1.07	0.95	0.92	1.07	0.98	1.10	0.96
Total	**29.04**	29.04	**34.44**	34.38	**38.79**	38.72	**41.46**	41.13	**44.45**	43.86
Exports										
Petroleum 6	2.15	2.15	1.71	1.70	1.90	1.90	2.02	2.04	2.12	2.10
Natural Gas	0.25	0.25	0.41	0.41	0.63	0.63	0.66	0.66	0.56	0.56
Coal	1.53	1.53	1.41	1.41	1.44	1.44	1.34	1.34	1.38	1.38
Total	3.93	3.93	3.53	3.52	3.97	3.97	4.02	4.03	4.06	4.05
Discrepancy 7	-1.37	-1.38	0.04	0.05	0.37	0.36	0.30	0.31	0.21	0.22
Consumption										
Petroleum Products 8	38.62	38.63	41.41	41.40	45.21	45.19	48.85	48.80	51.98	51.86
Natural Gas	23.44	23.44	26.19	26.15	28.83	28.66	32.10	30.58	34.55	32.24
Coal	22.33	22.33	24.00	24.04	25.40	25.33	26.19	27.17	27.38	28.28
Nuclear Power	8.03	8.03	8.10	8.10	7.87	7.87	7.55	7.37	7.49	7.21
Renewable Energy 1	6.48	6.48	7.38	7.37	7.90	7.88	8.47	8.37	8.94	8.67
Other 9	0.38	0.38	0.55	0.54	0.39	0.36	0.46	0.37	0.45	0.31
Total	**99.28**	99.29	**107.62**	107.61	**115.59**	115.30	**123.61**	122.65	**130.80**	128.57
Net Imports - Petroleum	22.28	22.28	26.63	26.61	30.30	30.29	32.33	32.44	35.03	35.18
Prices (2000 dollars per unit)										
World Oil Price ($ per bbl) 10	27.72	27.72	22.73	22.73	23.36	23.36	24.00	24.00	24.68	24.68
Nat. Gas Wellhead Price($/Mcf) 11	3.60	3.60	2.67	2.66	2.85	2.82	3.08	2.90	3.25	2.98
Coal Minemouth Price ($ / ton)	16.45	16.45	14.90	15.10	13.92	13.85	13.35	13.40	12.81	12.83
Avg. Electricity (cents / Kwh)	6.9	6.89	6.4	6.42	6.3	6.30	6.3	6.19	6.5	6.06

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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, net storage withdrawals and heat loss when natural gas is converted to liquid fuel.

8 Includes natural gas plant liquids, crude oil consumed as a fuel, and nonpetroleum-based liquids for blending, such as ethanol.

9 Includes net electricity imports, methanol, and liquid hydrogen.

10 Average refiner acquisition cost for imported crude oil.

11 Represents lower 48 onshore and offshore supplies.

Btu = British thermal unit.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports. Sources: 1999 natural gas values: Energy Information Administration (EIA), Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). 1999 coal minemouth prices: EIA, Coal Industry Annual 1999, DOE/EIA-0584(99) (Washington, DC, June 2001). Other 1999 values: EIA, Annual Energy Review 2000, DOE/EIA-0384(2000) (Washington, DC, August 2001). 2000 natural gas values: EIA, Natural Gas Monthly, DOE/EIA-0130(2001/06) (Washington, DC, June 2001).

Table A2. Energy Consumption by Sector and Sourc

(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	REF	HFET	REF	HFET	REF	HFET	REF	HFET	REF	HFET
Energy Consumption										
Residential										
Distillate Fuel	0.83	0.83	0.85	0.85	0.79	0.79	0.75	0.75	0.73	0.73
Kerosene	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07
Liquefied Petroleum Gas	0.47	0.47	0.44	0.44	0.45	0.45	0.42	0.42	0.41	0.41
Petroleum Subtotal	1.38	1.38	1.37	1.37	1.30	1.30	1.24	1.24	1.20	1.20
Natural Gas	5.14	5.14	5.52	5.53	5.68	5.68	5.89	5.89	6.15	6.15
Coal	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Renewable Energy 1	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45
Electricity	4.07	4.07	4.62	4.62	4.92	4.92	5.30	5.30	5.70	5.70
Delivered Energy	**11.06**	11.06	**11.99**	11.99	**12.40**	12.40	**12.92**	12.92	**13.55**	13.55
Electricity Related Losses	8.79	8.79	9.71	9.71	9.83	9.74	10.24	9.95	10.72	10.00
Total	**19.85**	19.85	**21.70**	21.71	**22.22**	22.14	**23.15**	22.87	**24.27**	23.55
Commercial										
Distillate Fuel	0.38	0.38	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Residual Fuel	0.14	0.14	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13
Kerosene	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Liquefied Petroleum Gas	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10
Motor Gasoline 2	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Petroleum Subtotal	0.65	0.65	0.67	0.67	0.69	0.69	0.70	0.70	0.71	0.71
Natural Gas	3.36	3.36	3.77	3.77	4.04	4.04	4.32	4.33	4.64	4.64
Coal	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08
Renewable Energy 3	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Electricity	3.90	3.90	4.46	4.46	5.03	5.03	5.62	5.62	6.14	6.13
Delivered Energy	**8.07**	8.07	**9.05**	9.05	**9.91**	9.91	**10.80**	10.80	**11.65**	11.64
Electricity Related Losses	8.42	8.43	9.37	9.37	10.05	9.96	10.85	10.53	11.53	10.76
Total	**16.49**	16.49	**18.42**	18.42	**19.96**	19.87	**21.64**	21.33	**23.18**	22.40
Industrial 4										
Distillate Fuel	1.11	1.11	1.17	1.17	1.22	1.22	1.30	1.29	1.38	1.38
Liquefied Petroleum Gas	2.36	2.36	2.50	2.50	2.66	2.66	2.84	2.85	3.00	3.00
Petrochemical Feedstocks	1.32	1.32	1.36	1.36	1.45	1.45	1.54	1.54	1.59	1.59
Residual Fuel	0.27	0.27	0.18	0.18	0.23	0.23	0.25	0.26	0.27	0.27
Motor Gasoline 2	0.22	0.22	0.23	0.23	0.24	0.24	0.26	0.26	0.27	0.27
Other Petroleum 3	3.96	3.96	4.37	4.36	4.77	4.77	4.99	4.99	5.17	5.17
Petroleum Subtotal	9.23	9.23	9.81	9.80	10.57	10.57	11.18	11.19	11.68	11.69
Natural Gas 6	9.79	9.79	10.42	10.43	11.19	11.18	11.78	11.72	12.18	12.10
Metallurgical Coal	0.77	0.77	0.69	0.69	0.64	0.64	0.59	0.59	0.54	0.54
Steam Coal	1.69	1.69	1.72	1.72	1.74	1.74	1.79	1.79	1.85	1.85
Net Coal Coke Imports	0.06	0.06	0.07	0.07	0.11	0.11	0.14	0.14	0.16	0.16
Coal Subtotal	2.53	2.53	2.49	2.49	2.50	2.50	2.51	2.51	2.55	2.55
Renewable Energy 7	2.41	2.41	2.66	2.66	2.89	2.89	3.18	3.18	3.43	3.43
Electricity	3.65	3.65	3.80	3.80	4.20	4.20	4.53	4.53	4.82	4.83
Delivered Energy	**27.62**	27.62	**29.17**	29.17	**31.35**	31.34	**33.19**	33.14	**34.66**	34.60
Electricity Related Losses	7.88	7.89	7.98	7.98	8.38	8.30	8.75	8.50	9.06	8.47
Total	**35.50**	35.50	**37.16**	37.15	**39.73**	39.64	**41.94**	41.64	**43.73**	43.07

Table A2. Energy Consumption by Sector and Source

(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Transportation										
Distillate Fuel 8	5.42	5.42	6.35	6.35	7.28	7.27	8.10	8.09	8.72	8.72
Jet Fuel 8	3.58	3.58	3.88	3.88	4.46	4.46	5.12	5.12	5.82	5.82
Motor Gasoline 2	16.05	16.05	17.67	17.67	19.33	19.32	20.86	20.86	22.12	22.12
Residual Fuel	1.14	1.14	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.10
Liquefied Petroleum Gas	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Other Petroleum 10	0.22	0.22	0.25	0.25	0.26	0.26	0.28	0.28	0.29	0.29
Petroleum Subtotal	26.42	26.42	29.24	29.24	32.45	32.43	35.49	35.48	38.10	38.11
Pipeline Fuel Natural Gas	0.79	0.79	0.80	0.80	0.86	0.85	0.95	0.91	1.02	0.95
Compressed Natural Gas	0.02	0.02	0.06	0.06	0.09	0.09	0.12	0.12	0.14	0.14
Renewable Energy (E85) 11	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.05
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.11	0.11
Delivered Energy	27.32	27.32	30.20	30.19	33.52	33.49	36.70	36.65	39.43	39.37
Electricity Related Losses	0.13	0.13	0.15	0.15	0.16	0.16	0.18	0.17	0.21	0.19
Total	27.45	27.45	30.34	30.33	33.68	33.65	36.88	36.82	39.63	39.56
Delivered Energy Consumption: All Sectors										
Distillate Fuel	7.73	7.73	8.78	8.78	9.71	9.70	10.56	10.55	11.24	11.24
Kerosene	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
Jet Fuel 9	3.58	3.58	3.88	3.88	4.46	4.46	5.12	5.12	5.82	5.82
Liquefied Petroleum Gas	2.93	2.93	3.05	3.05	3.23	3.23	3.40	3.41	3.55	3.56
Motor Gasoline 2	16.29	16.29	17.93	17.93	19.60	19.59	21.15	21.14	22.42	22.42
Petrochemical Feedstocks	1.32	1.32	1.36	1.36	1.45	1.45	1.54	1.54	1.59	1.59
Residual Fuel	1.54	1.54	1.37	1.37	1.43	1.43	1.47	1.48	1.51	1.51
Other Petroleum 12	4.16	4.16	4.58	4.59	5.02	5.01	5.25	5.25	5.44	5.44
Petroleum Subtotal	37.69	37.69	41.08	41.07	45.02	45.00	48.61	48.61	51.70	51.71
Natural Gas 6	19.11	19.11	20.59	20.58	21.87	21.85	23.09	22.96	24.14	23.98
Metallurgical Coal	0.77	0.77	0.69	0.69	0.64	0.64	0.59	0.59	0.54	0.54
Steam Coal	1.80	1.80	1.83	1.83	1.86	1.86	1.91	1.91	1.97	1.98
Net Coal Coke Imports	0.06	0.06	0.07	0.07	0.11	0.11	0.14	0.14	0.16	0.16
Coal Subtotal	2.64	2.64	2.59	2.60	2.61	2.62	2.63	2.64	2.67	2.68
Renewable Energy 13	2.93	2.93	3.20	3.19	3.44	3.44	3.74	3.74	4.00	4.00
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	11.69	11.69	12.94	12.94	14.23	14.23	15.55	15.54	16.77	16.77
Delivered Energy	74.06	74.06	80.40	80.39	87.19	87.14	93.62	93.50	99.29	99.15
Electricity Related Losses	25.22	25.22	27.23	27.22	28.43	28.18	30.03	29.11	31.52	29.36
Total	**99.28**	**99.28**	**107.64**	**107.61**	**115.62**	**115.32**	**123.65**	**122.61**	**130.81**	128.52
Electric Generators 14										
Distillate Fuel	0.08	0.08	0.06	0.06	0.05	0.04	0.05	0.04	0.06	0.05
Residual Fuel	0.85	0.85	0.26	0.26	0.15	0.15	0.19	0.14	0.21	0.10
Petroleum Subtotal	0.92	0.93	0.32	0.32	0.20	0.19	0.24	0.18	0.27	0.15
Natural Gas	4.32	4.33	5.58	5.58	6.99	6.80	9.08	7.70	10.46	8.13
Steam Coal	19.69	19.69	21.42	21.42	22.78	22.76	23.54	24.43	24.67	25.64
Nuclear Power	8.03	8.03	8.10	8.10	7.87	7.87	7.55	7.37	7.49	7.25
Renewable Energy 15	3.55	3.55	4.21	4.18	4.45	4.43	4.72	4.61	4.96	4.66
Electricity Imports 16	0.38	0.38	0.55	0.54	0.38	0.35	0.45	0.36	0.44	0.30
Total	**36.91**	**36.91**	**40.18**	**40.16**	**42.66**	**42.41**	**45.58**	**44.65**	**48.29**	**46.14**

Table A2. Energy Consumption by Sector and Source

(Quadrillion Btu per Year, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Total Energy Consumption										
Distillate Fuel	7.80	7.80	8.85	8.84	9.75	9.75	10.61	10.60	11.32	11.30
Kerosene	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
Jet Fuel 9	3.58	3.58	3.88	3.88	4.46	4.46	5.12	5.12	5.82	5.82
Liquefied Petroleum Gas	2.93	2.93	3.05	3.05	3.23	3.23	3.40	3.41	3.55	3.56
Motor Gasoline 2	16.29	16.29	17.93	17.93	19.60	19.59	21.14	21.14	22.42	22.42
Petrochemical Feedstocks	1.32	1.32	1.36	1.36	1.45	1.45	1.54	1.54	1.59	1.59
Residual Fuel	2.39	2.40	1.62	1.63	1.59	1.58	1.66	1.62	1.72	1.60
Other Petroleum 12	4.16	4.16	4.60	4.59	5.01	5.01	5.25	5.25	5.44	5.44
Petroleum Subtotal	38.62	38.63	41.41	41.40	45.21	45.19	48.85	48.80	51.98	51.86
Natural Gas	23.44	23.44	26.19	26.15	28.83	28.66	32.10	30.58	34.55	32.12
Metallurgical Coal	0.77	0.77	0.69	0.69	0.64	0.64	0.59	0.59	0.54	0.54
Steam Coal	21.49	21.49	23.23	23.27	24.65	24.58	25.46	26.44	26.69	27.62
Net Coal Coke Imports	0.06	0.06	0.07	0.07	0.11	0.11	0.14	0.14	0.16	0.16
Coal Subtotal	22.33	22.33	24.00	24.04	25.40	25.33	26.19	27.17	27.38	28.31
Nuclear Power	8.03	8.03	8.10	8.10	7.87	7.87	7.55	7.37	7.49	7.25
Renewable Energy 17	6.48	6.48	7.38	7.37	7.90	7.88	8.47	8.37	8.94	8.66
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity Imports 16	0.38	0.38	0.55	0.54	0.38	0.35	0.46	0.37	0.44	0.30
Total	**99.28**	99.29	**107.62**	107.61	**115.59**	115.30	**123.61**	122.65	**130.80**	128.52
Energy Use & Related Statistics										
Delivered Energy Use	74.1	74.1	80.4	80.4	87.2	87.1	93.6	93.5	99.3	99.2
Total Energy Use	99.3	99.3	107.6	107.6	115.6	115.3	123.6	122.7	130.8	128.6
Population (millions)	275.7	275.7	288.1	288.1	300.2	300.2	312.7	312.7	325.3	325.3
US GDP (billion 1996 dollars)	9224.0	9224.0	10422.6	10418.5	12318.5	12311.8	14397.5	14399.2	16520.5	16525.5
Carbon Dioxide Emissions(mmtce	1561.7	1561.7	1693.3	1693.4	1834.4	1829.9	1965.6	1967.9	2087.4	2074.3

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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, and solar photovoltaic electricity generation.

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 and solar photovoltaic electricity generation.

4 Fuel consumption includes consumption for cogeneration, which produces electricity and other useful thermal energy.

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

6 Includes lease and plant fuel and consumption by cogenerators; excludes consumption by nonutility generators.

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

8 Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur.

9 Includes only kerosene type.

10 Includes aviation gas and lubricants.

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

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

13 Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.

14 Includes co+A35nsumption of energy by all electric power generators for grid-connected power except cogenerators, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators.

15 Includes conventional hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes cogeneration. Excludes net electricity imports.

16 In 1999 approximately 70 percent of the U.S. electricity imports were provided by renewable sources (hydroelectricity); EIA does not project future proportions for the fuel source of imported electricity.

17 Includes hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, wind, photovoltaic and solar thermal sources. Includes ethanol components of E85; excludes ethanol blends (10 percent or less) in motor gasoline. Excludes net electricity imports and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.

Btu = British thermal unit.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports. Consumption values of 0.00 are values that round to 0.00, because they are less than 0.005.

Sources: 1999 natural gas lease, plant, and pipeline fuel values: Energy Information Administration (EIA), Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000), 1999 and 2000 electric utility fuel consumption: EIA, Electric Power Annual 1999, Volume 1, DOE/EIA-0348(99)/1 (Washington, DC, August 2000),

Table A3. Energy Prices by Sector and Source

(2000 Dollars per Million Btu, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Residential	**14.42**	14.42	**13.35**	13.33	**13.49**	13.44	**13.69**	13.44	**14.03**	13.45
Primary Energy [1]	8.26	8.26	7.33	7.32	7.27	7.24	7.40	7.27	7.48	7.28
Petroleum Products [2]	10.78	10.78	9.47	9.45	9.84	9.85	10.29	10.30	10.42	10.41
Distillate Fuel	9.42	9.42	7.69	7.68	7.94	7.94	8.42	8.43	8.56	8.55
Liquefied Petroleum Gas	13.65	13.65	12.94	12.91	13.26	13.27	13.65	13.67	13.82	13.81
Natural Gas	7.64	7.64	6.85	6.84	6.73	6.69	6.85	6.68	6.96	6.71
Electricity	24.37	24.36	22.39	22.36	22.40	22.31	22.20	21.80	22.53	21.46
Commercial	**14.03**	14.03	**12.96**	12.94	**12.87**	12.81	**13.15**	12.85	**13.55**	12.74
Primary Energy [1]	6.31	6.31	5.61	5.60	5.57	5.54	5.77	5.63	5.93	5.71
Petroleum Products [2]	7.19	7.19	6.11	6.10	6.36	6.36	6.76	6.77	6.93	6.92
Distillate Fuel	7.08	7.08	5.45	5.45	5.73	5.73	6.23	6.25	6.41	6.39
Residual Fuel	3.46	3.46	3.75	3.75	3.83	3.83	3.92	3.92	4.02	4.01
Natural Gas [3]	6.23	6.23	5.59	5.58	5.51	5.47	5.68	5.51	5.85	5.60
Electricity	22.11	22.11	20.41	20.37	19.84	19.75	19.86	19.41	20.31	18.97
Industrial [4]	**6.88**	6.88	**5.74**	5.73	**5.97**	5.95	**6.27**	6.16	**6.48**	6.19
Primary Energy	5.69	5.69	4.50	4.49	4.75	4.74	5.05	4.99	5.19	5.08
Petroleum Products [2]	8.10	8.10	6.37	6.36	6.69	6.70	7.06	7.09	7.13	7.14
Distillate Fuel	7.21	7.21	5.54	5.54	5.89	5.89	6.48	6.52	6.74	6.71
Liquefied Petroleum Gas	11.73	11.73	8.31	8.27	8.60	8.60	8.98	8.99	9.11	9.11
Residual Fuel	3.27	3.27	3.57	3.57	3.65	3.65	3.74	3.74	3.86	3.85
Natural Gas [5]	4.31	4.31	3.30	3.29	3.47	3.44	3.70	3.53	3.89	3.62
Metallurgical Coal	1.62	1.62	1.60	1.60	1.56	1.55	1.52	1.52	1.46	1.46
Steam Coal	1.41	1.41	1.35	1.35	1.30	1.30	1.26	1.27	1.22	1.21
Electricity	13.50	13.50	12.74	12.69	12.52	12.44	12.64	12.26	13.02	11.85
Transportation	**10.88**	10.88	**9.64**	9.59	**9.98**	9.98	**10.03**	10.03	**9.99**	9.99
Primary Energy	10.86	10.86	9.62	9.57	9.96	9.96	10.01	10.01	9.97	9.97
Petroleum Products [2]	10.86	10.86	9.62	9.57	9.96	9.96	10.00	10.01	9.96	9.97
Distillate Fuel [6]	10.81	10.81	9.24	9.23	10.14	10.14	10.06	10.10	9.98	10.01
Jet Fuel [7]	7.36	7.36	5.53	5.52	5.87	5.87	6.30	6.32	6.37	6.37
Motor Gasoline [8]	12.20	12.20	11.10	11.03	11.27	11.27	11.29	11.28	11.28	11.28
Residual Fuel	4.38	4.38	3.40	3.40	3.48	3.48	3.57	3.57	3.68	3.67
Liquefied Petroleum Gas [9]	15.91	15.91	14.18	14.15	14.43	14.43	14.70	14.76	14.67	14.64
Natural Gas [10]	8.04	8.04	6.65	6.64	6.89	6.85	7.13	6.95	7.27	7.01
Ethanol (E85) [11]	17.33	17.33	19.27	19.18	20.59	20.58	21.71	21.66	21.19	21.17
Electricity	21.78	21.78	16.60	16.54	18.19	18.09	19.28	18.86	17.90	16.93
Average End-Use Energy	10.40	10.40	9.30	9.27	9.52	9.50	9.72	9.62	9.90	9.62
Primary Energy	8.41	8.41	7.31	7.28	7.61	7.60	7.81	7.76	7.89	7.82
Electricity	20.20	20.20	18.84	18.81	18.56	18.47	18.55	18.14	18.95	17.76
Electric Generators [12]										
Fossil Fuel Average	1.87	1.87	1.59	1.58	1.61	1.59	1.77	1.60	1.85	1.60
Petroleum Products	4.33	4.33	3.81	3.80	3.97	3.99	4.14	4.19	4.37	4.43
Distillate Fuel	6.89	6.89	4.93	4.93	5.24	5.23	5.71	5.76	5.82	5.86
Residual Fuel	4.11	4.11	3.53	3.53	3.63	3.61	3.70	3.70	3.81	3.79
Natural Gas	4.40	4.40	3.20	3.19	3.38	3.32	3.66	3.41	3.85	3.51
Steam Coal	1.20	1.20	1.13	1.13	1.05	1.05	1.01	1.01	0.97	0.96

Table A3. Energy Prices by Sector and Source

(2000 Dollars per Million Btu, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Average Price to All Users 13										
Petroleum Products 2	10.05	10.05	8.82	8.78	9.19	9.20	9.34	9.36	9.34	9.36
Distillate Fuel	9.93	9.93	8.39	8.38	9.22	9.22	9.33	9.38	9.33	9.36
Jet Fuel	7.36	7.36	5.53	5.52	5.87	5.87	6.30	6.32	6.37	6.37
Liquefied Petroleum Gas	12.06	12.06	9.09	9.06	9.37	9.38	9.70	9.71	9.79	9.79
Motor Gasoline 8	12.20	12.20	11.10	11.03	11.27	11.27	11.29	11.28	11.28	11.28
Residual Fuel	4.11	4.11	3.46	3.46	3.55	3.54	3.64	3.64	3.75	3.74
Natural Gas	5.43	5.43	4.46	4.45	4.47	4.44	4.62	4.48	4.78	4.56
Coal	1.22	1.22	1.15	1.14	1.07	1.07	1.03	1.03	0.99	0.98
Ethanol (E85) 11	17.33	17.33	19.27	19.18	20.59	20.58	21.71	21.66	21.19	21.17
Electricity	20.20	20.20	18.84	18.81	18.56	18.47	18.55	18.14	18.95	17.76
Non-Renewable Energy Expended by Sector (billion 2000 dollars)										
Residential	153.4	153.4	154.3	154.1	161.4	160.8	170.8	167.8	183.9	176.2
Commercial	112.1	112.1	116.3	116.1	126.6	126.0	141.0	137.7	156.8	147.4
Industrial	142.9	142.9	124.3	123.9	136.1	135.5	150.5	147.3	162.2	154.5
Transportation	288.4	288.4	282.8	281.3	325.3	325.1	357.6	357.7	382.7	382.8
Total Non-Renewable Expend	696.7	696.7	677.7	675.4	749.4	747.3	819.8	810.5	885.6	861.0
Trans Renew Expenditures	0.3	0.3	0.5	0.5	0.7	0.7	0.9	0.9	1.0	1.0
Total Expenditures	**697.0**	697.0	**678.2**	675.9	**750.1**	748.0	**820.7**	811.4	**886.6**	862.0

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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 use for lease and plant fuel.

6 Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur. 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, State 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 Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators.

13 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: Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 prices for gasoline, distillate, and jet fuel are based on prices in the Energy Information Administration (EIA), Petroleum Marketing Annual 1999, http://www.eia.doe.gov/pub/ oil_gas/petroleum/data_publications/petroleum_marketing_annual/pma_historical.html (August 2000). 2000 prices for gasoline, distillate, and jet fuel are based on the preliminary Petroleum Marketing Annual 2000, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_marketing_annual/current/pdf/pmaall.pdf. 1999 and 2000 prices for all other petroleum products are derived from the EIA, State Energy Price and Expenditure Report 1997, DOE/EIA-0376(97) (Washington, DC, July 2000). 1999 residential, commercial, and transportation natural gas delivered prices: EIA, Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). 1999 electric generators natural gas delivered prices, Form FERC-423, "Monthly Report of Cost and Quality of Fuels for Electric Plants." 1999 and 2000 industrial gas delivered prices are based on EIA, Manufacturing Energy Consumption Survey 1994. 2000 residential and commercial natural gas delivered prices: EIA, Natural Gas Monthly, DOE/EIA-0130(2001/06) (Washington, DC, June 2001). 1999 and 2000 coal prices based on EIA, Quarterly Coal Report, DOE/EIA-0121(2000/4Q) (Washington, DC, October-December 2000) and EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B. 1999 residential electricity prices derived from EIA, Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/ forecasting/steo/oldsteos/oct01.pdf. 1999

Reference Case and High Fossil Electricity Technology Case Forecasts

Table A4. Residential Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Key Indicators										
Households (millions)										
Single-Family	76.57	76.57	81.19	81.18	85.89	85.88	90.56	90.55	95.28	95.27
Multifamily	21.97	21.97	22.60	22.59	23.15	23.15	23.77	23.77	24.58	24.58
Mobile Homes	6.61	6.61	6.63	6.63	6.95	6.95	7.14	7.14	7.27	7.27
Total	**105.15**	**105.15**	**110.42**	**110.41**	**115.99**	**115.98**	**121.47**	**121.46**	**127.12**	**127.12**
Average House Square Footage	**1678**	**1678**	**1707**	**1707**	**1735**	**1735**	**1762**	**1762**	**1787**	**1787**
Energy Intensity										
(million Btu per household)										
Delivered Energy Consumption	105.2	105.20	108.6	108.61	106.9	106.89	106.3	106.37	106.6	106.58
Total Energy Consumption	188.8	188.79	196.6	196.60	191.6	190.87	190.6	188.26	190.9	185.26
(thousand Btu per square foot)										
Delivered Energy Consumption	62.7	62.70	63.6	63.63	61.6	61.61	60.3	60.37	59.6	59.64
Total Energy Consumption	112.5	112.51	115.2	115.18	110.4	110.02	108.2	106.84	106.8	103.66
Delivered Energy Consum by Fuel										
Electricity										
Space Heating	0.42	0.42	0.46	0.46	0.48	0.48	0.50	0.50	0.53	0.53
Space Cooling	0.56	0.56	0.60	0.60	0.63	0.63	0.68	0.68	0.75	0.75
Water Heating	0.41	0.41	0.42	0.42	0.41	0.41	0.41	0.41	0.39	0.39
Refrigeration	0.43	0.43	0.38	0.38	0.34	0.34	0.32	0.32	0.32	0.32
Cooking	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13
Clothes Dryers	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.28	0.28
Freezers	0.12	0.12	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09
Lighting	0.35	0.35	0.41	0.41	0.45	0.45	0.48	0.48	0.51	0.51
Clothes Washers 1	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Dishwashers 1	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Color Televisions	0.13	0.13	0.17	0.17	0.20	0.20	0.23	0.23	0.26	0.26
Personal Computers	0.04	0.04	0.06	0.06	0.08	0.08	0.10	0.10	0.11	0.11
Furnace Fans	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11
Other Uses 2	1.14	1.14	1.51	1.51	1.71	1.71	1.95	1.95	2.16	2.16
Delivered Energy	**4.07**	**4.07**	**4.62**	**4.62**	**4.92**	**4.92**	**5.30**	**5.30**	**5.70**	**5.70**
Natural Gas										
Space Heating	3.44	3.44	3.69	3.69	3.82	3.82	3.99	3.99	4.22	4.22
Space Cooling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Heating	1.32	1.32	1.42	1.42	1.44	1.44	1.46	1.46	1.47	1.47
Cooking	0.20	0.20	0.21	0.21	0.22	0.22	0.24	0.24	0.25	0.25
Clothes Dryers	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10
Other Uses 3	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
Delivered Energy	**5.14**	**5.14**	**5.52**	**5.53**	**5.68**	**5.68**	**5.89**	**5.89**	**6.15**	**6.15**

Table A4. Residential Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Distillate										
Space Heating	0.70	0.70	0.72	0.72	0.67	0.67	0.64	0.64	0.63	0.63
Water Heating	0.12	0.12	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10
Other Uses 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delivered Energy	0.83	0.83	0.85	0.85	0.79	0.79	0.75	0.75	0.73	0.73
Liquefied Petroleum Gas										
Space Heating	0.33	0.33	0.31	0.31	0.31	0.31	0.30	0.30	0.29	0.29
Water Heating	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08
Cooking	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Other Uses 3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Delivered Energy	**0.47**	**0.47**	**0.44**	**0.44**	**0.45**	**0.45**	**0.42**	**0.42**	**0.41**	**0.41**
Marketed Renewables (wood) 4	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45
Other Fuels 5	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12
Deliv Energy Consumption by End-Use										
Space Heating	5.45	5.45	5.73	5.73	5.83	5.83	5.98	5.98	6.23	6.23
Space Cooling	0.56	0.56	0.61	0.60	0.64	0.64	0.68	0.68	0.75	0.75
Water Heating	1.95	1.95	2.06	2.06	2.07	2.07	2.06	2.06	2.04	2.04
Refrigeration	0.43	0.43	0.38	0.38	0.34	0.34	0.32	0.32	0.32	0.32
Cooking	0.33	0.33	0.36	0.36	0.37	0.37	0.39	0.39	0.41	0.41
Clothes Dryers	0.29	0.29	0.33	0.33	0.34	0.34	0.36	0.36	0.38	0.38
Freezers	0.12	0.12	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09
Lighting	0.35	0.35	0.41	0.41	0.45	0.45	0.48	0.48	0.51	0.51
Clothes Washers	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Dishwashers	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Color Televisions	0.13	0.13	0.17	0.17	0.20	0.20	0.23	0.23	0.26	0.26
Personal Computers	0.04	0.04	0.06	0.06	0.08	0.08	0.10	0.10	0.11	0.11
Furnace Fans	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11
Other Uses 7	1.27	1.27	1.64	1.63	1.83	1.83	2.07	2.07	2.28	2.28
Delivered Energy	**11.06**	**11.06**	**11.99**	**11.99**	**12.40**	**12.40**	**12.92**	**12.92**	**13.55**	**13.55**
Electricity Related Losses	**8.79**	**8.79**	**9.71**	**9.71**	**9.83**	**9.74**	**10.24**	9.95	**10.72**	10.00

Table A4. Residential Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Total Energy Consumption by End-Use										
Space Heating	6.36	6.36	6.69	6.69	6.78	6.77	6.96	6.93	7.24	7.17
Space Cooling	1.77	1.77	1.88	1.88	1.90	1.89	2.00	1.96	2.16	2.07
Water Heating	2.83	2.83	2.95	2.95	2.90	2.89	2.84	2.82	2.79	2.74
Refrigeration	1.36	1.36	1.19	1.19	1.03	1.02	0.95	0.93	0.93	0.89
Cooking	0.56	0.56	0.59	0.59	0.61	0.61	0.63	0.62	0.65	0.64
Clothes Dryers	0.78	0.78	0.84	0.84	0.85	0.85	0.87	0.86	0.90	0.86
Freezers	0.37	0.37	0.30	0.30	0.27	0.26	0.25	0.25	0.25	0.24
Lighting	1.11	1.11	1.28	1.28	1.36	1.35	1.42	1.39	1.47	1.40
Clothes Washers	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08
Dishwashers	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.08	0.08
Color Televisions	0.42	0.42	0.54	0.54	0.59	0.59	0.66	0.65	0.74	0.71
Personal Computers	0.14	0.14	0.19	0.19	0.23	0.23	0.28	0.28	0.31	0.30
Furnace Fans	0.25	0.25	0.27	0.27	0.29	0.28	0.30	0.30	0.32	0.31
Other Uses 7	3.73	3.73	4.81	4.81	5.25	5.22	5.82	5.72	6.34	6.07
Total	**19.85**	**19.85**	**21.70**	**21.71**	**22.22**	**22.14**	**23.15**	22.87	**24.27**	23.55
Non-Marketed Renewables										
Geothermal 8	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04
Solar 9	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Total	**0.04**	**0.04**	**0.05**	**0.05**	**0.06**	**0.06**	**0.07**	**0.07**	**0.08**	**0.08**

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Does not include electric water heating portion 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 1997.

6 Includes kerosene and coal.

7 Includes all other uses listed above.

8 Includes primary energy displaced by geothermal heat pumps in space heating and cooling applications.

9 Includes primary energy displaced by solar thermal water heaters and electricity generated using photovoltaics.

N/A = Not applicable.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000: Energy Information Administration (EIA), Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/forecasting/steo/oldsteos/oct01.pdf. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A5. Commercial Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Total Floorspace (billion sq ft)										
Surviving	62.3	62.31	69.6	69.59	75.5	75.50	81.7	81.66	87.5	87.51
New Additions	2.2	2.19	2.1	2.09	2.1	2.05	2.1	2.10	2.0	2.05
Total	**64.5**	**64.50**	**71.7**	**71.67**	**77.6**	**77.55**	**83.8**	**83.75**	**89.6**	**89.56**
Energy Consumption Intensity										
(thousand Btu/sq ft)										
Delivered Energy Consumption	125.1	125.06	126.3	126.25	127.8	127.81	128.9	128.89	130.0	130.00
Electricity Related Losses	130.6	130.60	130.9	130.77	129.6	128.50	129.5	125.55	128.7	119.88
Total Energy Consumption	**255.6**	**255.7**	**257.1**	**257.0**	**257.4**	**256.3**	**258.4**	254.4	**258.7**	249.9
Delivered Energy Consumption by Fuel										
Purchased Electricity										
Space Heating 1	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Space Cooling 1	0.45	0.45	0.48	0.48	0.50	0.50	0.53	0.53	0.54	0.54
Water Heating 1	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Ventilation	0.18	0.18	0.20	0.20	0.21	0.21	0.22	0.22	0.23	0.23
Cooking	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lighting	1.24	1.24	1.34	1.34	1.42	1.42	1.50	1.50	1.54	1.53
Refrigeration	0.19	0.19	0.20	0.20	0.22	0.22	0.23	0.23	0.24	0.24
Office Equipment (PC)	0.16	0.16	0.25	0.25	0.32	0.32	0.35	0.35	0.35	0.35
Office Equipment (non-PC)	0.32	0.32	0.41	0.41	0.52	0.52	0.65	0.65	0.78	0.78
Other Uses 2	1.05	1.05	1.23	1.23	1.49	1.49	1.79	1.79	2.10	2.10
Delivered Energy	**3.90**	3.90	**4.46**	4.46	**5.03**	5.03	**5.62**	5.62	**6.14**	6.13
Natural Gas										
Space Heating 1	1.50	1.50	1.64	1.64	1.72	1.72	1.80	1.79	1.87	1.87
Space Cooling 1	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04
Water Heating 1	0.65	0.65	0.72	0.72	0.79	0.79	0.85	0.85	0.91	0.91
Cooking	0.21	0.21	0.23	0.23	0.26	0.26	0.27	0.27	0.29	0.29
Other Uses 4	0.99	0.99	1.16	1.16	1.26	1.25	1.38	1.37	1.54	1.54
Delivered Energy	**3.36**	3.36	**3.77**	3.77	**4.04**	4.04	**4.33**	4.33	**4.64**	4.64
Distillate										
Space Heating 1	0.23	0.23	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24
Water Heating 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Other Uses 5	0.07	0.07	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Delivered Energy	**0.38**	0.38	**0.42**	0.42	**0.42**	0.42	**0.42**	0.42	**0.42**	0.42
Other Fuels 6	**0.34**	0.34	**0.32**	0.32	**0.34**	0.34	**0.36**	0.36	**0.37**	0.37

Table A5. Commercial Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Marketed Renewable Fuels										
Biomass	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Delivered Energy	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
Delivered Energy Consumption by End-Use										
Space Heating 1	1.88	1.88	2.04	2.04	2.13	2.13	2.20	2.20	2.27	2.27
Space Cooling 1	0.47	0.47	0.49	0.49	0.53	0.53	0.56	0.56	0.58	0.58
Water Heating 1	0.87	0.87	0.96	0.96	1.03	1.03	1.10	1.10	1.16	1.15
Ventilation	0.18	0.18	0.20	0.20	0.21	0.21	0.22	0.22	0.23	0.23
Cooking	0.24	0.24	0.27	0.27	0.29	0.29	0.30	0.30	0.32	0.32
Lighting	1.24	1.24	1.34	1.34	1.42	1.42	1.50	1.50	1.54	1.53
Refrigeration	0.19	0.19	0.20	0.20	0.22	0.22	0.23	0.23	0.24	0.24
Office Equipment (PC)	0.16	0.16	0.25	0.25	0.32	0.32	0.35	0.35	0.35	0.35
Office Equipment (non-PC)	0.32	0.32	0.41	0.41	0.52	0.52	0.65	0.65	0.78	0.78
Other Uses 7	2.53	2.53	2.89	2.89	3.25	3.25	3.69	3.69	4.18	4.18
Delivered Energy	**8.07**	**8.07**	**9.05**	**9.05**	**9.91**	**9.91**	**10.80**	**10.80**	**11.65**	**11.64**
Electricity Related Losses	**8.42**	**8.42**	**9.38**	**9.37**	**10.05**	**9.96**	**10.85**	10.51	**11.53**	10.74
Total Energy Consumption by End-Use										
Space Heating 1	2.20	2.20	2.37	2.37	2.45	2.45	2.52	2.51	2.58	2.56
Space Cooling 1	1.45	1.45	1.49	1.49	1.53	1.52	1.57	1.54	1.60	1.53
Water Heating 1	1.19	1.19	1.28	1.28	1.35	1.35	1.41	1.40	1.46	1.44
Ventilation	0.56	0.56	0.61	0.61	0.63	0.62	0.64	0.63	0.65	0.62
Cooking	0.31	0.31	0.33	0.33	0.35	0.35	0.36	0.36	0.38	0.37
Lighting	3.90	3.91	4.16	4.16	4.27	4.24	4.39	4.30	4.42	4.22
Refrigeration	0.59	0.59	0.63	0.63	0.65	0.65	0.67	0.66	0.69	0.66
Office Equipment (PC)	0.49	0.49	0.78	0.78	0.95	0.94	1.03	1.01	1.02	0.97
Office Equipment (non-PC)	1.00	1.00	1.28	1.28	1.57	1.56	1.91	1.87	2.24	2.14
Other Uses 7	4.79	4.79	5.49	5.48	6.23	6.20	7.14	7.03	8.13	7.86
Total	**16.49**	**16.49**	**18.43**	**18.42**	**19.96**	**19.88**	**21.65**	21.31	**23.18**	22.38
Non-Marketed Renewable Fuels										
Solar 8	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Total	**0.02**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes fuel consumption for district services.

2 Includes miscellaneous uses, such as service station equipment, automated teller machines, telecommunications equipment, and medical equipment.

3 Excludes estimated consumption from independent power producers.

4 Includes miscellaneous uses, such as pumps, emergency electric generators, cogeneration in commercial buildings, and manufacturing performed in commercial buildings.

5 Includes miscellaneous uses, such as cooking, emergency electric generators, and cogeneration in commercial buildings.

6 Includes residual fuel oil, liquefied petroleum gas, coal, motor gasoline, and kerosene.

7 Includes miscellaneous uses, such as service station equipment, automated teller machines, telecommunications equipment, medical equipment, pumps, lighting, emergency electric generators, cogeneration in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, liquefied petroleum gas, coal, motor gasoline, and kerosene.

8 Includes primary energy displaced by solar thermal space heating and water heating, and electricity generation by solar photovoltaic systems.

Btu = British thermal unit.

PC = Personal computer.

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

Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000: Energy Information Administration (EIA), Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/forecasting/steo/oldsteos/oct01.pdf.

Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A6. Industrial Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Value of Gross Output (billion 1992 dollars)										
Manufacturing	4022.4	4022.4	4552.4	4549.8	5376.4	5373.5	6206.4	6210.3	6993.7	7003.0
Nonmanufacturing	1039.3	1039.2	1127.6	1126.9	1212.2	1211.0	1325.4	1324.7	1444.9	1444.4
Total	**5061.7**	**5061.6**	**5680.0**	**5676.8**	**6588.7**	**6584.5**	**7531.8**	**7535.0**	**8438.6**	**8447.4**
Energy Prices (2000 dollars per million Btu)										
Electricity	13.50	13.5	12.72	12.7	12.56	12.4	12.64	12.3	13.03	11.8
Natural Gas	4.31	4.3	3.30	3.3	3.47	3.4	3.68	3.5	3.89	3.6
Steam Coal	1.41	1.4	1.35	1.4	1.30	1.3	1.26	1.3	1.22	1.2
Residual Oil	3.27	3.3	3.57	3.6	3.65	3.7	3.74	3.7	3.86	3.8
Distillate Oil	7.21	7.2	5.54	5.5	5.89	5.9	6.48	6.5	6.70	6.7
Liquefied Petroleum Gas	11.73	11.7	8.28	8.3	8.60	8.6	8.98	9.0	9.11	9.1
Motor Gasoline	12.18	12.2	10.95	11.0	11.23	11.2	11.24	11.2	11.24	11.2
Metallurgical Coal	1.62	1.6	1.60	1.6	1.56	1.6	1.52	1.5	1.46	1.5
Energy Consumption 1										
Purchased Electricity	3.65	3.7	3.80	3.8	4.20	4.2	4.53	4.5	4.83	4.8
Natural Gas 2	9.79	9.8	10.44	10.4	11.19	11.2	11.79	11.7	12.18	12.1
Steam Coal	1.69	1.7	1.71	1.7	1.74	1.7	1.78	1.8	1.85	1.9
Metallurgical Coal and Coke 3	0.84	0.8	0.77	0.8	0.75	0.8	0.72	0.7	0.69	0.7
Residual Fuel	0.27	0.3	0.18	0.2	0.23	0.2	0.25	0.3	0.27	0.3
Distillate	1.11	1.1	1.17	1.2	1.22	1.2	1.30	1.3	1.38	1.4
Liquefied Petroleum Gas	2.36	2.4	2.50	2.5	2.66	2.7	2.84	2.8	3.00	3.0
Petrochemical Feedstocks	1.32	1.3	1.36	1.4	1.45	1.5	1.54	1.5	1.59	1.6
Other Petroleum 4	4.17	4.2	4.58	4.6	5.01	5.0	5.25	5.2	5.45	5.4
Renewables 5	2.41	2.4	2.66	2.7	2.89	2.9	3.18	3.2	3.43	3.4
Delivered Energy	**27.62**	**27.6**	**29.17**	**29.2**	**31.36**	**31.3**	**33.20**	**33.1**	**34.67**	**34.6**
Electricity Related Losses	7.88	7.9	7.99	8.0	8.39	8.3	8.76	8.5	9.07	8.5
Total	**35.50**	**35.5**	**37.15**	**37.1**	**39.75**	**39.6**	**41.96**	**41.6**	**43.73**	43.0
Consumption / Unit of Output (thousand Btu / 1992 dollar) 1										
Purchased Electricity	0.72	0.7	0.67	0.7	0.64	0.6	0.60	0.6	0.57	0.6
Natural Gas 2	1.93	1.9	1.84	1.8	1.70	1.7	1.57	1.6	1.44	1.4
Steam Coal	0.33	0.3	0.30	0.3	0.26	0.3	0.24	0.2	0.22	0.2
Metallurgical Coal and Coke 3	0.17	0.2	0.13	0.1	0.11	0.1	0.10	0.1	0.08	0.1
Residual Fuel	0.05	0.1	0.03	0.0	0.04	0.0	0.03	0.0	0.03	0.0
Distillate	0.22	0.2	0.21	0.2	0.19	0.2	0.17	0.2	0.16	0.2
Liquefied Petroleum Gas	0.47	0.5	0.44	0.4	0.40	0.4	0.38	0.4	0.36	0.4
Petrochemical Feedstocks	0.26	0.3	0.24	0.2	0.22	0.2	0.21	0.2	0.19	0.2
Other Petroleum 4	0.82	0.8	0.81	0.8	0.76	0.8	0.70	0.7	0.65	0.6
Renewables 5	0.48	0.5	0.47	0.5	0.44	0.4	0.42	0.4	0.41	0.4
Delivered Energy	**5.46**	**5.5**	**5.13**	**5.1**	**4.76**	**4.8**	**4.41**	**4.4**	**4.11**	**4.1**
Electricity Related Losses	1.56	1.6	1.41	1.4	1.27	1.3	1.16	1.1	1.07	1.0
Total	**7.01**	**7.0**	**6.54**	**6.5**	**6.03**	**6.0**	**5.57**	**5.5**	**5.18**	5.1

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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: Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 prices for gasoline and distillate are based on prices in the Energy Information Administration (EIA), Petroleum Marketing Annual 1999, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_marketing_annual/pma_historical.html (August 2000). 2000 prices for gasoline and distillate are based on the preliminary Petroleum Marketing Annual 2000, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_marketing_annual/current/pdf/pmaall.pdf.
1999 and 2000 coal prices are based on EIA, Quarterly Coal Report, DOE/EIA-0121(2000/4Q) (Washington, DC, October-December 2000) and EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B.
1999 and 2000 electricity prices: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B.
Other 1999 values and other 2000 prices derived from EIA, State Energy Data Report 1999, DOE/EIA-0214(99) (Washington, DC, May 2001). Other 2000 values: EIA, Short-Term Energy Outlook, Octobe

Table A7. Transportation Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Key Indicators										
Level of Travel (billions)										
Light-Duty Veh<8500 lbs(VMT)	2340.3	2340.3	2659.8	2659.4	2982.4	2981.3	3318.9	3318.2	3630.4	3630.6
Commercial Light Trucks(VMT) 1	69.5	69.5	77.5	77.5	89.1	89.1	101.0	101.0	112.3	112.4
Freight Trucks >10000 lbs(VMT)	214.3	214.3	250.8	250.6	285.3	285.0	323.0	322.9	360.1	360.2
Air (seat miles available)	1184.3	1184.3	1318.1	1317.4	1604.6	1603.3	1949.2	1949.1	2340.8	2342.3
Rail (ton miles traveled)	1414.7	1414.7	1606.3	1609.0	1762.0	1757.1	1910.0	1906.6	2066.3	2065.9
Domestic Shipping (tmt)	689.4	689.2	741.3	740.9	792.8	791.7	857.1	855.3	911.8	910.1
Energy Efficiency Indicators										
New Light-Duty Vehicle (MPG) 2	24.52	24.52	25.12	25.12	25.72	25.72	26.60	26.60	27.20	27.20
New Car (MPG) 2	28.56	28.56	29.61	29.62	30.21	30.21	30.97	30.97	31.69	31.69
New Light Truck (MPG) 2	21.08	21.08	21.56	21.56	22.28	22.28	23.25	23.25	23.80	23.80
Light-Duty Fleet (MPG) 3	19.81	19.81	19.79	19.79	20.06	20.06	20.48	20.48	20.99	20.99
New Comm Light Truck (MPG) 1	14.18	14.18	14.43	14.43	14.88	14.88	15.53	15.53	15.92	15.92
Stock Comm Light Truck(MPG) 1	13.63	13.63	14.12	14.12	14.43	14.43	14.88	14.88	15.39	15.39
Aircraft Eff (seat miles/gal)	52.07	52.07	53.82	53.82	55.93	55.92	58.10	58.10	60.29	60.29
Freight Truck Efficiency (MPG)	5.92	5.92	6.02	6.02	6.01	6.01	6.12	6.12	6.35	6.35
Rail Eff(ton miles/thous Btu)	2.80	2.80	2.94	2.94	3.09	3.09	3.25	3.25	3.42	3.42
Domestic Shipping Efficiency (ton miles per thousand Btu)	2.28	2.28	2.31	2.31	2.33	2.33	2.35	2.35	2.38	2.38
Energy Use by Mode (quad Btu)										
Light-Duty Vehicles	14.97	14.97	16.75	16.74	18.49	18.49	20.08	20.07	21.37	21.37
Commercial Light Trucks 1	0.64	0.64	0.69	0.69	0.77	0.77	0.85	0.85	0.91	0.91
Freight Trucks 4	4.80	4.80	5.51	5.51	6.25	6.24	6.91	6.91	7.41	7.42
Air 5	3.62	3.62	3.92	3.92	4.52	4.51	5.19	5.19	5.91	5.91
Rail 6	0.58	0.58	0.63	0.63	0.67	0.66	0.69	0.69	0.72	0.72
Marine 7	1.73	1.73	1.68	1.68	1.73	1.73	1.78	1.78	1.82	1.82
Pipeline Fuel	0.79	0.79	0.80	0.80	0.86	0.85	0.95	0.91	1.02	0.95
Lubricants	0.18	0.18	0.21	0.21	0.22	0.22	0.24	0.24	0.25	0.25
Total	**27.32**	**27.32**	**30.20**	**30.19**	**33.52**	**33.49**	**36.70**	**36.65**	**39.43**	**39.37**

Table A7. Transportation Sector Key Indicators and Consumption

(Quadrillion Btu per year, Unless Otherwise Noted)

Key Indicators & Consumption	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Energy Use by Mode										
(million barrels per day oil eq)										
Light-Duty Vehicles	7.82	7.82	8.85	8.85	9.77	9.76	10.60	10.59	11.27	11.27
Commercial Light Trucks 1	0.33	0.33	0.36	0.36	0.41	0.41	0.45	0.45	0.48	0.48
Freight Trucks 4	2.14	2.14	2.47	2.47	2.81	2.81	3.12	3.12	3.35	3.35
Railroad	0.24	0.24	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.28
Domestic Shipping	0.14	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.18	0.18
International Shipping	0.48	0.48	0.45	0.45	0.45	0.45	0.45	0.45	0.46	0.46
Air 5	1.51	1.51	1.62	1.62	1.89	1.89	2.21	2.21	2.55	2.56
Military Use	0.30	0.30	0.34	0.34	0.35	0.35	0.36	0.36	0.36	0.36
Bus Transportation	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
Rail Transportation 6	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Recreational Boats	0.16	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.20	0.20
Lubricants	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12
Pipeline Fuel	0.40	0.40	0.40	0.40	0.44	0.43	0.48	0.46	0.51	0.48
Total	**13.73**	**13.73**	**15.29**	**15.28**	**16.96**	**16.95**	**18.56**	**18.53**	**19.92**	**19.89**

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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 energy use by buses and military distillate consumption.

5 Includes jet fuel and aviation gasoline.

6 Includes passenger rail.

7 Includes military residual fuel use and recreation boats.

Btu = British thermal unit.

VMT=Vehicle miles traveled.

MPG = Miles per gallon.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999: Energy Information Administration (EIA), Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000); Federal Highway Administration, Highway Statistics 1999 (Washington, DC, November 2000); Oak Ridge National Laboratory, Transportation Energy Data Book: 12, 13, 14, 15, 16, 17, 18, 19, and 20 (Oak Ridge, TN, November 2000);
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EIA, Alternatives To Traditional Transportation Fuels 1998,
http://www.eia.doe.gov/cneaf/alt_trans98/table1.html; and EIA, State Energy Data Report 1999, DOE/EIA-0214(99) (Washington, DC, May 2001). 2000: U.S. Department of Transportation, Research a Administration, Air Carrier Statistics Monthly, December 2000/1999 (Washington, DC, 2000); EIA, Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/ forecasting/steo/oldsteos/oct

Table A8. Electricity Supply, Dispositon, Prices, and Emissions

(Billion Kilowatthours, Unless Otherwise Noted)

Supply, Disposition & Prices	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Generation by Fuel Type										
Electric Generators 1										
Coal	1922.3	1922.1	2084.4	2085.7	2216.8	2220.3	2295.8	2462.9	2424.3	2663.0
Petroleum	92.4	92.8	38.9	39.2	27.6	27.2	32.6	26.8	36.7	26.2
Natural Gas 2	417.6	417.4	607.0	607.9	894.0	893.3	1200.1	1070.2	1411.3	1237.1
Nuclear Power	752.4	752.4	758.8	758.8	736.9	736.9	707.1	689.9	701.8	679.1
Pumped Storage	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
Renewable Sources 3	320.5	320.5	377.0	374.7	390.1	388.9	399.9	394.8	409.5	394.1
Total	**3504.4**	**3504.4**	**3865.3**	**3865.3**	**4264.5**	**4265.8**	**4634.7**	**4643.6**	**4982.7**	**4998.6**
Non-Utility Gen for Own Use	30.4	30.4	33.1	33.1	32.8	32.8	32.8	32.8	32.3	32.3
Distributed Generation	0.0	0.0	0.4	0.4	2.2	2.1	4.8	3.8	8.2	6.5
Cogenerators 4										
Coal	46.4	46.5	48.4	48.8	49.0	49.3	48.9	49.1	48.8	49.0
Petroleum	8.9	8.9	9.7	9.7	9.8	9.8	10.2	10.1	10.6	10.6
Natural Gas	208.7	208.7	239.1	239.2	259.9	260.0	286.4	285.8	318.9	316.5
Other Gaseous Fuels 5	5.6	5.6	8.5	8.5	9.3	9.3	10.4	10.4	11.8	11.9
Renewable Sources 3	32.9	32.9	37.0	37.0	41.4	41.3	47.3	47.3	52.3	52.3
Other	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Total	**306.9**	306.9	**347.2**	347.6	**373.9**	374.3	**407.7**	407.2	**446.9**	444.7
Other End-Use Generators 7	**4.0**	4.0	**4.6**	4.6	**5.1**	5.1	**5.2**	5.2	**5.3**	5.3
Sales to Utilities	163.5	163.4	179.6	179.8	189.3	189.4	204.3	203.8	223.8	221.7
Generation for Own Use	147.5	147.5	172.1	172.4	189.5	189.7	208.3	208.3	228.1	228.0
Net Imports 8	**35.0**	35.0	**49.6**	49.3	**34.7**	31.7	**41.2**	33.0	**39.8**	27.5
Electricity Sales by Sector										
Residential	1193.4	1193.4	1353.9	1353.9	1442.3	1442.5	1553.7	1554.0	1671.6	1671.5
Commercial	1144.2	1144.2	1306.5	1306.3	1474.9	1474.5	1646.3	1645.8	1798.2	1797.6
Industrial	1070.9	1070.9	1112.5	1112.3	1231.2	1229.6	1329.1	1328.9	1414.2	1415.0
Transportation	17.5	17.5	20.4	20.4	23.3	23.3	27.0	27.0	32.0	32.0
Total	**3426.1**	**3426.1**	**3793.2**	**3792.8**	**4171.7**	**4169.9**	**4556.0**	**4555.7**	**4916.0**	**4916.1**
End-Use Prices (2000 cents/kwh) 9										
Residential	8.32	8.31	7.64	7.63	7.66	7.61	7.58	7.44	7.69	7.31
Commercial	7.55	7.54	6.96	6.95	6.79	6.72	6.78	6.62	6.93	6.44
Industrial	4.61	4.61	4.34	4.33	4.29	4.24	4.31	4.19	4.44	4.03
Transportation	7.43	7.43	5.65	5.65	6.22	6.13	6.58	6.43	6.11	5.75
All Sectors Average	**6.90**	**6.89**	**6.43**	**6.42**	**6.35**	**6.29**	**6.33**	6.19	**6.47**	6.04
Prices by Service Category (2000 cents/kwh) 9										
Generation	4.28	4.3	3.91	3.9	3.75	3.7	3.75	3.6	3.91	3.5
Transmission	0.63	0.6	0.62	0.6	0.68	0.7	0.68	0.7	0.67	0.7
Distribution	2.02	2.0	1.94	1.9	1.95	1.9	1.94	1.9	1.92	1.9
Emissions (million short tons)										
Sulfur Dioxide	11.05	11.0	10.39	10.4	9.70	9.7	8.95	8.9	8.95	9.0
Nitrogen Oxide	4.28	4.3	3.94	3.9	4.03	4.0	4.11	4.0	4.18	4.0

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes grid-connected generation at all utilities and nonutilities except for cogenerators. Includes small power producers and exempt wholesale generators.

2 Includes electricity generation by fuel cells.

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

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

5 Other gaseous fuels include refinery and still gas.

6 Other includes hydrogen, sulfur, batteries, chemicals, fish oil, and spent sulfite liquor.

7 Includes small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

8 In 1999 approximately 70 percent of the U.S. electricity imports were provided by renewable sources (hydroelectricity); EIA does not project future proportions for the fuel source of imported electricity.

9 Prices represent average revenue per kilowatthour.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999: Electric generators and cogenerators generation, sales to utilities, net imports, residential, industrial, and total electricity sales, and emissions: Energy Information Administration (EIA), Electric Power Annual 1999, Volume 2, DOE/EIA-0348(99)/2 (Washington, DC, October 2000), and supporting databases. Other generators: EIA, Form EIA-860B: "Annual Electric Generator Report - Nonutility" and Department of Energy, Office of Energy Efficiency and Renewable Energy estimates. Commercial and transportation electricity sales: EIA estimates based on Oak Ridge National Laboratory, Transportation Energy Data Book 20 (Oak Ridge,

Table A9. Electricity Generating Capacity (including Advanced Fossil-Fuel Generators) (Gigawatts)

Net Summer Capacity 1	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Electric Generators 2										
Capability										
Coal Steam	304.57	304.57	303.74	303.73	306.22	307.64	313.84	339.47	329.63	366.53
Advanced Coal (IGCC)	0.50	0.50	0.50	0.50	0.80	3.37	2.41	35.52	6.29	63.79
Conventional Coal	304.07	304.07	303.24	303.24	305.42	304.28	311.43	303.95	323.35	302.74
Other Fossil Steam 3	134.96	134.96	127.43	127.50	115.63	115.51	114.35	112.69	113.27	108.36
Combined Cycle	30.56	30.56	59.63	59.45	139.87	134.49	181.28	165.14	212.90	211.17
Advanced	0.00	0.00	6.74	6.71	44.63	63.22	76.09	93.78	104.70	139.81
Conventional	30.56	30.56	52.89	52.74	95.24	71.27	105.18	71.36	108.20	71.36
Combustion Turbine/Diesel	77.73	77.73	104.88	105.24	129.67	133.29	149.98	146.37	178.59	167.12
Advanced	0.00	0.00	2.44	2.90	8.76	11.64	16.51	21.09	28.45	30.90
Conventional	77.73	77.73	102.44	102.34	120.91	121.65	133.47	125.28	150.14	136.22
Nuclear Power	97.51	97.51	97.70	97.70	94.34	94.34	88.83	86.37	88.02	84.77
Pumped Storage	19.18	19.18	19.64	19.64	19.64	19.64	19.64	19.64	19.64	19.64
Fuel Cells	0.00	0.00	0.06	0.06	0.16	0.16	0.24	0.24	0.25	0.25
Renewable Sources 4	89.13	89.13	95.16	95.16	97.21	97.05	99.41	98.62	101.18	99.15
Distributed Generation 5	0.00	0.00	0.86	0.86	5.02	4.74	10.86	8.77	18.82	14.77
Total	**753.6**	**753.6**	**809.1**	**809.3**	**907.8**	**906.9**	**978.4**	**977.3**	**1062.3**	**1071.8**
Cumulative Planned Additions 6										
Coal Steam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Advanced (IGCC)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conventional	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Fossil Steam 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Combined Cycle	0.00	0.00	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
Advanced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conventional	0.00	0.00	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
Combustion Turbine/Diesel	0.00	0.00	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Advanced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conventional	0.00	0.00	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Nuclear Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumped Storage	0.00	0.00	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Fuel Cells	0.00	0.00	0.06	0.06	0.16	0.16	0.24	0.24	0.25	0.25
Renewable Sources 4	0.00	0.00	5.63	5.63	6.96	6.96	7.92	7.92	8.18	8.18
Distributed Generation 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.00**	**0.00**	**16.27**	**16.27**	**17.70**	**17.70**	**18.74**	**18.74**	**19.01**	**19.01**

Table A9. Electricity Generating Capacity (including Advanced Fossil-Fuel Generators from Table A59

(Gigawatts)

Net Summer Capacity 1	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Cumulative Unplanned Additions 6										
Coal Steam	0.0	0.00	1.0	1.02	6.7	8.06	14.8	40.39	31.8	68.66
Advanced (IGCC)	0.0	0.00	0.0	0.00	0.3	2.87	1.9	35.03	5.8	63.30
Conventional	0.0	0.00	1.0	1.02	6.4	5.19	12.9	5.37	26.0	5.37
Other Fossil Steam 3	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Combined Cycle	0.0	0.00	21.7	21.49	101.9	96.53	143.3	127.18	175.0	173.21
Advanced	0.0	0.00	6.7	6.71	44.6	63.22	76.1	93.78	104.7	139.81
Conventional	0.0	0.00	14.9	14.79	57.3	33.31	67.2	33.40	70.2	33.40
Combustion Turbine/Diesel	0.0	0.00	28.1	28.51	54.4	58.03	77.1	73.38	107.2	95.63
Advanced	0.0	0.00	2.4	2.90	8.8	11.64	16.5	21.09	28.4	30.90
Conventional	0.0	0.00	25.7	25.61	45.6	46.40	60.6	52.29	78.7	64.73
Nuclear Power	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Pumped Storage	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Fuel Cells	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Renewable Sources 4	0.0	0.00	0.0	0.02	0.6	0.47	1.9	1.08	3.4	1.35
Distributed Generation 5	0.0	0.00	0.9	0.86	5.0	4.74	10.9	8.77	18.8	14.77
Total	**0.0**	**0.00**	**51.7**	**51.90**	**168.6**	**167.84**	**247.9**	250.81	**336.1**	353.62
Cumulative Total Additions	**0.0**	**0.00**	**68.0**	**68.17**	**186.3**	**185.54**	**266.7**	269.55	**355.1**	372.63
Cumulative Retirements										
Coal	0.0	0.00	2.1	2.08	5.2	5.21	5.7	5.72	6.9	6.93
Advanced	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Conventional	0.0	0.00	2.1	2.08	5.2	5.21	5.7	5.72	6.9	6.93
Other Fossil Steam	0.0	0.00	6.4	6.33	18.2	18.32	19.5	21.14	20.6	25.47
Combined Cycle	0.0	0.00	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04
Advanced	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Conventional	0.0	0.00	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04
Combustion Turbine/Diesel	0.0	0.00	4.7	4.66	6.1	6.14	8.5	8.40	10.0	9.90
Advanced	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Conventional	0.0	0.00	4.7	4.66	6.1	6.14	8.5	8.40	10.0	9.90
Nuclear Power	0.0	0.00	0.0	0.00	3.4	3.36	8.9	11.33	9.7	12.93
Pumped Storage	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Fuel Cells	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Renewable Sources	0.0	0.00	0.1	0.11	0.1	0.13	0.1	0.13	0.1	0.13
Total	**0.0**	**0.00**	**13.3**	**13.22**	**33.1**	**33.20**	**42.8**	46.77	**47.3**	55.41

Table A9. Electricity Generating Capacity (including Advanced Fossil-Fuel Generators from Table A59

(Gigawatts)

Net Summer Capacity 1	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Cogenerators										
Capability										
Coal	8.9	8.95	9.0	9.05	8.8	8.76	8.7	8.68	8.7	8.67
Petroleum	2.6	2.61	2.5	2.52	2.5	2.54	2.6	2.58	2.6	2.63
Natural Gas	35.9	35.87	40.2	40.23	43.5	43.48	47.2	47.15	51.6	51.57
Other Gaseous Fuels	0.7	0.67	1.1	1.09	1.2	1.20	1.4	1.37	1.6	1.58
Renewables	6.8	6.76	7.5	7.50	8.4	8.38	9.4	9.39	10.2	10.23
Other	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Total	**54.9**	**54.86**	**60.4**	**60.38**	**64.4**	**64.37**	**69.3**	**69.18**	**74.8**	**74.69**
Cumulative Additions 6	**0.0**	**0.00**	**5.3**	**5.31**	**9.1**	**9.13**	**14.0**	**13.91**	**19.5**	**19.39**
Other End-Use Generators 9										
Renewable Sources 10	1.0	0.99	1.1	1.09	1.4	1.36	1.4	1.40	1.4	1.44
Cumulative Additions	0.0	0.00	0.1	0.09	0.4	0.37	0.4	0.40	0.4	0.44

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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 and exempt wholesale generators.

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 Primarily peak-load capacity fueled by natural gas.

6 Cumulative additions after December 31, 2000.

7 Cumulative total retirements after December 31, 2000.

8 Nameplate capacity is reported for nonutilities on Form EIA-860B: "Annual Electric Generator Report - Nonutility." Nameplate capacity is designated by the manufacturer. The nameplate capacity has been converted to the net summer capability based on historic relationships.

9 Includes small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid. Excludes off-grid photovoltaics and other generators not connected to the distribution or transmission systems.

10 See Table A17 for more detail.

N/A = Not applicable.

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

Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Net summer capability has been estimated for nonutility generators to be consistent with capability estimates for electric utility generators.

Sources: 1999 electric utilities capability and projected planned additions: Energy Information Administration (EIA), Form EIA-860A: "Annual Electric Generator Report - Utility."

1999 nonutilities including cogenerators capability and projected planned additions:

EIA, Form EIA-860B: "Annual Electric Generator Report - Nonutility" and NewGen Data and Analysis, RDI Consulting/FT Energy (Boulder, CO, August 2000).

1999 other generators capability: EIA, Form EIA-860B:

Table A10. Electricity Trade

(Billion Kilowatthours, Unless Otherwise Notad)

Electricity Trade	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Interregional Electricity Trade										
Gross Domestic Firm Power Sales	156.9	156.9	125.3	125.3	102.9	102.9	45.7	45.7	0.0	0.0
Gross Domestic Economy Sales	150.1	151.4	188.0	189.5	187.7	190.7	196.6	184.6	205.8	188.4
Gross Domestic Trade	**307.0**	**308.3**	**313.3**	**314.8**	**290.6**	293.7	**242.3**	230.3	**205.8**	188.4
Gross Domestic Firm Power Sales (million 2000 dollars)	7576.3	7576.3	6050.5	6050.5	4970.1	4970.1	2208.9	2208.9	0.0	0.0
Gross Domestic Economy Sales (million 2000 dollars)	6853.8	6865.9	6203.4	6231.7	5825.3	5812.9	6645.5	5729.8	7254.1	5690.4
Gross Domestic Sales (million 2000 dollars)	**14430**	**14442**	**12254**	**12282**	**10795**	**10783**	**8854**	7939	**7254**	5690
International Electricity Trade										
Firm Power Imports from Canada & Mexico 1	23.7	23.70	10.7	10.67	5.8	5.81	2.6	2.58	0.0	0.00
Economy Imports from Canada & Mexico 1	24.3	24.26	55.6	55.35	45.3	42.30	50.1	41.94	47.5	35.20
Gross Imports from Canada & Mexico 1	**48.0**	**47.96**	**66.3**	**66.02**	**51.1**	48.11	**52.7**	44.52	**47.5**	35.20
Firm Power Exports to Canada & Mexico	6.6	6.57	9.7	9.69	8.7	8.72	3.9	3.88	0.0	0.00
Economy Exports to Canada & Mexico	6.4	6.43	7.0	6.98	7.7	7.66	7.7	7.66	7.7	7.66
Gross Exports to Canada & Mexico	**13.0**	**13.00**	**16.7**	**16.67**	**16.4**	**16.38**	**11.5**	**11.53**	**7.7**	**7.66**

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Historically electricity imports were primarily from renewable resources, principally hydroelectric.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports. Firm Power Sales are capacity sales, meaning the delivery of the power is scheduled as part of the normal operating conditions of the affected electric systems. Economy Sales are subject to curtailment or cessation of delivery by the supplier in accordance with prior agreements or under specified conditions.

Sources: 1999 interregional firm electricity trade data: North American Electric Reliability Council (NERC), Electricity Sales and Demand Database 1999. 1999 international electricity trade data: DOE Form FE-718R, “Annual Report of International Electrical Export/Import Data.” 1999 firm/economy share: National Energy Board, Annual Report 1999. 2000 and projections: Energy Information Administration, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A11. Petroleum Supply and Disposition Balance

(Million Barrels per Day, Unless Otherwise Notad)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Crude Oil										
Domestic Crude Production 1	5.82	5.82	5.38	5.38	5.08	5.08	5.56	5.55	5.63	5.60
Alaska	0.97	0.97	0.80	0.80	0.70	0.70	0.90	0.90	1.10	1.10
Lower 48 States	4.85	4.85	4.58	4.58	4.38	4.38	4.65	4.65	4.53	4.50
Net Imports	9.02	9.02	10.36	10.36	11.18	11.18	11.01	11.02	11.20	11.23
Gross Imports	9.07	9.07	10.41	10.41	11.22	11.22	11.07	11.08	11.26	11.29
Exports	0.05	0.05	0.05	0.05	0.04	0.04	0.06	0.06	0.06	0.06
Other Crude Supply 2	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Crude Supply	**15.07**	15.07	**15.74**	15.73	**16.27**	16.26	**16.57**	16.58	**16.83**	16.83
Natural Gas Plant Liquids	1.91	1.91	2.13	2.13	2.38	2.36	2.64	2.52	2.84	2.66
Other Inputs 3	**0.35**	0.35	**0.35**	0.34	**0.42**	0.42	**0.50**	0.50	**0.47**	0.51
Refinery Processing Gain 4	**0.95**	0.95	**0.87**	0.88	**1.00**	1.00	**1.01**	1.02	**1.02**	1.03
Net Product Imports 5	1.40	1.40	2.13	2.14	3.10	3.11	4.29	4.37	5.44	5.52
Gross Refined Prod Imports 6	2.04	2.04	2.52	2.52	3.21	3.20	4.31	4.41	5.48	5.56
Unfinished Oil Imports	0.27	0.27	0.38	0.38	0.76	0.77	0.88	0.87	0.90	0.90
Ether Imports	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exports	0.99	0.99	0.76	0.76	0.87	0.87	0.90	0.92	0.94	0.94
Total Primary Supply 7	**19.68**	19.68	**21.22**	21.22	**23.16**	23.14	**25.01**	24.99	**26.60**	26.55
Refined Petroleum Products Supply										
Motor Gasoline 8	8.50	8.50	9.44	9.44	10.32	10.32	11.14	11.13	11.81	11.81
Jet Fuel 9	1.73	1.73	1.87	1.87	2.15	2.15	2.47	2.47	2.81	2.81
Distillate Fuel 10	3.67	3.67	4.16	4.16	4.59	4.58	4.99	4.99	5.32	5.31
Residual Fuel	1.04	1.04	0.71	0.71	0.69	0.69	0.72	0.70	0.75	0.70
Other 11	4.80	4.80	5.09	5.10	5.47	5.46	5.74	5.75	5.96	5.97
Total	**19.74**	19.74	**21.28**	21.27	**23.22**	23.21	**25.06**	25.04	**26.65**	26.60
Refined Petrol Products Supp										
Residential and Commercial	1.12	1.12	1.11	1.11	1.09	1.09	1.06	1.06	1.04	1.04
Industrial 12	4.96	4.96	5.25	5.25	5.66	5.66	5.99	6.00	6.27	6.27
Transportation	13.26	13.26	14.77	14.76	16.38	16.37	17.91	17.90	19.22	19.22
Electric Generators 13	0.40	0.41	0.14	0.14	0.09	0.09	0.11	0.08	0.12	0.07
Total	**19.74**	19.74	**21.28**	21.27	**23.22**	23.21	**25.06**	25.04	**26.65**	26.60

Table A11. Petroleum Supply and Disposition Balance

(Million Barrels per Day, Unless Otherwise Notad)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Discrepancy 14	**-0.06**	-0.07	**-0.06**	-0.06	**-0.06**	-0.06	**-0.06**	-0.05	**-0.05**	-0.05
World Oil Price (2000 $/bbl) 15	**27.72**	27.72	**22.73**	22.73	**23.36**	23.36	**24.00**	24.00	**24.68**	24.68
Imported Share Product Supplied	**0.53**	0.53	**0.59**	0.59	**0.62**	0.62	**0.61**	0.61	**0.62**	0.63
Net Expenditures for Imp Crude & Petroleum Products (billion 2000$)	**106.46**	106.46	**105.27**	105.28	**125.61**	125.51	**140.99**	141.66	**159.76**	160.56
Domestic Refinery Distillation Capacity 6	**16.6**	16.59	**17.6**	17.57	**17.8**	17.83	**17.9**	17.88	**18.2**	18.17
Capacity Utilization Rate (%)	**93.0**	93.00	**89.9**	89.91	**91.7**	91.70	**93.2**	93.22	**93.2**	93.20

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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, other hydrocarbons, and natural gas converted to liquid fuel.

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 Includes blending components.

7 Total crude supply plus natural gas plant liquids, other inputs, refinery processing gain, and net petroleum imports.

8 Includes ethanol and ethers blended into gasoline.

9 Includes naphtha and kerosene types.

10 Includes distillate and kerosene.

11 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.

12 Includes consumption by cogenerators.

13 Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators.

14 Balancing item. Includes unaccounted for supply, losses and gains.

15 Average refiner acquisition cost for imported crude oil.

16 End-of-year capacity.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000 product supplied data from Table A2. Other 1999 data: Energy Information Administration (EIA), Petroleum Supply Annual 1999, DOE/EIA-0340(99/1) (Washington, DC, June 2000). Other 2000 data: EIA, Petroleum Supply Annual 2000, DOE/EIA-0340(2000/1) (Washington, DC, June 2001). Projections:

Table A12. Petroleum Product Prices

(2000 cents per Gallon, Unless Otherwise Notad)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
World Oil Price (2000$/bbl)	**27.72**	27.72	**22.73**	22.73	**23.36**	23.36	**24.00**	24.00	**24.68**	24.68
Delivered Sector Product Prices										
Residential										
Distillate Fuel	130.7	130.70	106.6	106.55	110.1	110.13	116.8	116.87	118.5	118.42
Liquefied Petroleum Gas	117.1	117.07	110.7	110.71	113.7	114.00	117.1	117.47	118.4	118.40
Commercial										
Distillate Fuel	98.2	98.21	75.6	75.55	79.4	79.44	86.5	86.65	88.6	88.53
Residual Fuel	51.8	51.84	56.1	56.09	57.3	57.32	58.7	58.65	60.2	60.01
Residual Fuel(00 $/bbl)	21.77	21.77	23.56	23.56	24.08	24.08	24.67	24.63	25.29	25.21
Industrial 1										
Distillate Fuel	99.9	99.95	76.9	76.83	81.7	81.65	89.9	90.38	93.0	92.76
Liquefied Petroleum Gas	100.6	100.63	71.0	70.99	73.7	73.92	77.0	77.22	78.1	78.14
Residual Fuel	48.9	48.93	53.4	53.45	54.7	54.67	56.0	55.93	57.8	57.61
Residual Fuel(00 $/bbl)	20.55	20.55	22.45	22.45	22.96	22.96	23.53	23.49	24.29	24.20
Transportation										
Diesel Fuel (Distillate) 2	149.9	149.87	128.0	127.93	140.6	140.57	139.4	140.06	138.4	138.78
Jet Fuel 3	99.3	99.33	74.6	74.58	79.2	79.21	84.9	85.38	86.0	86.01
Motor Gasoline 4	152.6	152.55	136.3	136.73	139.6	139.63	139.8	139.77	139.7	139.71
Liquefied Petroleum Gas	136.5	136.52	121.4	121.38	123.7	124.14	126.1	126.94	125.7	125.53
Residual Fuel	65.6	65.62	50.9	50.86	52.1	52.09	53.5	53.47	55.0	54.95
Residual Fuel(00 $/bbl)	27.56	27.56	21.36	21.36	21.88	21.88	22.46	22.46	23.10	23.08
Ethanol (E85)	155.3	155.27	171.1	171.63	184.1	184.06	194.1	193.71	189.5	189.28
Electric Generators 5										
Distillate Fuel	95.6	95.60	68.5	68.44	72.6	72.63	79.2	80.00	81.6	79.58
Residual Fuel	61.5	61.49	52.9	52.82	54.2	54.01	55.4	55.34	57.1	56.84
Residual Fuel(00 $/bbl)	25.84	25.82	22.20	22.19	22.77	22.69	23.28	23.24	23.97	23.87
Refined Petroleum ProdPrices 6										
Distillate Fuel	137.7	137.73	116.3	116.25	127.8	127.79	129.4	129.99	129.5	129.70
Jet Fuel 3	99.3	99.33	74.6	74.58	79.2	79.21	84.9	85.38	86.0	86.01
Liquefied Petroleum Gas	103.5	103.47	77.8	77.75	80.4	80.58	83.2	83.41	84.0	83.98
Motor Gasoline 4	152.6	152.55	136.3	136.72	139.6	139.63	139.8	139.76	139.7	139.71
Residual Fuel	61.5	61.50	51.8	51.84	53.1	53.06	54.5	54.44	56.1	55.93
Residual Fuel(00 $/bbl)	25.84	25.83	21.77	21.77	22.29	22.28	22.89	22.86	23.57	23.49
Average	**130.5**	130.49	**113.5**	113.70	**118.9**	118.92	**120.4**	120.58	**120.5**	120.67

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes cogenerators.

2 Diesel fuel containing 500 part per million (ppm) or 15 ppm sulfur. 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, State and local taxes.

5 I ncludes all electric power generators except cogenerators, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators.

6 Weighted averages of end-use fuel prices are derived from the prices in each sector and the corresponding sectoral consumption.

Note: Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 prices for gasoline, distillate, and jet fuel are based on prices in the Energy Information Administration (EIA), Petroleum Marketing Annual 1999, http://www.eia.doe.gov/pub/ oil_gas/petroleum/data_publications/petroleum_marketing_annual/pma_historical.html (August 2000). 2000 prices for gasoline, distillate, and jet fuel are based on prices in the preliminary Petroleum Marketing Annual 2000, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/ petroleum_marketing_annual/current/pdf/pmaall.pdf. 1999 and 2000 prices for all other petroleum products are derived from EIA, State Energy Price and Expenditure Report 1997, DOE/EIA-0376(97) (Washington, DC, July 2000). Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A13. Natural Gas Supply and Disposition

(Trillion Cubic Feet per Year)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Production										
Dry Gas Production 1	19.08	19.08	20.74	20.73	23.49	23.34	26.35	25.22	28.47	26.65
Supplemental Natural Gas 2	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Net Imports	**3.52**	3.52	**4.50**	4.50	**4.89**	4.85	**5.25**	4.90	**5.50**	4.88
Canada	3.46	3.46	4.09	4.09	4.51	4.47	4.90	4.55	5.05	4.43
Mexico	-0.09	-0.09	-0.22	-0.22	-0.45	-0.45	-0.47	-0.47	-0.38	-0.38
Liquefied Natural Gas	0.16	0.16	0.64	0.64	0.83	0.83	0.83	0.83	0.83	0.83
Total Supply	**22.69**	22.69	**25.35**	25.35	**28.50**	28.30	**31.71**	30.24	**34.08**	31.64
Consumption by Sector										
Residential	5.00	5.00	5.38	5.37	5.53	5.53	5.73	5.73	5.99	5.98
Commercial	3.27	3.27	3.67	3.67	3.93	3.93	4.21	4.21	4.52	4.52
Industrial 3	8.41	8.41	8.90	8.89	9.39	9.39	9.81	9.79	10.05	10.06
Electric Generators 4	4.24	4.24	5.47	5.48	6.86	6.68	8.91	7.55	10.27	7.98
Transportation 5	0.02	0.02	0.06	0.06	0.09	0.09	0.12	0.12	0.14	0.14
Pipeline Fuel	0.77	0.77	0.78	0.77	0.84	0.83	0.93	0.88	0.99	0.93
Lease and Plant Fuel 6	1.12	1.12	1.25	1.25	1.50	1.49	1.67	1.61	1.80	1.71
Gas to Liquids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**22.83**	22.83	**25.51**	25.50	**28.14**	27.94	**31.37**	29.89	**33.76**	31.32
Discrepancy 7	**-0.14**	-0.14	**-0.16**	-0.15	**0.36**	0.36	**0.34**	0.35	**0.32**	0.32

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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. Includes small power producers and exempt wholesale generators.

5 Compressed natural gas used as vehicle fuel.

6 Represents natural gas used in the field gathering and processing plant machinery.

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, 1999 and 2000 values include net storage injections.

Btu = British thermal unit.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 supply values and consumption as lease, plant, and pipeline fuel: Energy Information Administration (EIA), Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). Other 1999 consumption derived from: EIA, State Energy Data Report 1999, DOE/EIA-0214(99) (Washington, DC, May 2001). 2000 supplemental natural gas: EIA, Natural Gas Monthly, DOE/EIA-0130(2001/06) (Washington, DC, June 2001). 1999 imports and dry gas production derived from: EIA, Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). 2000 transportation sector consumption: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B. Other 2000 consumption: EIA, Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/forecasting/steo/oldsteos/oct01.pdf with adjustments to end-use sector consumption levels for consumption of natural gas by electric wholesale generators based on EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A14. Natural Gas Prices, Margins and Revenues

(2000 dollars per Thousand Cubic Feet, Unless Otherwise Noted)

Prices, Margins and Revenues	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Source Price										
Average Lower 48 Well Price 1	3.60	3.60	2.66	2.66	2.86	2.82	3.06	2.89	3.25	2.97
Average Import Price	3.94	3.94	2.68	2.68	2.92	2.90	3.13	3.02	3.39	3.20
Average 2	**3.66**	3.66	**2.67**	2.67	**2.87**	2.83	**3.07**	2.91	**3.27**	3.00
Delivered Prices										
Residential	7.85	7.85	7.04	7.04	6.92	6.88	7.02	6.85	7.15	6.88
Commercial	6.40	6.40	5.74	5.74	5.66	5.63	5.82	5.65	6.01	5.74
Industrial	4.43	4.43	3.39	3.39	3.57	3.53	3.78	3.61	4.00	3.71
Electric Generators 4	4.49	4.49	3.26	3.25	3.45	3.39	3.71	3.47	3.93	3.56
Transportation 5	8.26	8.26	6.83	6.83	7.08	7.04	7.32	7.13	7.47	7.19
Average 6	**5.58**	5.58	**4.57**	4.57	**4.59**	4.56	**4.73**	4.58	**4.91**	4.67
Transmission & Distribution Margins 7										
Residential	4.19	4.19	4.37	4.37	4.05	4.05	3.95	3.94	3.88	3.88
Commercial	2.74	2.74	3.08	3.07	2.80	2.79	2.75	2.74	2.74	2.73
Industrial 3	0.78	0.78	0.72	0.72	0.70	0.70	0.71	0.70	0.73	0.70
Electric Generators 4	0.84	0.83	0.59	0.59	0.58	0.56	0.64	0.56	0.66	0.56
Transportation 5	4.61	4.61	4.16	4.16	4.22	4.21	4.24	4.22	4.20	4.18
Average 6	**1.92**	1.92	**1.91**	1.91	**1.73**	1.72	**1.66**	1.67	**1.63**	1.67
Transmission & Distribution Revenue (billion 2000 dollars)										
Residential	20.96	20.96	23.50	23.50	22.40	22.38	22.63	22.58	23.23	23.21
Commercial	8.98	8.98	11.29	11.29	11.00	10.98	11.59	11.53	12.37	12.33
Industrial 3	6.55	6.55	6.42	6.42	6.62	6.59	6.97	6.81	7.31	7.05
Electric Generators 4	3.54	3.53	3.22	3.21	3.98	3.71	5.71	4.22	6.76	4.47
Transportation 5	0.10	0.10	0.23	0.23	0.37	0.37	0.50	0.50	0.58	0.58
Total	**40.13**	40.12	**44.67**	44.65	**44.37**	44.03	**47.41**	45.64	**50.24**	47.65

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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. Includes small power producers and exempt wholesale generators.

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. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 residential, commercial, and transportation delivered prices; average lower 48 wellhead price; and average import price: Energy Information Administration (EIA), Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). 1999 electric generators delivered price: Form FERC-423, "Monthly Report of Cost and Quality of Fuels for Electric Plants." 1999 and 2000 industrial delivered prices based on EIA, Manufacturing Energy Consumption Survey 1994. 2000 residential and commercial delivered prices, average lower 48 wellhead price, and average import price: EIA, Natural Gas Monthly, DOE/EIA-0130(2001/06) (Washington, DC, June 2001). Other 1999 values, other 2000 values, and projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A15. Oil and Gas Supply

Production & Supply	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Crude Oil										
Lower 48 Average Wellhead Price 1										
(2000$ per barrel)	**27.59**	27.59	**22.27**	22.29	**22.70**	22.70	**23.16**	23.15	23.81	23.77
Production (million barrels/day) 2										
US Total	**5.82**	5.82	**5.38**	5.38	**5.08**	5.08	**5.56**	5.55	5.63	5.60
Lower 48 Onshore	3.25	3.25	2.90	2.90	2.64	2.64	2.64	2.64	2.70	2.67
Conventional	2.60	2.60	2.24	2.24	1.91	1.91	1.82	1.81	1.87	1.85
Enhanced Oil Recovery	0.65	0.65	0.65	0.65	0.73	0.73	0.82	0.83	0.83	0.83
Lower 48 Offshore	1.61	1.61	1.68	1.68	1.74	1.74	2.01	2.01	1.83	1.82
Alaska	0.97	0.97	0.80	0.80	0.70	0.70	0.90	0.90	1.10	1.10
Lower 48 End of Year Reserves 2										
(billion barrels)	**18.29**	18.29	**15.43**	15.43	**14.23**	14.22	**14.63**	14.62	14.44	14.32
Natural Gas										
Lower 48 Aver Wellhead Price 1										
(2000$ / thousand cubic feet)	3.60	3.60	2.66	2.66	2.86	2.82	3.06	2.89	3.25	2.97
Dry Production (trillion cubic feet) 3										
US Total	**19.08**	19.08	**20.74**	20.73	**23.49**	23.34	**26.35**	25.22	28.47	26.65
Lower 48 Onshore	13.31	13.31	14.37	14.36	16.46	16.33	19.39	18.44	21.13	19.67
Associated-Dissolved 4	1.79	1.79	1.63	1.63	1.43	1.43	1.37	1.37	1.36	1.36
Non-Associated	11.52	11.52	12.73	12.73	15.03	14.90	18.02	17.07	19.76	18.31
Conventional	6.89	6.89	6.93	6.92	7.89	7.83	9.93	9.37	10.78	10.04
Unconventional	4.63	4.63	5.81	5.80	7.14	7.07	8.09	7.70	8.98	8.28
Lower 48 Offshore	5.34	5.34	5.87	5.87	6.50	6.47	6.39	6.21	6.74	6.37
Associated-Dissolved 4	1.16	1.16	1.19	1.19	1.22	1.22	1.27	1.27	1.25	1.25
Non-Associated	4.18	4.18	4.68	4.68	5.28	5.25	5.12	4.94	5.49	5.13
Alaska	0.43	0.43	0.50	0.50	0.53	0.53	0.57	0.57	0.60	0.60
Lower 48 End of Year Dry Reserves 3										
(trillion cubic feet)	**162.31**	162.31	**167.15**	167.15	**174.10**	174.11	**181.39**	183.79	187.64	194.25
Supplemental Gas Supplies (tcf) 5	**0.10**	0.10	**0.11**	0.11	**0.11**	0.11	**0.11**	0.11	0.11	0.11
Total Lower 48 Wells (thousands)	**24.05**	24.05	**23.38**	23.38	**24.37**	24.15	**25.62**	24.80	32.96	30.48

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Represents lower 48 onshore and offshore supplies.

2 Includes lease condensate.

3 Marketed production (wet) minus extraction losses.

4 Gas which occurs in crude oil reserves either as free gas (associated) or as gas in solution with crude oil (dissolved).

5 Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 lower 48 onshore, lower 48 offshore, Alaska crude oil production: Energy Information Administration (EIA), Petroleum Supply Annual 1999, DOE/EIA-0340(99/1) (Washington, DC, June 2000). 1999 U.S. crude oil and natural gas reserves: EIA, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, DOE/EIA-0216(99) (Washington, DC, December 2000). 1999 natural gas lower 48 average wellhead price and total natural gas production: EIA, Natural Gas Annual 1999, DOE/EIA-0131(99) (Washington, DC, October 2000). 2000 lower 48 onshore, lower 48 offshore, and Alaska crude oil production: EIA, Petroleum Supply Annual 2000, DOE/EIA-0340(2000/1) (Washington, DC, June 2001). 2000 natural gas lower 48 average wellhead price, Alaska and total natural gas production, and supplemental gas supplies: EIA, Natural Gas Monthly, DOE/EIA-0130(2001/06) (Washington, DC, June 2001). Other 1999 and 2000 values: EIA, Office of Integrated Analysis and Forecasting. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B. HIFOSS02

Table A16. Coal Supply, Disposition and Prices

(Million Short Tons per Year, Unless Otherwise Noted)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Production 1										
Appalachia	430	430	430	428	427	423	414	426	405	417
Interior	144	144	157	154	147	153	143	144	136	154
West	510	510	620	628	714	711	771	803	854	873
East of the Mississippi	518	518	533	527	529	526	518	530	507	532
West of the Mississippi	566	566	674	683	758	762	810	843	889	912
Total	**1084**	**1084**	**1208**	**1210**	**1287**	**1288**	**1328**	1372	**1396**	1444
Net Imports										
Imports	**13**	13	**18**	18	**19**	19	**19**	19	**20**	20
Exports	58.5	58	56.1	56	56.8	57	54.9	53	54.3	55
Total	**-46.0**	-46	**-38.0**	-38	**-38.2**	-38	**-35.7**	-34	**-34.5**	-35
Total Supply 2	**1038.2**	**1038**	**1169.6**	**1172**	**1248.6**	**1250**	**1292.7**	1339	**1361.3**	1409
Consumption by Sector										
Residential and Commercial	4.9	5	5.1	5	5.5	5	5.6	6	5.7	6
Industrial 3	82.2	82	79.3	80	80.6	81	82.8	83	85.8	86
Coke Plants	29.3	29	25.8	26	24.1	24	21.9	22	20.0	20
Electric Generators 4	964.6	964	1061.9	1064	1140.8	1142	1185.2	1231	1252.8	1300
Total	**1081.0**	**1081**	**1172.1**	**1174**	**1251.0**	**1252**	**1295.6**	1341	**1364.4**	1412
Discrepancy and Stock Change 5										
	-42.8	**-42**	**-2.5**	**-2**	**-2.4**	-3	**-2.9**	-3	**-3.1**	-3
Average Minemouth Price										
(2000 dollars per short ton)	16.45	16	15.11	15	13.93	14	13.40	13	12.78	13
(2000$ per million Btu)	0.79	1	0.73	1	0.68	1	0.66	1	0.64	1
Delivered Prices (2000$/short ton) 6										
Industrial	31.86	32	29.23	29	27.99	28	27.21	27	26.17	26
Coke Plants	44.41	44	42.94	43	41.87	42	40.71	41	39.23	39
Electric Generators										
(2000 dollars / short ton)	24.42	24	22.75	23	21.02	21	20.21	20	19.08	19
(2000 dollars /million Btu)	1.21	1	1.13	1	1.05	1	1.02	1	0.97	1
Average	**25.48**	**25**	**23.64**	**24**	**21.88**	**22**	**21.01**	**21**	**19.82**	**20**
Exports 7	34.90	35	36.48	36	35.62	36	34.84	35	33.76	34

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes anthracite, bituminous coal, lignite, and waste coal delivered to independent power producers. Waste coal deliveries totaled 8.5 million tons in 1995, 8.8 million tons in 1996, 8.1 million tons in 1997, 8.6 million tons in 1998, and are projected to reach 9.6 million tons in 1999, and 12.2 million tons in 2000.

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. Includes small power producers and exempt wholesale generators.

5 Balancing item: the sum of production, net imports, and net storage withdrawals 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.

N/A = Not applicable.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999: Energy Information Administration (EIA), Coal Industry Annual 1999, DOE/EIA-0584(99) (Washington, DC, June 2001). 2000 data based on EIA, Quarterly Coal Report, DOE/EIA-0121(2000/4Q) (Washington, DC, October-December 2000) and EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A17. Renewable Energy Generating Capability and Generation

(Gigawatts, Unless Otherwise Noted)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Electicity Generators (excluding cogenerators) 1										
Net Summer Capability										
Conventional Hydropower	79.29	79.29	79.78	79.78	79.90	79.90	79.90	79.90	79.90	79.90
Geothermal 2	2.85	2.85	3.05	3.05	3.56	3.58	4.51	4.22	5.30	4.48
Municipal Solid Waste 3	2.84	2.84	3.50	3.50	3.91	3.73	4.19	3.95	4.30	4.07
Wood and Other Biomass 4	1.39	1.39	1.61	1.61	1.73	1.73	1.82	1.78	2.02	1.79
Solar Thermal	0.33	0.33	0.34	0.34	0.36	0.36	0.39	0.39	0.41	0.41
Solar Photovoltaic 5	0.01	0.01	0.05	0.05	0.11	0.11	0.19	0.19	0.27	0.27
Wind	2.42	2.42	6.82	6.82	7.65	7.65	8.42	8.21	8.97	8.23
Total	**89.13**	**89.13**	**95.16**	**95.16**	**97.21**	**97.05**	**99.41**	**98.62**	**101.18**	99.15
Generation (billion kwh)										
Conventional Hydropower	272.33	272.33	301.26	301.26	301.14	301.14	300.55	300.54	300.00	300.00
Geothermal	13.52	13.52	15.67	15.67	20.09	20.25	27.96	25.53	34.60	27.80
Municipal Solid Waste 3	20.15	20.15	24.90	24.90	28.00	26.64	30.05	28.18	30.98	29.11
Wood and Other Biomass 4	8.37	8.37	17.46	15.10	20.23	20.24	18.00	17.90	18.37	14.22
Dedicated Plants	7.46	7.46	8.94	8.93	9.72	9.72	10.27	10.02	11.65	10.10
Cofiring	0.91	0.91	8.51	6.18	10.51	10.52	7.73	7.87	6.72	4.12
Solar Thermal	0.87	0.87	0.90	0.90	0.96	0.96	1.05	1.05	1.12	1.12
Solar Photovoltaic	0.01	0.01	0.11	0.11	0.26	0.26	0.46	0.46	0.68	0.68
Wind	5.30	5.30	16.74	16.74	19.45	19.45	21.81	21.09	23.75	21.22
Total	**320.5**	**320.5**	**377.0**	**374.7**	**390.1**	**388.9**	**399.9**	394.8	**409.5**	394.1
Cogenerators 6										
Net Summer Capability										
Municipal Solid Waste	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Biomass	5.26	5.26	5.92	5.92	6.64	6.64	7.62	7.62	8.42	8.43
Total	**5.77**	**5.77**	**6.43**	**6.43**	**7.15**	**7.15**	**8.13**	**8.13**	**8.93**	**8.94**
Generation (billion kwh)										
Municipal Solid Waste	3.29	3.29	3.29	3.29	3.29	3.29	3.29	3.29	3.29	3.29
Biomass	29.63	29.63	33.75	33.72	38.07	38.04	44.04	44.04	48.96	48.99
Total	**32.93**	**32.93**	**37.04**	**37.02**	**41.36**	**41.34**	**47.33**	**47.33**	**52.25**	**52.28**

Table A17. Renewable Energy Generating Capability and Generation

(Gigawatts, Unless Otherwise Noted)

Supply and Disposition	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Other End-Use Generators 7										
Conventional Hydropower 8	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Geothermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solar Photovoltaic 5	0.02	0.02	0.11	0.11	0.39	0.39	0.42	0.42	0.46	0.46
Total	**0.99**	**0.99**	**1.09**	**1.09**	**1.36**	**1.36**	**1.40**	**1.40**	**1.44**	**1.44**
Generation (billion kwh)										
Conventional Hydropower 8	3.98	3.98	4.33	4.33	4.32	4.32	4.32	4.32	4.31	4.31
Geothermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solar Photovoltaic	0.04	0.04	0.23	0.23	0.81	0.81	0.89	0.89	0.98	0.98
Total	**4.02**	**4.02**	**4.56**	**4.56**	**5.14**	**5.14**	**5.21**	**5.21**	**5.29**	**5.29**

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes grid-connected utilities and nonutilities other than cogenerators. These nonutility facilities include small power producers and exempt wholesale generators.

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

3 Includes landfill gas.

4 Includes projections for energy crops after 2010.

5 Does not include off-grid photovoltaics (PV). EIA estimates that another 76 megawatts of remote electricity generation PV applications were in service in 1999, plus an additional 205 megawatts in communications, transportation, and assorted other non-grid-connected applications.

6 Cogenerators produce electricity and other useful thermal energy.

7 Includes small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

8 Represents own-use industrial hydroelectric power.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports. Net summer capability has been estimated for nonutility generators for AEO2002. Net summer capability is used to be consistent with electric utility capacity estimates. Additional retirements are determined on the basis of the size and age of the units.

Sources: 1999 and 2000 electric utility capability: Energy Information Administration (EIA), Form EIA-860A: "Annual Electric Generator Report - Utility." 1999 and 2000 nonutility and cogenerator capability: EIA, Form EIA-860B: "Annual Electric Generator Report - Nonutility." 1999 and 2000 generation: EIA, Annual Energy Review 2000, DOE/EIA-0384(2000) (Washington, DC, August 2001). Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A18. Renewable Energy Consumption by Sector and Source 1

(Quadrillion Btu per year)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Marketed Renewable Energy 2										
Residential	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45
Wood	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45
Commercial	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Biomass	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Industrial 3	2.41	2.41	2.66	2.66	2.89	2.89	3.18	3.18	3.43	3.43
Conventional Hydroelectric	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Municipal Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Biomass	2.21	2.21	2.46	2.46	2.69	2.69	2.98	2.98	3.23	3.23
Transportation	0.14	0.14	0.22	0.22	0.24	0.24	0.26	0.26	0.28	0.28
Ethanol used in E85 4	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04
Ethanol used in GasBlending	0.14	0.14	0.20	0.20	0.21	0.21	0.23	0.23	0.24	0.24
Electric Generators 5	3.55	3.55	4.21	4.18	4.45	4.43	4.72	4.61	4.96	4.66
Conventional Hydroelectric	2.82	2.82	3.12	3.12	3.11	3.11	3.11	3.11	3.10	3.10
Geothermal	0.28	0.28	0.36	0.36	0.50	0.50	0.75	0.67	0.96	0.75
Municipal Solid Waste 6	0.28	0.28	0.34	0.34	0.38	0.36	0.41	0.38	0.42	0.39
Biomass	0.11	0.11	0.21	0.19	0.24	0.24	0.22	0.22	0.22	0.18
Dedicated Plants	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.12	0.14	0.13
Cofiring	0.01	0.01	0.10	0.08	0.13	0.13	0.09	0.10	0.08	0.05
Solar Thermal	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wind	0.05	0.05	0.17	0.17	0.20	0.20	0.22	0.22	0.24	0.22
Total Marketed Renew Energy	6.60	6.60	7.60	7.57	8.09	8.08	8.68	8.58	9.20	8.90

Table A18. Renewable Energy Consumption by Sector and Source 1

(Quadrillion Btu per year)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Sources of Ethanol										
From Corn	0.14	0.14	0.21	0.21	0.22	0.22	0.23	0.23	0.22	0.22
From Cellulose	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.06	0.06
Total	0.14	0.14	0.22	0.22	0.24	0.24	0.26	0.26	0.28	0.28
Non-Marketed Renewable Energy -- Selected Consumption 7										
Residential	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08
Solar Hot Water Heating	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Geothermal Heat Pumps	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Solar Thermal	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Solar Photovoltaic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

If HFET data are more than 1% different than Reference data they're shown underlined and red.

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

4 Excludes motor gasoline component of E85.

5 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.

6 Includes landfill gas.

7 Includes selected renewable energy consumption data for which the energy is not bought or sold, either directly or indirectly as an input to marketed energy. The Energy Information Administration does not estimate or project total consumption of nonmarketed renewable energy.

N/A = Not applicable.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000 ethanol: Energy Information Administration (EIA), Annual Energy Review 2000, DOE/EIA-0384(2000) (Washington, DC, August 2001). 1999 and 2000 electric generators: EIA, Form EIA-860A: "Annual Electric Generator Report - Utility" and Form EIA-860B: "Annual Electric Generator Report - Nonutility." Other 1999 and 2000: EIA, Office of Integrated Analysis and Forecasting. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A19. Carbon Dioxide Emissions by Sector and Source

(Million Metric Tons Carbon Equivalent, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Residential										
Petroleum	27.51	27.51	25.88	25.88	24.57	24.57	23.32	23.31	22.57	22.57
Natural Gas	73.16	73.16	79.57	79.56	81.85	81.84	84.83	84.80	88.63	88.58
Coal	1.20	1.20	1.20	1.20	1.34	1.34	1.30	1.30	1.27	1.27
Electricity	203.94	203.99	226.70	226.82	237.99	237.00	252.04	252.77	268.42	264.58
Total	305.81	305.86	333.35	333.46	345.75	344.75	361.50	362.19	380.88	376.99
Commercial										
Petroleum	14.17	14.17	13.21	13.21	13.59	13.59	13.80	13.78	13.98	13.97
Natural Gas	49.32	49.32	54.36	54.35	58.19	58.18	62.33	62.29	66.88	66.84
Coal	1.80	1.80	1.69	1.69	1.78	1.78	1.88	1.88	1.99	1.99
Electricity	195.53	195.57	218.77	218.85	243.37	242.26	267.06	267.70	288.74	284.52
Total	260.82	260.86	288.03	288.11	316.94	315.81	345.08	345.66	371.59	367.32
Industrial 1										
Petroleum	93.88	93.81	98.52	98.54	107.31	107.20	112.77	112.92	117.72	117.71
Natural Gas 2	136.15	136.11	147.74	147.62	158.53	158.38	166.97	166.00	172.41	171.07
Coal	65.12	65.10	62.87	63.04	63.19	63.29	63.60	63.74	64.47	64.67
Electricity	183.01	183.05	186.29	186.35	203.17	202.03	215.61	216.15	227.09	223.98
Total	478.16	478.07	495.42	495.56	532.19	530.90	558.94	558.81	581.69	577.43
Transportation										
Petroleum 3	502.50	502.50	560.49	560.31	622.15	621.79	680.50	680.33	730.60	730.70
Natural Gas 4	11.42	11.42	12.28	12.28	13.71	13.62	15.48	14.80	16.70	15.76
Other 5	0.00	0.00	0.07	0.06	0.09	0.09	0.09	0.09	0.10	0.10
Electricity	2.99	2.99	3.42	3.42	3.84	3.83	4.38	4.39	5.14	5.06
Total 3	516.91	516.91	576.25	576.07	639.80	639.32	700.45	699.62	752.54	751.63
Total Carbon Dioxide Emissions by Delivered Fuel										
Petroleum 3	638.1	638.0	698.1	697.9	767.6	767.1	830.4	830.3	884.9	885.0
Natural Gas	270.0	270.0	294.0	293.8	312.3	312.0	329.6	327.9	344.6	342.2
Coal	68.1	68.1	65.8	65.9	66.3	66.4	66.8	66.9	67.7	67.9
Other 5	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Electricity	585.5	585.6	635.2	635.4	688.4	685.1	739.1	741.0	789.4	778.1
Total 3	1561.7	1561.7	1693.1	1693.2	1834.7	1830.8	1966.0	1966.3	2086.7	2073.4
Electric Generators 6										
Petroleum	19.69	19.76	6.73	6.81	4.12	4.04	4.97	3.76	5.61	3.15
Natural Gas	61.13	61.17	80.33	80.39	100.65	97.99	130.72	110.81	150.67	117.14
Coal	504.65	504.67	548.11	548.24	583.59	583.08	603.41	626.44	633.10	657.85
Total	585.46	585.60	635.18	635.44	688.37	685.12	739.10	741.02	789.38	778.14

Table A19. Carbon Dioxide Emissions by Sector and Source

(Million Metric Tons Carbon Equivalent, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Total Carbon Dioxide Emissions by Primary Fuel 7										
Petroleum 3	657.8	657.8	704.8	704.8	771.7	771.2	835.4	834.1	890.5	888.1
Natural Gas	331.2	331.2	374.3	374.2	412.9	410.0	460.3	438.7	495.3	459.4
Coal	572.8	572.8	613.9	614.2	649.9	649.5	670.2	693.4	700.8	725.8
Other 5	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total 3	1561.7	1561.7	1693.1	1693.2	1834.7	1830.8	1966.0	1966.3	2086.7	2073.4
Carbon Dioxide Emissions (tons carbon equivalent per person)	5.7	5.7	5.9	5.9	6.1	6.1	6.3	6.3	6.4	6.4

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Includes consumption by cogenerators.

2 Includes lease and plant fuel.

3 This includes international bunker fuel, which by convention are excluded from the international accounting of carbon dioxide emissions. In the years from 1990 through 1998, international bunker fuels accounted for 25 to 30 million metric tons carbon equivalent of carbon dioxide annually.

4 Includes pipeline fuel natural gas and compressed natural gas used as vehicle fuel.

5 Includes methanol and liquid hydrogen.

6 Includes all electric power generators except cogenerators, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators. Does not include emissions from the nonbiogenic component of municipal solid waste because under international guidelines these are accounted for as waste, not energy.

7 Emissions from electric power generators are distributed to the primary fuels.

N/A = Not applicable

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000 emissions and emission factors: Energy Information Administration (EIA), Emissions of Greenhouse Gases in the United States 2000, DOE/EIA-0573(2000) (Washington, DC, November 2001). Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A20. Macroeconomic Indicators

(Billion 1996 Chain-Weighted Dollars, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
GDP Chain-Type Price Index (1996=1000)	1.07	1.07	1.21	1.21	1.37	1.37	1.56	1.56	1.83	1.83
Real Gross Domestic Product	9224	9224	10423	10418	12318	12312	14398	14399	16521	16525
Real Consumption	6258	6258	7151	7148	8262	8256	9547	9545	10993	10991
Real Investment	1773	1773	1924	1923	2519	2518	3252	3252	3953	3953
Real Government Spending	1573	1573	1754	1754	1892	1892	2016	2016	2149	2149
Real Exports	1133	1133	1346	1346	1968	1968	2836	2840	4023	4032
Real Imports	1532	1532	1779	1778	2265	2263	3092	3090	4372	4369
Real Disposable Personal Income	6539	6539	7596	7593	8749	8742	10207	10202	11697	11698
AA Utility Bond Rate (percent)	7.91	7.91	7.00	7.01	7.37	7.37	7.66	7.66	8.04	8.07
Real Yield on Government 10 Year Bonds (percent)	4.84	4.84	3.89	3.88	4.54	4.54	4.98	4.99	5.33	5.34
Real Utility Bond Rate (percent)	6.27	6.27	4.29	4.28	4.93	4.94	4.95	4.95	4.63	4.64
Energy Intensity (thousand Btu/96 dollar of GDP)										
Delivered Energy	8.04	8.04	7.72	7.72	7.08	7.08	6.51	6.50	6.02	6.01
Total Energy	10.77	10.77	10.33	10.34	9.39	9.37	8.60	8.52	7.92	7.78
Consumer Price Ind(1982-4=100)	1.72	1.72	1.98	1.98	2.27	2.27	2.64	2.64	3.14	3.15
Unemployment Rate (percent)	4.01	4.01	5.19	5.21	4.46	4.49	4.58	4.56	4.07	4.04
Housing Starts(millions)	1.82	1.82	1.84	1.84	1.93	1.93	1.89	1.90	2.01	2.01
Single-Family	1.23	1.23	1.29	1.29	1.33	1.33	1.32	1.32	1.36	1.36
Multifamily	0.34	0.34	0.28	0.27	0.29	0.29	0.30	0.30	0.36	0.36
Mobile Home Shipments	0.25	0.25	0.27	0.27	0.30	0.30	0.27	0.27	0.28	0.28
Commercial Floorspace, Total (billion square feet)	64.50	64.50	71.68	71.67	77.57	77.55	83.79	83.75	89.58	89.56
Gross Output(billion 92 dollars)										
Total Industrial	5061.7	5061.6	5680.0	5676.8	6588.7	6584.5	7531.8	7535.0	8438.6	8447.4
Non-Manufacturing	1039.3	1039.2	1127.6	1126.9	1212.2	1211.0	1325.4	1324.7	1444.9	1444.4
Manufacturing	4022.4	4022.4	4552.4	4549.8	5376.4	5373.5	6206.4	6210.3	6993.7	7003.0
Energy Intensive	1100.2	1100.2	1178.3	1177.9	1251.9	1251.2	1340.1	1340.3	1409.6	1410.2
Non-Intensive	2922.2	2922.2	3374.0	3371.9	4124.5	4122.2	4866.3	4870.0	5584.1	5592.8

Table A20. Macroeconomic Indicators

(Billion 1996 Chain-Weighted Dollars, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Unit Sales Light-Duty Veh (mill)	17.36	17.36	16.64	16.62	17.37	17.34	17.81	17.81	18.25	18.24
Millions of People										
Pop w/Armed Forces Overseas	275.69	275.69	288.09	288.09	300.24	300.24	312.66	312.66	325.33	325.33
Population (aged 16 and over)	213.13	213.13	224.79	224.79	236.58	236.58	246.72	246.72	256.50	256.50
Employment, Non-Agriculture	130.12	130.12	136.99	136.93	145.27	145.18	150.24	150.25	154.49	154.53
Employment, Manufacturing	17.54	17.54	16.49	16.48	16.28	16.27	15.53	15.54	15.26	15.27
Labor Force	140.87	140.87	149.22	149.21	156.91	156.90	161.39	161.39	165.29	165.31

If HFET data are more than 1% different than Reference data they're shown underlined and red.
GDP = Gross domestic product.
Btu = British thermal unit.
N/A = Not applicable.
Sources: 1999 and 2000: DRI-WEFA, Simulation CTL0901. Projections: Energy Information Administration, AEO2002 National Energy Modeling System run AEO2002.D102001B, HIFOSS02

Table A21. International Petroleum Supply and Disposition Summary

(Million Barrels per Day, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
World Oil Price (2000 $ / bbl) 1	27.72	27.72	22.73	22.73	23.36	23.36	24.00	24.00	24.68	24.68
Production 2										
OECD										
US (50 states)	9.03	9.03	8.72	8.72	8.87	8.87	9.71	9.71	9.95	9.95
Canada	2.74	2.74	3.01	3.01	3.20	3.20	3.37	3.37	3.55	3.55
Mexico	3.54	3.54	4.08	4.08	4.24	4.24	4.39	4.39	4.44	4.44
OECD Europe 3	7.06	7.06	7.33	7.33	7.20	7.20	6.92	6.92	6.65	6.65
Other OECD	0.98	0.98	0.93	0.93	0.92	0.92	0.90	0.90	0.88	0.88
Total OECD	23.35	23.35	24.08	24.08	24.43	24.43	25.29	25.29	25.46	25.46
Developing Countries										
Other South & Central Americ	3.78	3.78	4.19	4.19	4.82	4.82	5.58	5.58	6.48	6.48
Pacific Rim	2.31	2.31	2.62	2.62	2.63	2.63	2.59	2.59	2.55	2.55
OPEC	30.93	30.93	35.15	35.15	40.79	40.78	48.33	48.32	57.45	57.46
Other Developing Countries	4.96	4.96	5.38	5.38	6.25	6.25	7.23	7.23	8.38	8.38
Total Developing Countries	41.98	41.98	47.34	47.35	54.49	54.48	63.73	63.73	74.85	74.86
Eurasia										
Former Soviet Union	7.83	7.83	9.67	9.67	12.02	12.02	13.72	13.72	14.89	14.89
Eastern Europe	0.24	0.24	0.28	0.28	0.30	0.30	0.33	0.33	0.36	0.36
China	3.26	3.26	3.09	3.09	3.07	3.07	3.05	3.05	3.02	3.02
Total Eurasia	11.33	11.33	13.04	13.04	15.39	15.39	17.10	17.10	18.26	18.26
Total Production	76.66	76.66	84.46	84.46	94.32	94.31	106.12	106.12	118.58	118.59
Consumption										
OECD										
US (50 states)	19.74	19.74	21.28	21.27	23.22	23.21	25.06	25.04	26.65	26.60
US Territories	0.35	0.35	0.40	0.40	0.43	0.43	0.45	0.45	0.48	0.48
Canada	1.96	1.96	2.02	2.02	2.09	2.09	2.12	2.12	2.14	2.14
Mexico	2.03	2.03	2.33	2.33	2.75	2.75	3.33	3.33	4.11	4.11
Japan	5.54	5.54	5.66	5.66	5.62	5.62	5.64	5.64	5.62	5.62
Australia and New Zealand	1.00	1.00	1.02	1.02	1.09	1.09	1.18	1.18	1.28	1.28
OECD Europe	14.53	14.53	15.46	15.46	15.80	15.80	16.12	16.12	16.44	16.44
Total OECD	45.16	45.16	48.17	48.16	50.99	50.98	53.90	53.88	56.71	56.67

Table A21. International Petroleum Supply and Disposition Summary

(Million Barrels per Day, Unless Otherwise Noted)

Sector and Source	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Developing Countries										
Other South & Central Americ	4.29	4.29	4.82	4.82	5.86	5.86	7.11	7.11	8.62	8.62
Pacific Rim	8.20	8.20	10.23	10.23	12.20	12.20	14.46	14.46	16.76	16.76
OPEC	5.81	5.81	6.55	6.55	7.55	7.55	8.72	8.72	10.08	10.08
Other Developing Countries	2.85	2.85	3.33	3.33	4.20	4.20	5.41	5.41	7.12	7.12
Total Developing Countries	21.15	21.15	24.93	24.93	29.81	29.81	35.70	35.70	42.58	42.58
Eurasia										
Former Soviet Union	3.66	3.66	4.87	4.87	5.56	5.56	6.79	6.79	7.69	7.69
Eastern Europe	1.54	1.54	1.56	1.56	1.63	1.63	1.68	1.68	1.69	1.69
China	4.53	4.53	5.22	5.22	6.62	6.62	8.35	8.35	10.18	10.18
Total Eurasia	9.73	9.73	11.66	11.66	13.81	13.81	16.82	16.82	19.57	19.57
Total Consumption	75.99	75.99	84.76	84.76	94.62	94.61	106.42	106.42	118.88	118.89
Non-OPEC Production	45.73	45.73	49.31	49.30	53.52	53.52	57.79	57.80	61.12	61.12
Net Eurasia Exports	1.61	1.61	1.38	1.38	1.59	1.59	0.28	0.28	-1.30	-1.30
OPEC Market Share	0.40	0.40	0.42	0.42	0.43	0.43	0.46	0.46	0.48	0.48

If HFET data are more than 1% different than Reference data they're shown underlined and red.

1 Average refiner acquisition cost of imported crude oil.

2 Includes production of crude oil (including lease condensates), natural gas plant liquids, other hydrogen and hydrocarbons for refinery feedstocks, alcohol, liquids produced from coal and other sources, and refinery gains.

3 OECD Europe includes the unified Germany.

OECD = Organization for Economic Cooperation and Development - Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States (including territories).

Pacific Rim = Hong Kong, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand.

OPEC = Organization of Petroleum Exporting Countries - Algeria, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

Eurasia = Albania, Bulgaria, China, Czech Republic, Hungary, Poland, Romania, Slovakia, the Former Soviet Union, and the Former Yugoslavia.

N/A = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 1999 and 2000 are model results and may differ slightly from official EIA data reports.

Sources: 1999 and 2000 data derived from: Energy Information Administration (EIA), Short-Term Energy Outlook, October 2001, http://www.eia.doe.gov/pub/forecasting/steo/oldsteos/oct01.pdf. Projections: EIA, AEO2002 National Energy Modeling System run AEO2002.D102001B.

Table A95. Coal Production by Region and Type

(Million Short Tons)

	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Northern Appalachia	149.1	149.1	165.9	160.9	166.6	168.8	160.4	171.3	164.7	178.9
Medium Sulfur (Premium)	9.5	9.5	9.9	9.7	9.3	9.3	8.3	8.6	7.4	7.8
Low Sulfur (Bituminous)	2.4	2.4	2.8	2.8	4.1	4.0	4.1	4.0	2.7	2.7
Medium Sulfur (Bituminous)	71.0	71.0	92.2	90.9	90.0	93.3	84.8	91.4	90.0	99.2
High Sulfur (Bituminous)	56.2	56.2	49.5	46.0	51.8	50.8	51.8	55.7	53.2	57.7
High Sulfur (Gob)	10.0	10.0	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Central Appalachia	259.0	259.0	247.4	250.1	243.4	238.1	238.1	238.5	225.9	223.2
Medium Sulfur (Premium)	47.4	47.4	42.2	42.4	42.4	42.4	42.7	42.3	42.7	42.7
Low Sulfur (Bituminous)	71.9	71.9	68.3	68.9	65.1	62.4	65.9	65.4	59.0	57.3
Medium Sulfur (Bituminous)	139.6	139.6	136.9	138.8	135.9	133.4	129.6	130.8	124.2	123.2
Southern Appalachia	21.8	21.8	16.8	17.0	16.8	16.5	15.6	15.7	14.5	14.9
Low Sulfur (Premium)	4.8	4.8	4.4	4.4	4.4	4.4	3.6	3.6	3.1	3.1
Low Sulfur (Bituminous)	6.9	6.9	3.1	3.2	3.8	3.5	3.8	3.7	3.3	3.3
Medium Sulfur (Bituminous)	9.2	9.2	6.4	6.5	5.7	5.7	5.3	5.5	5.2	5.5
Medium Sulfur (Lignite)	0.9	0.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Eastern Interior	88.4	88.4	103.3	98.8	101.8	102.8	103.8	104.2	101.7	114.7
Medium Sulfur (Bituminous)	27.6	27.6	28.1	28.1	24.1	25.3	25.8	25.5	24.8	27.7
High Sulfur (Bituminous)	60.8	60.8	75.1	70.7	77.7	77.5	78.0	78.6	76.9	87.0
Western Int High Sulfur (Bit)	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3
Gulf	53.2	53.2	51.9	52.8	42.5	48.3	36.9	37.1	32.5	37.2
Medium Sulfur (Lignite)	33.4	33.4	29.7	30.5	21.9	24.7	19.2	19.0	16.5	18.5
High Sulfur (Lignite)	19.8	19.8	22.3	22.3	20.6	23.7	17.8	18.1	16.0	18.7
Dakota Medium Sulfur (Lignite)	31.3	31.3	32.8	32.8	32.7	33.4	31.9	33.6	32.8	34.5
Powder/Green River	377.6	377.6	463.1	468.9	560.4	556.2	617.7	645.8	699.1	713.6
Low Sulfur (Bituminous)	1.2	1.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
Low Sulfur (Sub-Bituminous)	345.8	345.8	437.8	446.1	534.4	529.5	598.4	625.6	678.1	693.5
Medium Sulfur (Sub-Bituminous)	30.6	30.6	25.1	22.7	25.9	26.6	19.2	20.1	20.9	20.0
Rocky Mountain	56.3	56.3	82.4	84.4	78.3	79.4	81.1	83.3	82.5	85.0
Low Sulfur (Bituminous)	46.6	46.6	74.8	76.9	72.8	73.9	76.7	78.8	78.3	80.7
Low Sulfur (Sub-Bituminous)	9.6	9.6	7.5	7.5	5.5	5.5	4.4	4.5	4.2	4.3
Arizona/New Mexico	39.3	39.3	35.4	35.4	35.5	35.5	34.0	34.0	33.1	33.1
Low Sulfur (Bituminous)	19.2	19.2	16.3	16.3	16.1	16.1	15.9	15.9	15.7	15.7
Medium Sulfur (Sub-Bituminous)	20.0	20.0	19.1	19.1	19.4	19.4	18.1	18.1	17.4	17.4
Washington/Alaska										
Medium Sulfur (Sub-Bituminous)	5.9	5.9	6.5	6.5	6.6	6.6	6.7	6.7	6.8	6.8

Table A95. Coal Production by Region and Type

(Million Short Tons)

Production	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Subtotals: All Regions										
Premium Metallurgical	**61.7**	61.7	**56.5**	56.5	**56.0**	56.0	**54.6**	54.6	**53.2**	53.6
Bituminous	515.1	515.1	556.0	551.5	549.5	548.3	543.9	557.8	535.5	562.5
Sub-Bituminous	412.0	412.0	496.1	501.9	591.7	587.4	646.8	675.0	727.5	742.0
Lignite	95.4	95.4	99.1	100.0	89.6	96.1	83.2	85.1	79.7	86.1
Low Sulfur	508.5	508.5	615.1	626.2	706.3	699.3	772.8	801.6	844.5	860.7
Medium Sulfur	426.5	426.5	432.0	430.9	416.7	422.9	394.4	404.6	391.6	406.4
High Sulfur	149.2	149.2	160.6	152.7	163.8	165.7	161.2	166.2	159.8	177.1
Underground	370.9	370.9	414.9	412.3	408.5	412.1	413.3	424.8	413.7	435.8
Surface	713.3	713.3	792.7	797.6	878.3	875.8	915.1	947.6	982.2	1008.3
US Total	1084.2	1084.2	1207.7	1209.9	1286.8	1287.9	1328.4	1372.4	1395.8	1444.2

Table A117. National Impacts of the Clean Air Act Amendments (CAAA90)

	2000		2005		2010		2015		2020	
	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET	Reference	HFET
Scrubber Retrofits (gigawatts)	0.00	0.0	11.63	8.6	13.58	13.6	18.26	16.2	18.26	16.2
Interregional SO2 Allowances										
Target (millions tons)	9.48	9.5	9.48	9.5	8.95	8.9	8.95	8.9	8.95	8.9
Cumulative Banked Allowances	10.05	10.1	3.10	3.1	0.00	0.0	0.00	0.0	0.00	0.0
SO2 Allowance Price (2000 $)	203.93	191.6	196.67	190.5	239.55	193.2	266.84	248.5	213.64	182.2
SO2 Emissions (million tons)										
Total	11.05	11.05	10.39	10.39	9.70	9.70	8.95	8.95	8.95	8.95
From Coal	10.53	10.52	10.23	10.23	9.61	9.61	8.84	8.87	8.82	8.89
Oil/Other	0.52	0.53	0.16	0.16	0.09	0.09	0.11	0.08	0.13	0.06
Reg./Seas. NOX Allowance Price	0	0.0	4170	4421.3	4285	4436.6	4687	4575.3	5010	4136.4
Nat./Ann. NOX Allowance Price	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NOX Emissions	4.28	4.27	3.94	3.94	4.03	4.02	4.11	4.04	4.18	4.00
NOX Controls										
Combustion	0.00	0.0	13.22	13.4	14.30	14.5	14.69	14.9	15.12	15.0
SCR Post-combustion	0.00	0.0	93.49	91.3	94.27	91.7	94.48	92.5	94.48	92.5
NCR Post-combustion	0.00	0.0	18.09	20.6	19.62	23.1	28.40	27.5	33.83	27.8
Mercury Allowance Price	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Mercury Emissions (tons)	40.60	40.3	42.94	43.1	43.86	44.3	43.35	46.6	44.32	49.2
Coal Production by Sulfur Cat (million tons)										
Low Sulfur (< .61 lbs s/mmBtu)	508.55	508.5	615.13	626.2	706.32	699.3	772.78	801.6	844.48	860.7
Med.Sulfur(.61-1.67 lbs.S/mmBtu)	426.47	426.5	431.98	430.9	416.69	422.9	394.40	404.6	391.59	406.4
High Sulfur (> 1.67 lbs.S/mmBtu)	149.20	149.2	160.58	152.7	163.78	165.7	161.22	166.2	159.78	177.1
Coal Characteristics										
SO2 Content (lbs/mmbtu)	1.80	1.8	1.80	1.8	1.74	1.7	1.68	1.7	1.63	1.7
Mercury Content (lbs/mmmmbtu)	7.18	7.1	7.28	7.3	7.16	7.2	7.04	7.1	6.98	7.0

Appendix B. Alternate NEMS Cases for the Annual Energy Outlook 2002.

Table B1 below lists the alternate cases for the AEO 2002. See Appendix G and Table G1 from the EIA Annual Energy Outlook 2002 for more information on these alternate cases.

Table B1. Alternate Cases of the Annual Energy Outlook 2002.

AEO 2002 NEMS Case	Description
Reference	Baseline economic growth, world oil price, and technology assumptions
Low Economic Growth	Gross domestic product grows at an average annual rate of 2.4 percent, compared to the reference case growth of 3.0 percent.
High Economic Growth	Gross domestic product grows at an average annual rate of 3.4 percent, compared to the reference case growth of 3.0 percent.
Low World Oil Price	World oil prices are $17.64 per barrel in 2020, compared to $24.68 per barrel in the reference case.
High World Oil Price	World oil prices are $30.58 per barrel in 2020, compared to $24.68 per barrel in the reference case.
Residential: 2002 Technology	Future equipment purchases based on equipment available in 2002. Existing building shell efficiencies fixed at 2002 levels.
Residential: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment. Heating shell efficiency increases by 8 percent from 1997 values by 2020.
Residential: Best Available Technology	Future equipment purchases and new building shells based on most efficient technologies available. Heating shell efficiency increases by 16 percent from 1997 values by 2020.
Commercial: 2002 Technology	Future equipment purchases based on equipment available in 2002. Building shell efficiencies fixed at 2002 levels.
Commercial: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment. Building shell efficiencies increase 50 percent faster than in the reference case.
Commercial: Best Available Technology	Future equipment purchases based on most efficient technologies available. Building shell efficiencies increase 50 percent faster than in the reference case.
Industrial: 2002 Technology	Efficiency of plant and equipment fixed at 2002 levels.
Industrial: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment.
Transportation: 2002 Technology	Efficiencies for new equipment in all modes of travel are fixed at 2002 levels.
Transportation: High Technology	Reduced costs and improved efficiencies are assumed for advanced technologies.
Consumption: 2002 Technology	Combination of the residential, commercial, industrial, and transportation 2002 technology cases and electricity low fossil technology case.
Consumption: High Technology	Combination of the residential, commercial, industrial, and transportation high technology cases, electricity high fossil technology case, and high renewables case.

Appendix B. NEMS Cases for the Annual Energy Outlook 2002.

AEO 2002 NEMS Case	Description
Electricity: High Nuclear	No increases in operating costs due to plant aging.
Electricity: Advanced Nuclear Cost	New nuclear capacity is assumed to have both lower capital costs than in the reference case and a shorter (3-year) construction lead time.
Electricity: High Demand	Electricity demand increases at an annual rate of 2.5 percent, compared to 1.8 percent in the reference case.
Electricity: Low Fossil Technology	New advanced fossil generating technologies are assumed not to improve over time from 2002.
Electricity: High Fossil Technology	Costs and/or efficiencies for advanced fossil-fired generating technologies improve from reference case values.
Renewables: High Renewables	Lower costs and higher efficiencies for central-station renewable generating technologies and for distributed photovoltaics, approximating U.S. Department of Energy goals for 2020. Includes greater improvements in residential and commercial photovoltaic systems, more rapid improvement in recovery of industrial biomass byproducts, and more rapid improvement in cellulosic ethanol production technology.
Renewables: Production Tax Credit Extension	Production tax credit for wind and closed-loop biomass power plants assumed to be extended through 2006, with coverage expanded to open-loop biomass and landfill gas power plants.
Oil and Gas: Slow Technology	Cost, finding rate, and success rate parameters adjusted for slower improvement.
Oil and Gas: Rapid Technology	Cost, finding rate, and success rate parameters adjusted for more rapid improvement.
Oil and Gas: Federal MTBE Ban	MTBE and other ethers blended with gasoline are banned from all gasoline starting in 2006. The Federal requirement for 2.0 percent oxygen in reformulated gasoline is not changed.
Coal: Low Mining Cost	Productivity increases at an annual rate of 3.7 percent, compared to the reference case growth of 2.2 percent. Real wages and real mine equipment costs decrease by 0.5 percent annually, compared to constant real wages and equipment costs in the reference case.
Coal: High Mining Cost	Productivity increases at an annual rate of 0.6 percent, compared to the reference case growth of 2.2 percent. Real wages and real mine equipment costs increase by 0.5 percent annually, compared to constant real wages and equipment costs in the reference case.

Distributed generation is modeled in three modules of NEMS: the Residential Demand Module, the Commercial Module. the Electricity Market Module. The Residential and Commercial Demand Modules model distributed generation in residential and commercial buildings. The types of distributed generators available for buildings include:

- photovoltaics
- fuel cells
- microturbines
- conventional combined heat & power systems
- natural gas fired engines
- oil-fired engines
- natural gas turbines
- natural gas micro-turbines

Distributed generation within the commercial sector are currently concentrated in education, health care, office and warehouse buildings. For more information on how NEMS models distributed generation in buildings see the EIA report "Modeling Distributed Electricity Generation in the NEMS Buildings Models" by Boedecker, Cymbalsky and Wade. The report is available online at : http://www.eia.doe.gov/oiaf/analysispaper/electricity_generation.html

The Electricity Market Module of NEMS models grid-connected distributed generation. Because there are so many different types of distributed generators that make up a small percentage of electricity generating capacity, distributed generators are grouped into two generic categories: base load and peaking. The base load category represents:

- heavy-duty micro-turbines
- combustions turbines
- compression ignition engines
- fuel cells

The peak load category represents:

- micro-turbines
- frame-type combustions turbines operating on natural gas
- three types of reciprocating engines

The cost for each generic category is a weighted average based on the market share of each technology. For the base load category, combustion turbines and engines make up about 50% of the market share. For the peaking category, diesel cycle/compression ignition engines operating with natural gas make up about 40% of the market share. The lowest costs are for the diesel cycle/compression ignition engines operated with natural gas. This technology represents 40 percent of the generic technology for peaking distributed generators.

The typical unit size is 2.0 MW for the base load distributed generator category and 1.0 MW for the peak load category. NOx emissions are 0.02 lb/mmbtu for the base load and 0.08 lb/mmbtu for the peak load.

Figures C1 and C2 show the capital cost and efficiency generic distributed generation technologies in the Electricity Marketing Module. Specifications for distributed generators are the same in the AEO Reference and HFET cases.

An assumption is made in the EMM that small distributed generators will pay higher prices for natural gas than large volume buyers (central generating stations). It is assumed that distributed generators will pay a price $2 higher per million Btu than paid by central generating stations.

Figure C1. Capital costs of generic distributed generation categories.

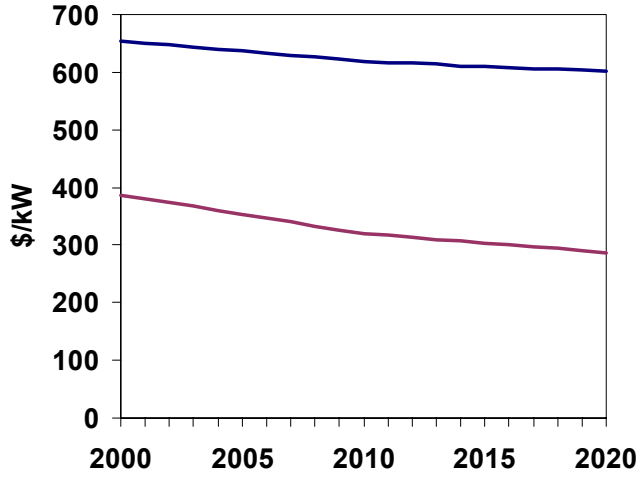


Figure C2. Efficiency of generic distributed generation categories (based on HHV).

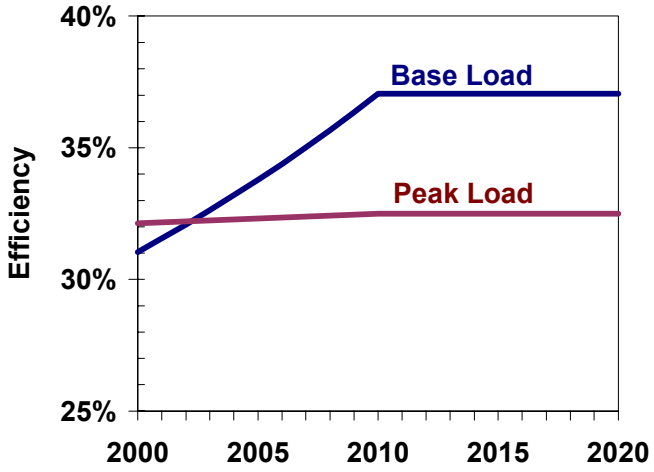
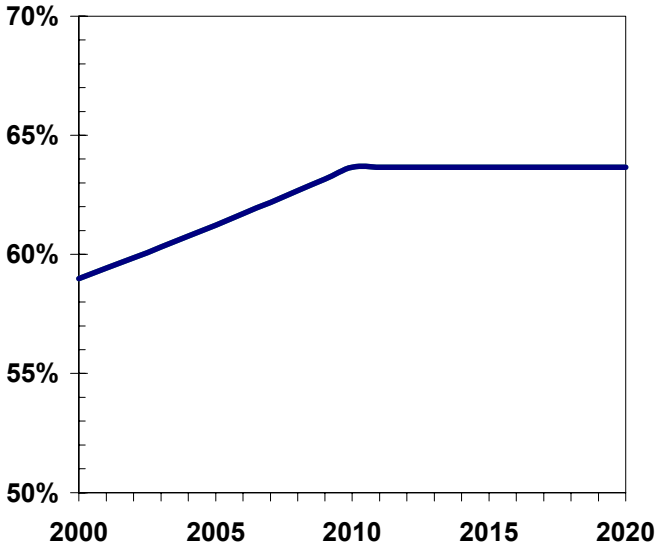
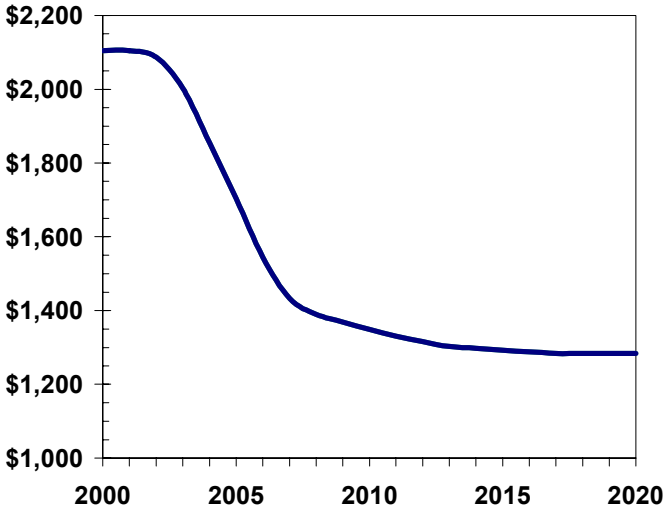


Figure C4. Efficiency of fuel cells in the Electricity Market Module (based on HHV).



The Electricity Market Module also describes a seperate technology for fuel cells. The separate description for fuel cells covers larger units than those covered in base load category of generic distributed generators. The typical unit size of a fuel cell is 10.0 MW versus 2.0 MW for base load distributed generators. Figures C3 and C4 show the capital cost and efficiency specifications of fuels cells throughout the forecasting horizon of NEMS. The capital cost and efficiency of fuel cells (shown below) is the same in the AEO Reference and HFET cases.

Figure C3. Capital costs of fuel cells in the Electricity Market Module ($/kW in year 2000 dollars).



Appendix D. Variation in Capital Cost by NERC Region

Capital costs vary by NERC region to account for regional differences in material and labor costs and in ambient conditions. In NEMS a baseline overnight capital cost is specified for "Middletown, USA." Differences in capital costs due to regional differences are calculated by applying regional multipliers shown in Table B1. The Regional Material/Labor Cost Multiplier values are from the report "*Cost and Performance Database for Electric Power Generating Technologies*" by Argonne National Laboratory.

Ambient conditions (air pressure and temperature) can affect the overall plant efficiency, and thereby can affect the plant size required to produce a certain electricity output. Variations in capital cost due to ambient conditions are accounted for by a Regional Ambient Condition Multiplier as shown in the Table B1. Capital cost can vary by as much as 20% from region to region.

Table D1. Regional Multipliers for IGCC Capital Cost in NEMS

	NERC Region	Regional Material/Labor Cost Multiplier	Regional Ambient Condition Multiplier	Total Regional Multiplier
1	East Central Area Reliability Coordination Agreement (ECAR)	1.004	1.015	1.019
2	Electric Reliability Council of Texas (ERCOT)	0.986	1.050	1.035
3	Mid-Atlantic Area Council (MAAC)	0.996	0.995	0.991
4	Mid-America Interconnected Network (MAIN)	1.004	0.998	1.002
5	Mid-Continent Area Power Pool (MAAP)	1.004	1.003	1.007
6	Northeast Power Coordinating Council/New York (NPCC/NY)	1.043	1.000	1.043
7	Northeast Power Coordinating Council/New England (NPCC/NE)	1.043	0.987	1.029
8	Florida Reliability Coordinating Council (SERC/FL)	0.961	1.000	0.961
9	Southeastern Electric Reliability Council, excluding Florida (SERC/STV)	0.960	1.032	0.961
10	Southwest Power Pool (SPP)	0.997	1.027	1.024
11	Western Systems Coordinating Council/Northwest Power Pool (SERC/NWP)	1.026	1.038	1.065
12	Rocky Mountain, Arizona, New Mexico, Southern Nevada (WSCC/RA)	1.003	1.137	1.140
13	California (WSCC/CNV)	1.058	1.025	1.084

Table D2. Regional capital costs for IGCC in NEMS for the year 2002.

NERC Region		Capital Cost ($/kW)
1	ECAR	1,357
2	ERCOT	1,379
3	MAAC	1,320
4	MAIN	1,334
5	MAAP	1,341
6	NY	1,392
7	NE	1,371
8	FL	1,344
9	STV	1,319
10	SPP	1,364
11	NWP	1,418
12	RA	1,519
13	CNV	1,444

Appendix E. Comparison of IGCC capital cost estimates by the EIA and Parsons

The Table on the next page shows cost estimates for an IGCC plant from Appendix 3B of the report "Evaluation of Innovative Fossil Fuel Power Plant with CO2 Removal" by Parsons Energy and Chemicals Group. The report was funded by the NETL Gasification Program and EPRI and is available at http://www.netl.doe.gov/coalpower/gasification/index.html .

The Total Plant Cost (TPC) is $1,262.5 /kW (in year 2000 dollars). The Total Plant Cost does not include Allowance of Funds During Construction (AFDC), Preproduction costs, inventory capital and land costs.

In NEMS, all costs except allowance of funds during construction (AFDC) are included in the capital cost. Therefore, to compare the Parsons capital cost with EIA's capital cost, the preproduction costs ($33.5/kW), inventory capital ($10.3/kW) and land costs ($1.6 /kW) must be added to the Total Plant Cost (TPC). This gives a capital cost estimate by Parsons of $1,262.5/kW + $33.5/kW + $10.3/kW + $1.6/kW = $1,308/kW.

The location of the Parsons IGCC plant is a generic "East West" region where the labor cost factor is 1.0. Below is an excerpt from page A-1 of the Parsons report:

> "Site is characterized to be located in an East West region of the United States. Although not specifically sited within this region, it is based on a relative equipment/materials/labor cost factor of 1.0. Specific regional locations would result in adjustments to these cost factors."

In NEMS, the capital cost of an IGCC in "Middletown, USA," a location with regional neutral regional multipliers is $1,338/kW. This is 2% higher than the capital cost of $1,308/kW estimated by Parsons.

However, NEMS forecasts that the Southeastern Electric Reliability Council (STV) region is where most IGCC plants will be built. In the STV region the capital cost in NEMS is $1,319/kW, within 1% of the capital cost estimate of Parsons.

CAPITAL INVESTMENT & REVENUE REQUIREMENT SUMMARY

TITLE/DEFINITION

Case:	IGCC w/o CO_2 Removal (3B)		
Plant Size:	424.5 (MW,net)	HeatRate:	7,915 (Btu/kWh)
Primary/Secondary Fuel(type):	Illinois #6	Cost:	1.24 ($/MMBtu)
Design/Construction:	4 (years)	BookLife:	20 (years)
TPC(Plant Cost) Year:	1999 (Dec.)	TPI Year:	2000 (Jan.)
Capacity Factor:	65 (%)	CO_2 Removed	

CAPITAL INVESTMENT		**$x1000**	**$/kW**
Process Capital & Facilities		427,040	1005.9
Engineering(incl.C.M.,H.O.& Fee)		25,622	60.4
Process Contingency		19,954	47.0
Project Contingency		63,367	149.3
TOTAL PLANT COST(TPC)		$535,983	1262.5
TOTAL CASH EXPENDED	$535,983		
AFDC	$47,525		
TOTAL PLANT INVESTMENT(TPI)		$583,508	1374.4
Royalty Allowance			
Preproduction Costs		14,222	33.5
Inventory Capital		4,361	10.3
Initial Catalyst & Chemicals(w/equip.)			
Land Cost		700	1.6
TOTAL CAPITAL REQUIREMENT(TCR)		$602,791	1419.9

OPERATING & MAINTENANCE COSTS (1999 Dollars)	**$x1000**	**$/kW-yr**
Operating Labor	5,503	13.0
Maintenance Labor	4,300	10.1
Maintenance Material	6,450	15.2
Administrative & Support Labor	2,451	5.8
TOTAL OPERATION & MAINTENANCE	$18,704	44.1
FIXED O & M	28.86 $/kW-yr	
VARIABLE O & M	0.27 ¢/kWh	

CONSUMABLE OPERATING COSTS,less Fuel (1999 Dollars)	**$x1000**	**¢/kWh**
Water	237	0.01
Chemicals	270	0.01
Other Consumables		
Waste Disposal	1,306	0.05
TOTAL CONSUMABLE OPERATING COSTS	$1,814	0.08
BY-PRODUCT CREDITS (1999 Dollars)	($876)	-0.04
FUEL COST (1999 Dollars)	$23,725	0.98

PRODUCTION COST SUMMARY	**Levelized (Over Book Life $)** **$/ton CO_2**		**¢/kWh**
Fixed O & M		28.9/kW-yr	0.51
Variable O & M			0.27
Consumables			0.08
By-product Credit			-0.04
Fuel			0.98
TOTAL PRODUCTION COST			1.79
LEVELIZED CARRYING CHARGES(Capital)		195.9/kW-yr	3.44
LEVELIZED (Over Book Life) BUSBAR COST OF POWER			5.24

Appendix F. IGCC Externality Costs in the CNV Region

In all cases of the Annual Energy Outlook 2002 it is assumed that an externality charge is imposed on IGCC plants for emissions of carbon, SO2, NOx and VOC in Region 13, the California (CNV) NERC region. Apparently no such charges exists in the CNV region, but they are nevertheless included in NEMS (private communication with John Ruether, NETL Office of Systems and Policy Support).

The externality charges are applied per unit of energy output of the IGCC plant. The externality costs are listed below in $/million kWh (year 2000 dollars):

Carbon externality charge:	$10.60/million kWh
SO2 externality charge:	$15.58/million kWh
NOx externality charge:	$15.87/million kWh
VOC externality charge:	$0.91/million kWh
Total externality charge:	**$42.14/million kWh**

The variable operating cost of IGCC is $882/million kWh, so the externality charge of $42.14/million kWh represents an increase in variable operating costs of about 5%. This is enough to significantly reduce the prediction of IGCC plants built in the CNV region. The chart below shows the market penetration of advanced fossil-fuel electricity generating technologies predicted by the HFET case in the CNV region with and without externality costs.

Externality reduce the prediction of IGCC plants in the CNV region by the year 2020 from 17.3 GW to 7.5 GW in the HFET case.

Figure F1. Predictions of adv. fossil-fuel electricity generating plants built in the CNV region by 2020 with and without externality charges.

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Appendix G. Standard output Tables of NEMS

The Tables listed below are available for every NEMS run in an excel file format:

1 Total Energy Supply and Disposition Summary
2 Energy Consumption by Sector and Source
3 Energy Prices by Sector and Source
4 Residential Sector Key Indicators and Consumption
5 Commercial Sector Key Indicators and Consumption
6 Industrial Sector Key Indicators and Consumption
7 Transportation Sector Key Indicators and Delivered Energy Consumption
8 Electricity Supply, Disposition, Prices, and Emissions
9 Electricity Generating Capability
10 Electricity Trade
11 Petroleum Supply and Disposition Balance
12 Petroleum Product Prices
13 Natural Gas Supply and Disposition
14 Oil and Gas Supply
15 Coal Supply, Disposition, and Prices
16 Renewable Energy Generating Capability and Generation
17 Carbon Dioxide Emissions by Sector and Source
18 Macroeconomic Indicators
19 International Petroleum Supply and Disposition Summary
20 Conversion Factors
21 Average Household Expenditures for Energy by Household Characteristic (output: hemTable.txt)
22 Natural Gas Prices, Margins and Revenues
23 Total Energy Supply and Disposition Summary, Crude Oil Equivalence
24 Renewable Energy Consumption by Sector and Source
25 Total Energy Supply and Disposition Summary
26 Non-Utility Electricity Generation
27 Non-Utility Electricity Capacity
28 Non-Utility Fuel Consumption
29 Methane Emissions from Energy Activities
30 Residential Sector Equipment Stock and Efficiency
31 Energy and Energy Efficiency Indices
32 Commercial Sector Energy Consumption, Floorspace, and Equipment Efficiency
33 Other Commercial Sector Consumption
34 Industrial Sector Macroeconomic Indicators
35 Refining Industry Energy Consumption
36 Food Industry Energy Consumption
37 Paper Industry Energy Consumption
38 Bulk Chemical Industry Energy Consumption
39 Glass Industry Energy Consumption
40 Cement Industry Energy Consumption
41 Iron and Steel Industries Energy Consumption
42 Aluminum Industry Energy Consumption
43 Other Industrial Sector Energy Consumption
44 Industrial Consumption by Sector
45 Transportation Sector Energy Use by Mode and Type
46 Transportation Sector Energy Use by Fuel Type Within a Mode
47 Light-Duty Vehicle Energy Consumption by Technology Type and Fuel Type
48 Light-Duty Vehicle Sales by Technology Type
49 Light-Duty Vehicle Stock by Technology Type
50 Light-Duty Vehicle Miles per Gallon by Technology Type
51 Light-Duty Vehicle Miles Traveled by Technology Type
52 Summary of New Light-Duty Vehicle Size Class Attributes
53 Transportation Fleet Car and Truck Fuel Consumption by Type and Technology
54 Transportation Fleet Car and Truck Sales by Type and Technology
55 Transportation Fleet Car and Truck Stock by Type and Technology
56 Transportation Fleet Car and Truck Vehicle Miles Traveled by Type and Technology
57 Air Travel Energy Use
58 Freight Transportation Energy Use
59 Electricity Generating Capability by Plant Type and Technology
60 Technology Market Penetration in Light-Duty Vehicles
61 Electric Competitive Prices
62 Electric Power Projections for EMM Region
63 Electric Generation by Electricity Market Module Region and Source
64 Electric Generation Capacity by Electricity Market Module Region and Source
65 Renewable Resources Consumption/Displacement by Region and Source for Electricity
66 Renewable Resource Generating Capacity by EMM Region and Source
67 Renewable Energy Generation by Fuel
68 Domestic Refinery Distillation Base Capacity, Expansion, and Utilization
69 Domestic Refinery Production by Region
70 Components of Selected Petroleum Product Prices
71 Lower 48 Crude Oil Production and Wellhead Prices by Supply Region
72 Lower 48 Natural Gas Production and Wellhead Prices by Supply Region
73 Oil and Gas End-of-Year Reserves and Annual Reserve Additions
74 Lower 48 Oil and Gas Well Completions
75 Average Technology Cost for Light-Duty Vehicles
76 Natural Gas Imports and Exports
77 Natural Gas Consumption by End-Use Sector and Census Division
78 Natural Gas Delivered Prices by End-Use Sector and Census Division
79 blank Table
80 blank Table
81 Annual Natural Gas Underground Storage and Pipeline Capacity
82 Natural Gas Consumption by End-Use Sector, Region, and Service Type
83 Natural Gas Delivered Price by End-Use Sector, Region, and Service Type
84 Natural Gas Pipeline Capacity By NGTDM Region
85 Natural Gas Pipeline Flows by NGTDM Region
86 Natural Gas Pipeline Capacity Utilization By NGTDM Region
87 Natural Gas Pipeline Capacity By Census Division
88 Natural Gas Pipeline Flows by Census Division
89 Natural Gas Pipeline Capacity Utilization by Census Division
90 Primary NG Flows Entering NGTDM Region from Neighboring Regions
91 Primary NG Capacity Entering NGTDM Region from Neighboring Regions
92 blank Table
93 Domestic Coal Supply, Disposition, and Prices
94 Coal Production and Minemouth Prices by Region
95 Coal Production by Region and Type
96 World Steam Coal Flows By Importing Regions and Exporting Countries

97 World Metallurgical Coal Flows By Importing Regions and Exporting Countries
98 World Total Coal Flows By Importing Regions and Exporting Countries
99 Coal Prices by Region and Type
100 Indicators of Macroeconomic Activity
101 Inputs to Macroeconomic Activity Module
102 DRI Energy Variables
103 Investment
104 Imported Petroleum by Source
105 Equilibrium Import Petroleum Supply
106 Energy Performance Indicators
107 Supply and Disposition of Total Energy, Supply Detail
108 Supply and Disposition of Total Energy, Disposition Detail
109 Energy Consumption--M.E.RAccounting Detail and Summaries
110 NEMS/STIFS Comparison (not a fort.20 Table: steoTable.txt)
111 blank Table
112 blank Table
113 New Light-Duty Vehicle Fuel Economy
114 New Light-Duty Vehicle Prices
115 New Light-Duty Vehicle Range
116 blank Table
117 National Impacts of the Clean Air Act Amendments of 1990 (CAAA90)
118 Fuel Tax by End-Use Sector and Source
119 Values to Use in AEO Graphics
120 International Energy Agency Submission (not a fort.20 Table: ieaTable.txt)
121 Electricity Generating Capability -- for IEA
122 blank Table
123 blank Table
124 blank Table
125 blank Table
126 blank Table
127 blank Table
128 blank Table
129 blank Table
130 blank Table
131 Key Results for Residential Sector Technology Cases
132 Key Results for Commercial Sector Technology Cases
133 Key Results for Industrial Sector Technology Cases
134 Key Results for Transportation Sector Technology Cases
135 Key Results for Integrated Technology Cases
136 Key Results for Nuclear Retirement Cases
137 Key Results for Electricity Demand Case
138 Key Results for Electricity Generator Sector Technology Cases
139 blank Table
140 Key Results for Renewable Portfolio Standard Cases
141 Key Results for High Renewable Energy Technology Case
142 blank Table
143 Key Results for Oil and Gas Resource Cases
144 Key Results for Coal Mining Cost Cases
145 blank Table
146 Freight Technology Penetration
147 Transportation Sector Carbon Monoxide and Carbon Dioxide Emissions
148 Transportation Sector SOx and NOx Emissions
149 Transportation Sector VOC and HC Emissions
150 Transportation Sector Total Carbon Dioxide Emissions