Appendix A – GPRA05 Benefits Estimates: MARKAL and NEMS Model Baseline Cases

MARKAL Baseline Case: Assumptions and Projections

Economic and Demographic Assumptions

The Baseline Case projection used to evaluate the impact of the EERE portfolio was benchmarked to the Energy Information Administration's (EIA) *2003 Annual Energy Outlook* (AEO) for the period between 2000 and 2025. To the extent possible, the same input data and assumptions were used in MARKAL (market allocation model) as were used to generate the AEO reference case. For example, the macroeconomic projections for gross domestic product (GDP), housing stock, commercial square footage, industrial output, and vehicle miles traveled (VMTs) were taken from the AEO. At the sector level, both supply-side and demand-side technologies were characterized to reflect the AEO assumptions, in cases where the representation of technologies is similar between MARKAL and the National Energy Modeling System (NEMS). The resulting projections track closely with the AEO at the aggregate level, although they do not match exactly at the end-use level. For the period after 2025, various sources were drawn upon to compile a set of economic and technical assumptions. The primary economic drivers of GDP and population were based on the real GDP growth rate from the Congressional Budget Office's Long-Term Budget Outlook and population growth rates from the Social Security Administration's 2002 Annual Report to the Board of Trustees.

In the Baseline Case, GDP is projected to increase at an average annual rate of 2.9 % 2000 to 2025, and then slow to an average annual rate of 2.3 % from 2025 to 2050. The population growth rate is projected to decline from an average annual rate of 0.8 % between 2000 and 2025 to 0.5 % from 2025 to 2050. The Baseline Case macroeconomic assumptions are shown in **Table 1.**

Table 1. Baseline Case Macroeconomic and Demographic Assumptions

												Annual Growth Rates		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
GDP (Bill. 2001$)	$10,052	$11,332	$13,407	$15,627	$17,991	$20,690	$23,582	$26,728	$29,694	$32,990	$36,246	2.9%	2.3%	2.6%
Population (Million)	275.3	287.7	299.9	312.3	324.9	337.8	347.8	358.0	365.6	373.4	379.4	0.8%	0.5%	0.6%
Total Households (Million)	105.2	110.8	117.2	123.5	128.8	134.3	135.9	139.8	142.8	145.9	148.2	1.0%	0.4%	0.7%
Commercial Floorspace (Bill. sq ft)	68.5	76.1	81.8	88.2	94.6	101.1	108.9	116.9	124.0	131.6	138.8	1.6%	1.3%	1.4%
Industrial Production (2000=100)	100	103	122	140	157	177	198	219	242	265	290	2.3%	2.0%	2.2%
Light Duty Vehicle Miles Traveled (Bill. VMT)	2,355	2,642	3,004	3,380	3,753	4,132	4,475	4,721	4,980	5,168	5,362	2.3%	1.0%	1.7%

Assumptions on Energy Prices

Table 2 shows projected energy prices for the reference case. Natural gas prices are projected to drop between 2000 and 2005, and then increase at about 1.5 % per year from 2005 to 2025, before increasing amounts of arctic gas and liquefied natural gas (LNG) imports limit the average annual increase to 1.1 % from 2025 to 2050. Crude oil prices are also projected to decrease between 2000 and 2005, increase at average annual rates of 0.6 % between 2005 and 2025, and 0.8 % per year thereafter.

Average mine-mouth coal prices are projected to continue to decline by about 0.6 % a year between 2000 and 2025 due to increasing productivity gains and a continued shift to less labor-intensive Western coal production. However, coal prices are projected to increase at an average rate of 1.1 % per year after 2025, due to increased demands, gradually increasing mine depths and a saturation of labor productivity gains.

Table 2. Baseline Case Energy Prices

												Annual Growth Rates		
2001 $s	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
World Oil Price ($/bbl)	$28.36	$23.58	$23.96	$24.71	$25.40	$26.66	$27.98	$29.11	$30.75	$31.56	$32.82	-0.2%	0.8%	0.3%
Natural Gas Wellhead Price ($/Mcf)	$3.83	$2.88	$3.33	$3.59	$3.73	$3.86	$4.10	$4.35	$4.71	$4.80	$5.05	0.0%	1.1%	0.6%
Coal Minemouth Price ($/short ton)	$17.05	$16.41	$14.76	$14.60	$14.32	$14.47	$15.29	$16.08	$16.56	$17.93	$19.33	-0.7%	1.2%	0.3%
Average Wholesale Electricity Price (¢/kWh)	4.0¢	3.9¢	4.4¢	4.6¢	4.8¢	4.4¢	4.6¢	4.9¢	5.0¢	4.8¢	4.6¢	0.4%	0.2%	0.3%

Primary Energy Consumption

As a result of slightly increasing energy prices, technology improvements, and shifts within the economy, energy demand is projected to increase more slowly than GDP. As shown in **Table 3**, total primary energy use is projected to increase at a rate of 1.4 % per year from 2000 to 2025, and at an average annual rate of 0.6 % between 2025 and 2050. By 2050, total primary energy consumption is projected to reach 163 quadrillion Btus (quads). Overall, the energy consumption to GDP ratio is projected to decline by 1.5 % per year from 2000 to 2050, while total carbon emissions increase by 1.1 % per year during the same period.

Table 3. Primary Energy Consumption, Energy Intensity, and Carbon Emissions

												Annual Growth Rates		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
Petroleum	37.5	39.9	44.6	48.9	52.7	56.9	59.7	62.6	65.0	67.1	68.9	1.7%	0.8%	1.2%
Natural Gas	23.3	24.9	28.1	30.6	33.2	35.2	38.7	41.4	43.6	45.0	46.6	1.7%	1.1%	1.4%
Coal	22.5	23.3	25.2	26.6	28.3	29.8	29.0	29.7	30.6	31.8	32.8	1.1%	0.4%	0.8%
Nuclear	7.9	8.6	8.7	8.7	8.7	8.7	7.6	6.1	5.2	3.4	1.6	0.4%	-6.5%	-3.1%
Renewables	7.2	7.8	7.8	8.2	8.6	9.1	9.8	11.3	12.5	12.9	12.9	1.0%	1.4%	1.2%
Total Primary Energy	**98.3**	**104.5**	**114.3**	**123.0**	**131.5**	**139.8**	**144.7**	**151.1**	**156.8**	**160.1**	**162.8**	**1.4%**	**0.6%**	**1.0%**
Energy/GDP (Thos. Btu/ '01$ GDP)	9.8	9.2	8.5	7.9	7.3	6.8	6.1	5.7	5.3	4.9	4.5	-1.5%	-1.6%	-1.5%
Carbon Emissions (MMT)	1,564	1,657	1,835	1,983	2,130	2,274	2,347	2,454	2,549	2,634	2,714	1.5%	0.7%	1.1%

Crude oil's share of total energy consumption is projected to increase from 38 % in 2000 to 42% in 2050. The natural gas share is projected to grow from 24% to 28% during the same period. Coal generation is projected to decline from a 23% share in 2000 to 20% in 2050. All currently existing nuclear-generation capacity is assumed to retire between 2025 and 2045. However, 14 GW of new nuclear capacity is projected to be added between 2025 and 2040. The share of renewable energy is projected to be relatively stable at between 7% and 8% throughout the projection period.

It should be noted that the outlook for natural gas supply has changed considerably during the past few years. The 2004 Annual Energy Outlook shows considerably tighter gas markets than the 2003 edition. Both U.S. production and net pipeline imports (from Canada and Mexico) show significant declines. While LNG imports for the 2004 AEO are more than twice the level of the 2003 AEO, total gas supply in 2025 is 9.5% lower between the two projections. Overall, the 2025 average natural gas supply price increases by about 11%. A summary of these changes is shown in **Table 4.**

Table 4. Comparison of 2003 and 2004 AEO Natural Gas Supply for 2025

Quad. Btus	AEO 2003	AEO 2004	Difference
U.S. Production	27.6	24.7	-2.8
Net Pipleine Imports	5.7	2.5	-3.2
Net LNG Inports	2.2	4.9	2.7
Total Supply	35.5	32.1	-3.4
Average Supply Price (2001$)	$3.97	$4.42	$0.45

As the MARKAL Baseline Case projection was calibrated to the 2003 Annual Energy Outlook, the natural gas supply assumptions are more optimistic than in the more recent AEO. Nevertheless, LNG imports and Arctic gas supplies account for 44% of gas supply in 2050. **Figure 1** shows natural gas supplies by source for the reference case.

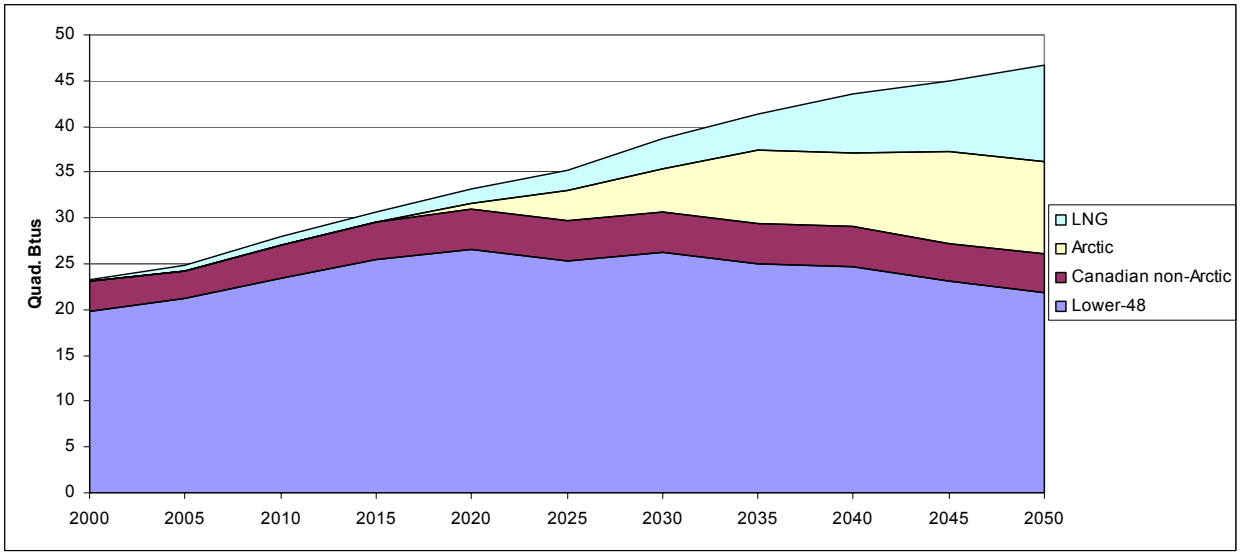
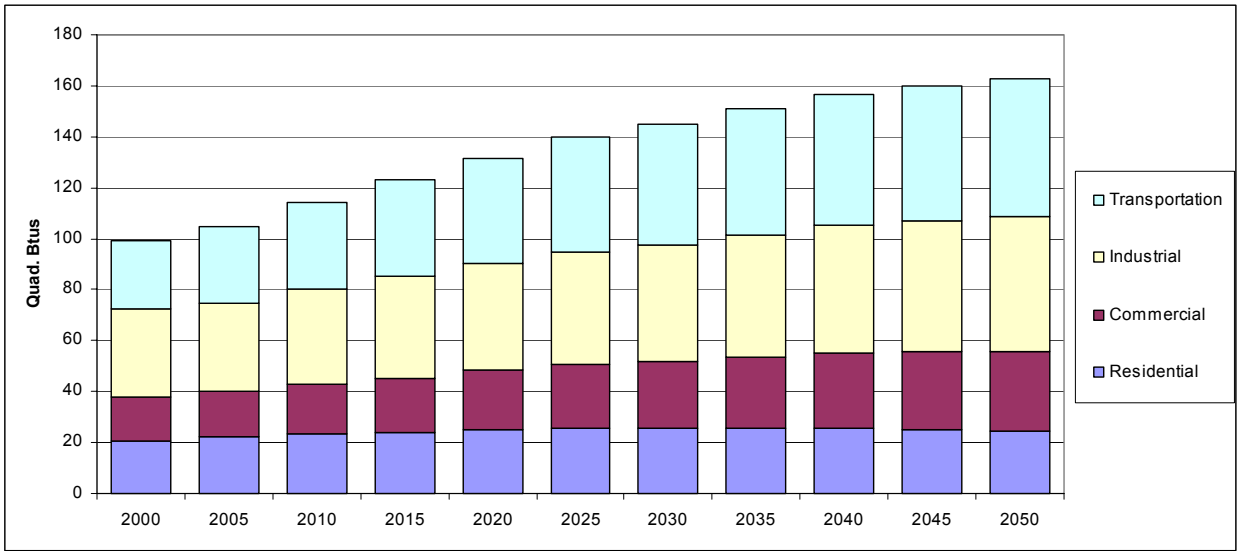


Figure 1. Baseline Case Natural Gas Supply by Source

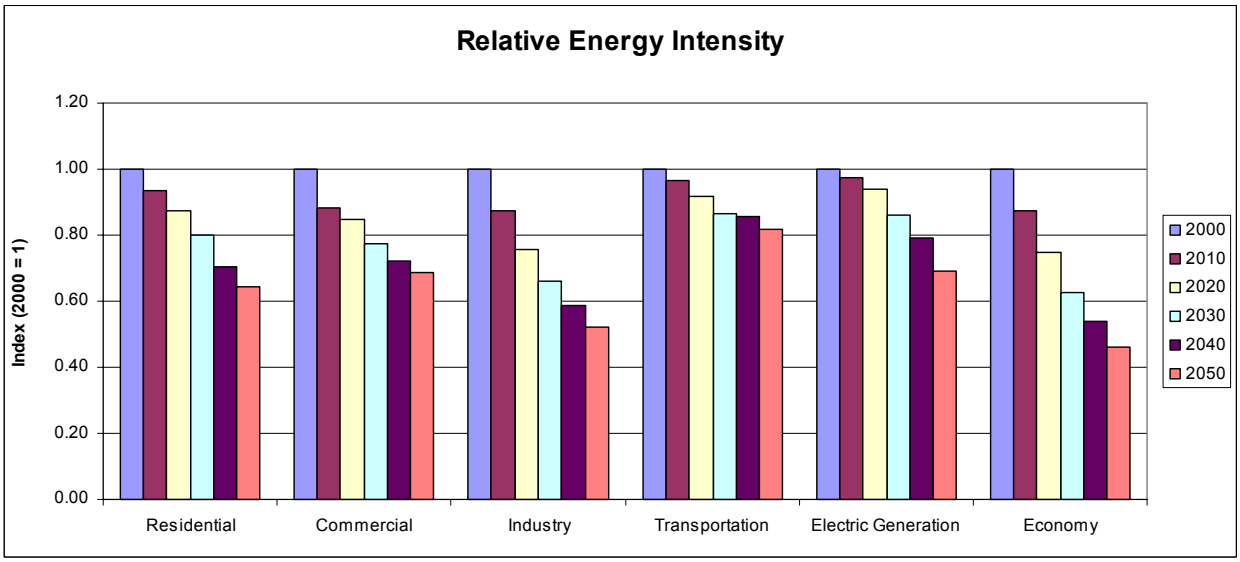
End-Use Energy Demand

The sectoral breakout of energy use, shown in **Figure 2**, demonstrates that transportation energy demand is projected to increase most rapidly, at 1.4% per year, from 2000 to 2050; while residential energy demand increases most slowly, at 0.4% per year. Industrial and commercial energy demands are projected to grow at intermediate rates of 0.9% and 1.2% per year, respectively. The growth rates in energy consumption are a function of the opposing trends of increasing end-use energy service demand and improvements in the efficiency of technologies that satisfy this demand, as well as macroeconomic shifts toward less energy-intensive industries. This phenomenon is best illustrated by examining the energy intensity of the economy. **Figure 3** shows the relative energy intensity for different end-use and conversion sectors, and the economy as a whole.



Note: Consumption totals include electric-generation and distribution losses

Figure 2. Energy Consumption by Sector



Note: Residential index is primary energy, excluding misc. use per household. Commercial index is primary energy use, excluding office equipment and misc. appliances per square foot. Industrial index is total primary energy per unit output. Transportation index is LDV primary energy per mile traveled. Electricity index is nonrenewable average heat rate. Economy index is total primary energy per unit GDP.

Figure 3. Relative Energy Intensity by Sector

As shown in **Figure 3**, the Baseline Case projection indicates that the energy intensity of the economy—which is defined as total primary energy consumption per dollar ($) of GDP—is projected to decrease by more than half by 2050. This decrease reflects both a continued shift toward a service-based economy, as well as increases in energy-technology efficiency. End-use efficiencies are projected to increase throughout the economy over the projection period as new, more-efficient capital stocks are purchased to replace existing equipment and to meet new demand. The Baseline Case technology database includes technologies that are expected to

become available in the future, as well as those that are currently on the market. For example, more efficient electric heat pumps and light-duty vehicles are assumed to become available throughout the projection period. The technical and economic data associated with these technologies are derived from a variety of sources, but rely most heavily on the NEMS database.

The residential energy-intensity index shows significant improvements in energy use per household. However, the residential index excludes "miscellaneous demands," the fastest growing segment of residential energy demand. The miscellaneous demand category includes electric devices such as home computers, TVs, and microwave ovens; as well as devices such as gas lamps and swimming pool heaters. Because these service demands are growing faster than the sector as a whole, their energy use per household actually increases over time. Thus, the inclusion of miscellaneous demands in the calculation of residential energy intensity would obscure the efficiency gains being made in other residential service demands.

The commercial energy-intensity index shows significant improvements in energy use per square foot. However, as with the residential sector, this calculation excludes the fastest-growing demand categories: office equipment and miscellaneous commercial appliances. The inclusion of these demand categories would result in relatively constant commercial energy demand per square foot.

The industrial-sector efficiency index shows dramatic declines in energy intensity due to a shift from energy-intensive industries to nonenergy-intensive manufacturing, as well as improvements in process efficiency. During the 50-year projection period, nonenergy-intensive manufacturing output is expected to grow at twice the rate as energy-intensive industrial output. This shift in output exaggerates the decline in energy intensity. However, in the transportation sector, consumer preferences for more powerful engines—and a continued shift from passenger cars to sport utility vehicles (SUVs)—limit gains in overall efficiency.

On an individual technology basis, there are several important trends in the Baseline Case technology assumptions. Although most technologies' capital costs are assumed to remain constant at their current level in real terms, the costs of a few key technologies are projected to decline over time. These include gas combined cycle, integrated coal gasification, and renewable technologies, such as wind and PV. Most of these technologies also show improvements in their heat rates or performance (e.g. capacity factor) between 2000 and 2050.

In the power-generation sector, the efficiency of nonrenewable generation is expected to increase as older, less-efficient fossil steam units retire and new high efficiency gas combined-cycle and IGCC capacity is built. Electric generation by type is shown in **Figure 4**. Natural gas-fired generation is projected to increase its share of total generation from about 18% to 37% during the projection period. Coal-fired generation remains the largest source of electricity at 45% to 51% of total generation. Due to retirements of existing nuclear capacity, nuclear's share of generation falls from 19% to 2% of generation during the projection period. Renewable generation is relatively constant at about 10% of total generation.

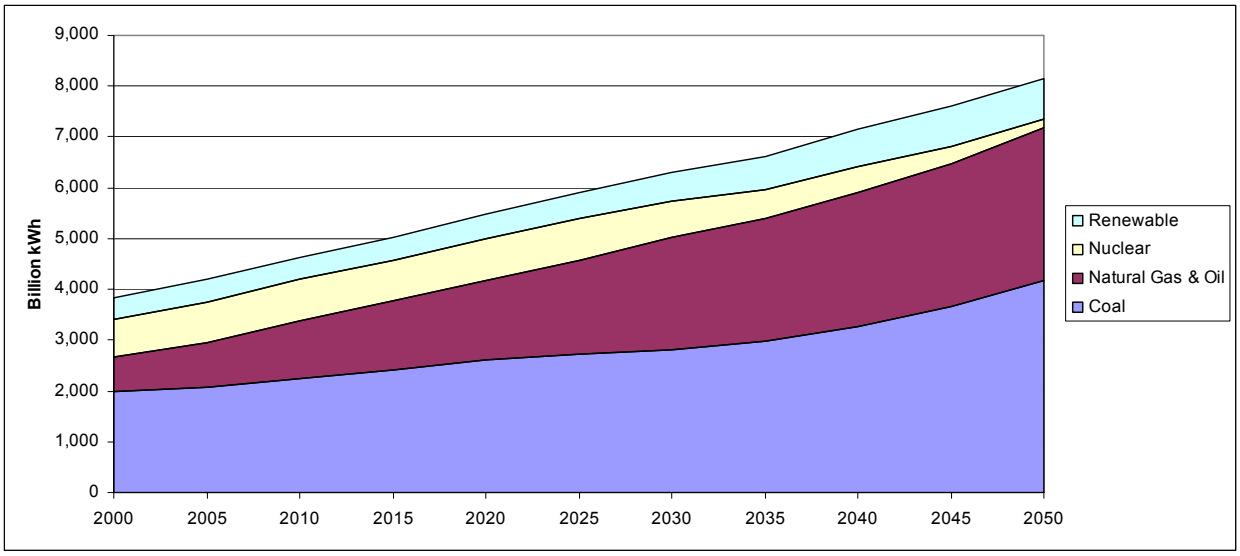


Figure 4. Electricity Generation by Type: Baseline Case

While both natural gas and coal-fired generation show increased efficiency, fossil fuel use for electric generation increases by 92% during the projection period. Such an increase in coal and natural gas demand for power generation is dependent on the availability of these resources. However, potential reduction in supply—such as changes in the outlook in natural gas supply—would necessitate a significant change in fuels used for electric generation.

NEMS Baseline Case Assumptions and Projections

Overview

The Office of Energy Efficiency and Renewable Energy (EERE) programs uses an integrated energy modeling system to analyze the benefits expected from successful implementation of individual programs and the EERE portfolio as a whole. The use of an integrated model provides a consistent economic framework and incorporates the interactive effects among the various programs. Feedback and interactive effects result from (1) changes in energy prices resulting from lower energy consumption, (2) the interaction between supply programs affecting the mix of generation sources and the end-use sector programs affecting the demand for electricity, and (3) additional savings from reduced energy production and delivery.

A modified version of the National Energy Modeling System (NEMS)[1] was one of the models used for this benefits analysis. NEMS is an integrated energy model of the U.S. energy system that was developed by the Energy Information Administration (EIA) for forecasting and policy analysis purposes. The latest version of NEMS available at the time of the benefits analysis—the one used for the *Annual Energy Outlook 2003* (AEO2003)—was used as the starting point. This version provides projection capability to the year 2025. Several changes were made to the model to enhance its ability to represent the EERE programs. The modified version of the model is referred to as NEMS-GPRA05.

GPRA 2005 Baseline

The first step in the benefits analysis process is to establish an appropriate Baseline Case. The EERE Baseline Case is a projection intended to represent the future U.S. energy system without the effect of EERE Programs. This Baseline Case assures that program benefits are estimated based on the same initial forecasts for economic growth, energy prices, and levels of energy demand. It also assures that these initial assumptions are consistent with each other; e.g., that the level of electricity demand expected under the economic growth assumptions could be met at the electricity price assumed. It provides a basis for assessing how well renewable and efficiency technologies might be able to compete against future, rather than current, conventional energy technologies (e.g., more efficient central power generation). Finally, it helps assure that underlying improvements in efficiency and renewable energy are not counted as part of the benefits of the EERE programs.

The most recent Annual Energy Outlook Reference Case is used as the starting point for developing the base case.[2] The Energy Information Administration (EIA) Annual Energy Outlook (AEO) Reference Case provides an independent representation of the likely evolution of energy markets. This forecast reflects expected changes in the demand for energy (e.g., to reflect the availability of new appliances), technology improvements that might improve the efficiency of energy use, and changes in energy resource production costs, including renewable energy.

[1] The National Energy Modeling System: An Overview 2003, March 2003, DOE/EIA-0581(2003)

[2] The Annual Energy Outlook 2003 with Projections to 2025, January 2003, DOE/EIA-0383 (2003). See http://www.eia.doe.gov/oiaf/archive/aeo03/pdf/0383(2003).pdf.

Current energy market policies, such as state Renewable Portfolio Standards, which facilitate the development and adoption of these technologies, are included in the Baseline Case. This approach ensures that EERE's benefits estimates do not include expected impacts of such policies. Neither the EIA Reference Case nor the EERE Baseline Case includes any changes in future energy policies.

The baseline is constructed starting with EIA's *Annual Energy Outlook* Reference Case, and then any identifiable effects of EERE programs already included are removed. For example, EIA's estimate of rooftop photovoltaic installations resulting from the Million Solar Roofs Initiative were removed from the EERE Baseline. The AEO2003 assumption of roughly constant hydroelectric capacity over time was modified to reflect the expectation that without more environmentally benign turbine designs, some reduction in hydro capacity would occur as a result of relicensing requirements. The constraints on the maximum growth rate for cellulosic ethanol production were reduced by a factor of 4, because growth of this new industry is expected to be very slow without EERE program involvement.

The AEO forecast includes technology improvements in all areas of energy demand and supply, and identifying what portion is due to EERE programs is extremely difficult. For GPRA 2005, selected technology changes were made where the AEO appeared to already incorporate the EERE program goals. Technology assumptions that were modified for the baseline include cost and efficiency improvements to distributed combined heat and power (CHP) technologies that were reduced to reflect expected effects without an ongoing DEER program. In addition, the distributed peaker technology in the electricity-generation sector was modified to reflect reciprocating engines (lower capital costs and lower efficiency), and the fixed capacity factor was reduced from 5% to 2.5%.

A few other modifications were made to reflect EERE program assumptions or updated information about energy markets. These changes affect both the Baseline and the Portfolio Cases. The size of typical PV systems was increased to 4 kW in residential and 100 kW in commercial buildings to reflect recent PV installation experience and trends. The maximum market for PV systems was increased from 30% to 55% in the commercial sector and to 60% for residential PVs. Similarly, the maximum market share for gas-fired distributed-generation technologies was increased from 30% to 50% in the commercial sector. California PV credits were incorporated in the Pacific region. Solar water heat was added to the slate of technologies for new homes, and the share of the replacement market in which it can compete was increased from 20% to 50%. The electrodeless fluorescent assumed to become available for commercial lighting in 2015 was removed as recommended by the Building Technologies (BT) Program because they are not aware of a source that shows that much R&D is being directed to develop this level of efficiency. The conversion efficiency of cellulosic ethanol was reduced because EIA's assumption appeared too optimistic.

In a few cases, structural changes were made to improve the model's representation of markets important to EERE technologies. The wind module was modified, so that each of the three wind classes is treated more discretely with separate capital costs and resource multipliers. To improve the geothermal module representation, an EIA update for the price signal sent from the electricity module to the geothermal module was incorporated. The shell indices in the commercial module

were replaced with a technology choice algorithm necessary for later representation of EERE shell technologies. In addition, alterations to the distributed-generation algorithm in the building modules were made to smooth new market shares, to reflect the DEER program's market adoption data, to account for the efficiency of using waste heat from combined heat and power systems, and to account for buildings that have already installed a DG technology in prior years.

A summary of these changes is provided in **Table 5**.

Table 5. Summary of Baseline Changes from the AEO2003

	AEO2003	GPRA Baseline Case
Removal of EERE Programs		
Million Solar Roofs	0.4 GW installed 2004 to 2025	Removed
Hydroelectric capacity	Roughly constant hydro capacity and generation	6 % reduction by 2025
Cellulosic ethanol production	0.6 billion gallons by 2025	0.15 billion gallons by 2025
DG technology improvement	Significant improvement	Some improvement but less
Energy Market Updates		
PV system size	2 kW residential, 10 kW commercial	4 kW residential, 100 kW commercial
PV maximum market share	30 % for both residential and commercial	60 % for residential and 55 % for commercial
CHP commercial building maximum share	30 %	50 %
California PV subsidy	Not included	Included for residential systems
Solar water heat	Maximum 30 % replacement market	New and replacement market
Cellulosic conversion efficiency	90 to 103 tons biomass per gallon	82 to 101 tons biomass per gallon
Structural Changes		
Wind module	One capital cost and resource multiplier for all wind classes	Capital costs and resource multipliers by wind classes
Geothermal		Updated price signal
Commercial shell efficiency	Index	Technology representation
Commercial DG algorithms		Market share and stock accounting modified

In the baseline, similar to the AEO2003, oil and natural gas prices are projected to increase from 2005 to 2025, as shown in **Figure 5**. Coal prices, on the other hand, are projected to decline slightly, due to continued productivity gains. Electricity prices are projected to be relatively constant in real terms, with a slight decrease and then an increase after 2010.

The resulting Baseline Case projects a 35% increase in energy demand from 2005 to 2025.[3] Energy efficiency and renewable energy improvements, however, contribute toward a 26% reduction in conventional energy intensity (energy used per dollar of GPD produced) during the

[3] Very similar to the AEO2003.

same period (**Figure 6**).[4] Between 2005 and 2025, renewable energy technology improvements result in increases in electric generation in both central and distributed applications (in billions of kWh) of 27 for geothermal, 28 for biomass, 7 for wind, 4 for municipal solid waste, 19 for photovoltaics, and 0.3 for solar thermal.

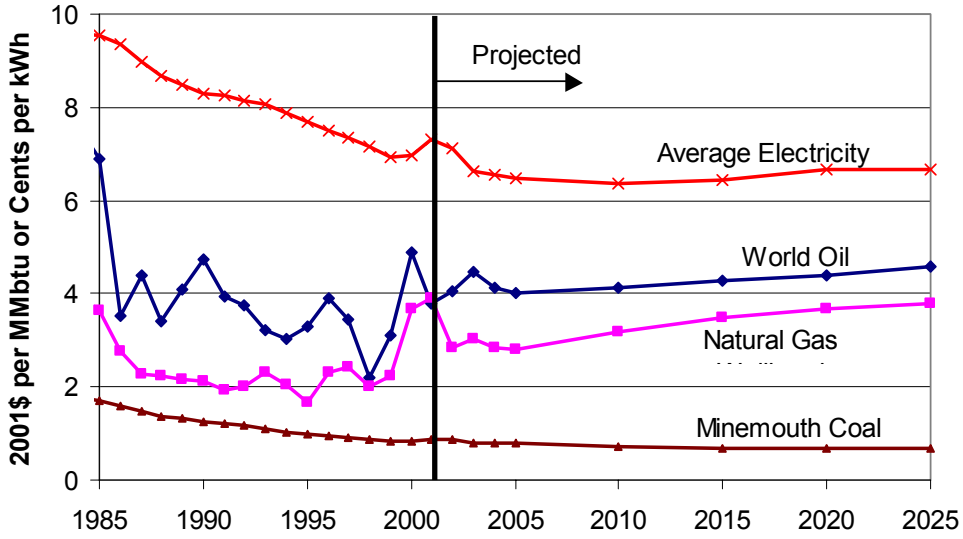


Figure 5. Projected Energy Prices

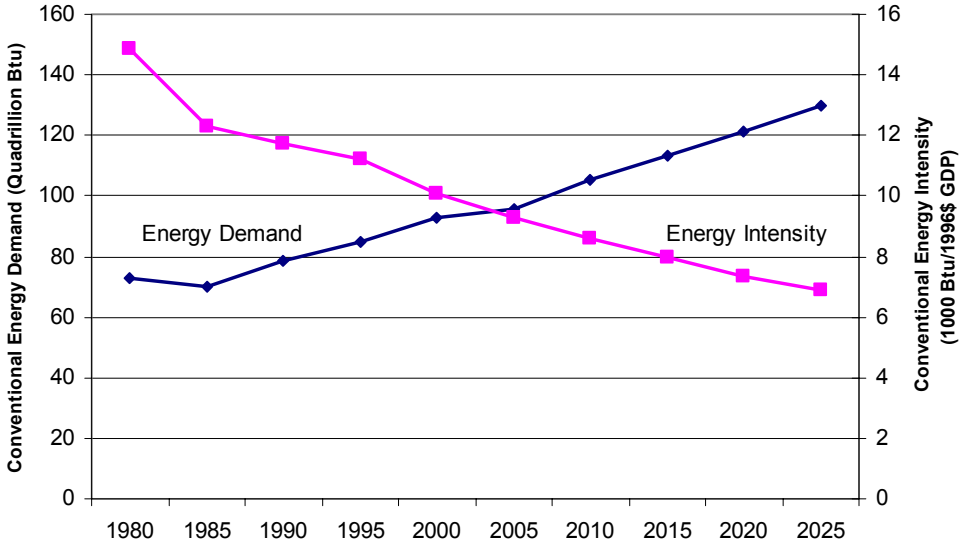


Figure 6. U.S. Conventional Energy Demand and Energy Intensity, 1980-2000, and Baseline Projections to 2025

[4] Energy intensity changes result from a mix of structural changes in the economy (e.g., growing service sector) and efficiency improvements. Two recent EERE-sponsored studies provide additional background on understanding the sources of changes to our energy intensity: Ortiz and Sollinger, *Shaping Our Future by Reducing Energy Intensity in the U.S. Economy; Volume 1: Proceedings of the Conference* (2003, Rand Corporation); and Bernstein, Fonkych, Loeb, and Loughran, "State-Level Changes in Energy Intensity and their National Implications (2003, Rand Corporation).

EERE NEMS-GPRA05 Baseline Case Tables

Table 1. Total Energy Supply and Disposition Summary
(Quadrillion Btu per Year, Unless Otherwise Noted)

The Worksheet was generated by ftab
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	2005	2010	2015	2020	2025
Production					
Crude Oil & Lease Condensate	11.82	11.92	11.10	11.56	11.26
Natural Gas Plant Liquids	2.95	3.16	3.41	3.58	3.76
Dry Natural Gas	20.68	22.42	24.45	25.70	27.47
Coal	23.32	25.32	26.36	27.49	28.94
Nuclear Power	8.28	8.36	8.41	8.43	8.43
Renewable Energy 1/	6.59	7.15	7.66	8.20	8.67
Other 2/	0.83	0.84	0.74	0.80	0.80
Total	74.46	79.16	82.13	85.76	89.33
Imports					
Crude Oil 3/	22.34	25.09	26.94	27.62	28.52
Petroleum Products 4/	4.21	6.42	9.56	12.02	15.18
Natural Gas	4.54	5.50	5.94	7.28	8.44
Other Imports 5/	0.79	0.90	0.98	0.97	0.94
Total	31.88	37.91	43.42	47.89	53.08
Exports					
Petroleum 6/	2.05	2.24	2.26	2.35	2.40
Natural Gas	0.59	0.61	0.54	0.41	0.37
Coal	1.00	0.91	0.81	0.74	0.67
Total	3.64	3.76	3.60	3.50	3.45
Discrepancy 7/	-0.26	0.20	0.22	0.24	0.18
Consumption					
Petroleum Products 8/	39.75	44.63	48.92	52.65	56.59
Natural Gas	25.24	27.68	30.24	32.97	35.94
Coal	22.80	25.00	26.23	27.48	29.07
Nuclear Power	8.28	8.36	8.41	8.43	8.43
Renewable Energy 1/	6.59	7.15	7.66	8.20	8.67
Other 9/	0.30	0.30	0.27	0.18	0.07
Total	102.97	113.11	121.73	129.92	138.78
Net Imports - Petroleum	24.51	29.27	34.24	37.30	41.29
Prices (2001 dollars per unit)					
World Oil Price ($ per bbl) 10/	23.27	23.99	24.72	25.48	26.57
Gas Wellhead Price($ / Mcf) 11/	2.88	3.28	3.57	3.76	3.89
Coal Minemouth Price ($ / ton)	16.44	14.96	14.64	14.28	14.27
Aver. Electricity (cents / Kwh)	6.49	6.35	6.46	6.67	6.67

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, heat loss when natural gas is converted to liquid fuel, and heat loss when coal is converted to liquid fuel.

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

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

10/ Average refiner acquisition cost for imported crude oil.

11/ Represents lower 48 onshore and offshore supplies.

Table 2. Energy Consumption by Sector and Source
(Quadrillion Btu per Year, Unless Otherwise Noted)

Energy Consumption	2005	2010	2015	2020	2025
Residential					
Distillate Fuel	0.92	0.89	0.85	0.81	0.78
Kerosene	0.08	0.08	0.07	0.06	0.06
Liquefied Petroleum Gas	0.47	0.46	0.45	0.46	0.46
Petroleum Subtotal	1.48	1.43	1.37	1.33	1.30
Natural Gas	5.46	5.67	5.86	6.11	6.40
Coal	0.01	0.01	0.01	0.01	0.01
Renewable Energy 1/	0.41	0.41	0.41	0.40	0.40
Electricity	4.53	4.93	5.25	5.58	5.91
Delivered Energy	11.89	12.46	12.90	13.44	14.02
Electricity Related Losses	9.72	10.29	10.57	10.99	11.34
Total	21.61	22.75	23.47	24.44	25.37
Commercial					
Distillate Fuel	0.46	0.48	0.48	0.48	0.49
Residual Fuel	0.04	0.04	0.05	0.05	0.05
Kerosene	0.02	0.02	0.02	0.02	0.02
Liquefied Petroleum Gas	0.09	0.09	0.09	0.09	0.10
Motor Gasoline 2/	0.03	0.03	0.03	0.04	0.04
Petroleum Subtotal	0.65	0.67	0.68	0.68	0.69
Natural Gas	3.61	3.78	3.99	4.30	4.64
Coal	0.09	0.10	0.10	0.11	0.11
Renewable Energy 3/	0.10	0.10	0.10	0.10	0.10
Electricity	4.46	4.97	5.53	6.09	6.65
Delivered Energy	8.91	9.61	10.39	11.27	12.19
Electricity Related Losses	9.56	10.38	11.13	11.99	12.77
Total	18.47	19.99	21.52	23.26	24.96
Industrial 4/					
Distillate Fuel	1.11	1.21	1.29	1.36	1.45
Liquefied Petroleum Gas	2.29	2.55	2.87	3.10	3.33
Petrochemical Feedstocks	1.27	1.43	1.58	1.70	1.82
Residual Fuel	0.17	0.19	0.19	0.20	0.20
Motor Gasoline 2/	0.15	0.17	0.18	0.18	0.20
Other Petroleum 5/	4.15	4.31	4.37	4.50	4.62
Petroleum Subtotal	9.14	9.86	10.47	11.05	11.62
Natural Gas 6/	8.35	9.12	9.76	10.36	11.20
Lease and Plant Fuel 7/	1.32	1.39	1.51	1.58	1.74
Natural Gas Subtotal 6/	9.67	10.51	11.27	11.95	12.93
Metallurgical Coal	0.68	0.66	0.60	0.55	0.50
Steam Coal	1.39	1.44	1.48	1.51	1.53
Net Coal Coke Imports	0.05	0.11	0.15	0.16	0.18
Coal Subtotal	2.13	2.22	2.23	2.22	2.21
Renewable Energy 8/	1.95	2.22	2.51	2.77	3.06
Electricity	3.47	3.95	4.34	4.64	5.02
Delivered Energy	26.35	28.76	30.83	32.63	34.83
Electricity Related Losses	7.43	8.25	8.73	9.14	9.63
Total	33.79	37.00	39.56	41.77	44.46

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 combined heat and power, which produces electricity and other useful thermal energy.

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

6/ Includes consumption for combined heat and power; excludes consumption by nonutility generators.

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

8/ Includes consumption of energy from hydroelectric, wood and wood waste, municipal solid waste, and other biomass; includes combined heat and power, both for sale to the grid and for own use.

Table 2. Energy Consumption by Sector and Source (Continued)

	2005	2010	2015	2020	2025
Transportation					
Distillate Fuel 9/	5.98	7.08	7.98	8.70	9.58
Jet Fuel 10/	3.41	3.93	4.50	5.09	5.66
Motor Gasoline 2/	17.65	20.09	22.25	24.05	25.91
Residual Fuel	0.82	0.83	0.84	0.85	0.87
Liquefied Petroleum Gas	0.04	0.06	0.07	0.08	0.09
Other Petroleum 11/	0.24	0.26	0.28	0.30	0.32
Petroleum Subtotal	28.15	32.24	35.92	39.08	42.44
Pipeline Fuel Natural Gas	0.66	0.78	0.85	0.91	1.02
Compressed Natural Gas 19/	0.03	0.06	0.08	0.10	0.11
Renewable Energy (E85) 12/	0.00	0.00	0.00	0.00	0.00
Liquid Hydrogen 20/	0.00	0.00	0.00	0.00	0.00
Electricity	0.08	0.09	0.11	0.12	0.14
Delivered Energy	28.93	33.17	36.96	40.21	43.72
Electricity Related Losses	0.18	0.19	0.21	0.24	0.27
Total	29.10	33.36	37.18	40.45	43.99
Electric Generators 15/					
Distillate Fuel	0.08	0.11	0.11	0.13	0.17
Residual Fuel	0.26	0.32	0.37	0.39	0.38
Petroleum Subtotal	0.34	0.42	0.48	0.52	0.56
Natural Gas	5.81	6.89	8.19	9.60	10.84
Steam Coal	20.57	22.67	23.88	25.15	26.73
Nuclear Power	8.28	8.36	8.41	8.43	8.43
Renewable Energy/Other 16/	4.13	4.43	4.65	4.92	5.11
Electricity Imports 17/	0.30	0.30	0.27	0.18	0.07
Total	39.43	43.06	45.87	48.80	51.74
Total Energy Consumption					
Distillate Fuel	8.56	9.78	10.70	11.49	12.47
Kerosene	0.12	0.12	0.12	0.11	0.10
Jet Fuel 10/	3.41	3.93	4.50	5.09	5.66
Liquefied Petroleum Gas	2.90	3.15	3.49	3.73	3.98
Motor Gasoline 2/	17.84	20.29	22.46	24.27	26.14
Petrochemical Feedstocks	1.27	1.43	1.58	1.70	1.82
Residual Fuel	1.29	1.38	1.45	1.49	1.50
Other Petroleum 13/	4.37	4.55	4.63	4.78	4.92
Petroleum Subtotal	39.75	44.63	48.92	52.65	56.59
Natural Gas	23.26	25.52	27.89	30.48	33.18
Lease and Plant Fuel 7/	1.32	1.39	1.51	1.58	1.74
Pipeline Natural Gas	0.66	0.78	0.85	0.91	1.02
Natural Gas Subtotal	25.24	27.68	30.24	32.97	35.94
Metallurgical Coal	0.68	0.66	0.60	0.55	0.50
Steam Coal	22.07	24.22	25.47	26.77	28.38
Net Coal Coke Imports	0.05	0.11	0.15	0.16	0.18
Coal Subtotal	22.80	25.00	26.23	27.48	29.07
Nuclear Power	8.28	8.36	8.41	8.43	8.43
Renewable Energy 18/	6.59	7.15	7.66	8.20	8.67
Liquid Hydrogen	0.00	0.00	0.00	0.00	0.00
Electricity Imports 17/	0.30	0.30	0.27	0.18	0.07
Total	102.97	113.11	121.73	129.92	138.78

2/ Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.
7/ Represents natural gas used in the field gathering and processing plant machinery.
9/ Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur.
10/ Includes only kerosene type.
11/ Includes aviation gas and lubricants.
12/ E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable).
13/ Includes unfinished oils, natural gasoline, motor gasoline blending compounds, aviation gasoline, lubricants, still gas, asphalt, road oil, petroleum coke, and miscellaneous petroleum products.
15/ Includes consumption of energy by electricity-only and combined heat and power (CHP) plants whose primary business is to sellelectricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
16/ Includes conventional hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes net electricity imports.
17/ 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.
18/ Includes hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, wind, photovoltaic and solar thermal sources. Includes ethanol components of E85; excludes ethanol blends (10 percent or less) in motor gasoline. Excludes net electricity imports and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
19/ Includes natural gas for hydrogen production.
20/ Hydrogen is not reported separately but rather as the fuel feedstock. See note 19.

Table 3. Energy Prices by Sector and Source
(2001 Dollars per Million Btu, Unless Otherwise Noted)

	2005	2010	2015	2020	2025
Residential	13.75	13.86	14.29	14.65	14.84
Primary Energy 1/	7.81	7.94	8.17	8.30	8.46
Petroleum Products 2/	9.72	9.88	10.30	10.68	10.99
Distillate Fuel	7.89	7.96	8.35	8.71	8.93
Liquefied Petroleum Gas	13.65	14.00	14.30	14.52	14.83
Natural Gas	7.31	7.47	7.69	7.80	7.96
Electricity	22.88	22.40	22.73	23.13	23.15
Commercial	13.07	13.25	13.84	14.50	14.65
Primary Energy 1/	6.00	6.34	6.61	6.79	6.98
Petroleum Products 2/	6.67	6.79	7.14	7.51	7.78
Distillate Fuel	5.58	5.66	6.08	6.49	6.75
Residual Fuel	3.91	4.01	4.12	4.23	4.38
Natural Gas 3/	5.99	6.38	6.65	6.80	6.99
Electricity	19.96	19.56	20.07	20.95	20.92
Industrial 4/	5.97	6.27	6.66	6.94	7.16
Primary Energy	4.77	5.07	5.45	5.65	5.87
Petroleum Products 2/	6.65	6.94	7.42	7.65	7.94
Distillate Fuel	5.62	5.73	6.28	6.82	7.24
Liquefied Petroleum Gas	9.28	9.58	9.90	10.13	10.40
Residual Fuel	3.60	3.71	3.82	3.94	4.10
Natural Gas 5/	3.52	3.88	4.20	4.37	4.56
Metallurgical Coal	1.58	1.51	1.46	1.40	1.35
Steam Coal	1.44	1.38	1.35	1.31	1.29
Electricity	12.78	12.69	12.88	13.48	13.57
Transportation	9.95	10.28	10.18	10.42	10.82
Primary Energy	9.93	10.26	10.15	10.40	10.79
Petroleum Products 2/	9.93	10.26	10.15	10.40	10.80
Distillate Fuel 6/	9.37	10.22	10.04	10.26	10.54
Jet Fuel 7/	5.62	5.62	5.97	6.38	6.72
Motor Gasoline 8/	11.33	11.53	11.34	11.61	12.08
Residual Fuel	3.45	3.55	3.66	3.77	3.94
Liquefied Petroleum Gas9/	14.84	15.19	15.45	15.53	15.61
Natural Gas 10/	6.09	7.05	7.55	7.79	8.02
Ethanol (E85) 11/	19.51	21.32	22.94	22.88	23.43
Electricity	19.81	19.08	18.87	18.62	17.95

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 combined heat and power.
5/ Excludes uses 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).

Table 3. Energy Prices by Sector and Source (Continued)

	2005	2010	2015	2020	2025
Average End-Use Energy	9.67	9.91	10.12	10.46	10.74
Primary Energy	7.68	8.05	8.21	8.47	8.79
Electricity	19.03	18.61	18.93	19.56	19.56
Electric Generators 12/					
Fossil Fuel Average	1.70	1.81	1.95	2.05	2.15
Petroleum Products	4.13	4.26	4.40	4.64	4.93
Distillate Fuel	5.03	5.12	5.59	5.99	6.17
Residual Fuel	3.86	3.96	4.06	4.19	4.38
Natural Gas	3.27	3.78	4.16	4.36	4.58
Steam Coal	1.22	1.17	1.15	1.12	1.10
Average Price to All Users 13/					
Petroleum Products 2/	9.15	9.48	9.54	9.81	10.18
Distillate Fuel	8.48	9.17	9.23	9.54	9.85
Jet Fuel	5.62	5.62	5.97	6.38	6.72
Liquefied Petroleum Gas	10.15	10.40	10.66	10.85	11.09
Motor Gasoline 8/	11.32	11.53	11.34	11.61	12.08
Residual Fuel	3.57	3.68	3.80	3.92	4.09
Natural Gas	4.73	5.03	5.28	5.41	5.57
Coal	1.24	1.18	1.16	1.13	1.12
Ethanol (E85) 11/	19.51	21.32	22.94	22.88	23.43
Electricity	19.03	18.61	18.93	19.56	19.56
Non-Renewable Energy Expenditures by Sector (billion 2001 dollars)					
Residential	157.97	167.02	178.54	191.05	202.08
Commercial	115.11	126.06	142.42	162.02	177.13
Industrial	118.70	135.36	154.28	171.02	188.98
Transportation	281.32	333.00	367.43	409.71	461.82
Total Non-Renewable Expenditures	673.10	761.44	842.67	933.79	1030.01
Transportation Renewable Expenditures	0.03	0.05	0.07	0.09	0.11
Total Expenditures	673.13	761.49	842.73	933.88	1030.12

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

12/ Includes all electric power generators except combined heat and power, 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.

Table 4. Electricity Supply, Disposition, Prices, and Emissions
(Billion Kilowatthours, Unless Otherwise Noted)

	2005	2010	2015	2020	2025
Generation by Fuel Type					
Electric Power Sector 1/					
Power Only 2/					
Coal	1988	2191	2325	2471	2659
Petroleum	31	39	44	48	54
Natural Gas 3/	511	702	938	1139	1333
Nuclear Power	793	800	805	807	807
Pumped Storage/Other	-1	-1	-1	-1	-1
Renewable Sources 4/	367	379	388	398	406
Distributed Gen (Natural Gas)	0	2	4	7	12
Non-Utility Gen for Own Use	-24	-24	-24	-24	-24
Total	3666	4089	4479	4847	5248
Combined Heat and Power 5/					
Coal	30	33	33	33	33
Petroleum	3	4	4	4	4
Natural Gas	176	167	151	156	153
Renewable Sources	4	4	4	4	4
Non-Utility Gen for Own Use	-18	-18	-18	-18	-18
Total	196	190	174	179	176
Net Available to the Grid	3861	4279	4654	5026	5424
End-Use Sector Generation 6/					
Combined Heat and Power					
Coal	23	23	23	23	23
Petroleum	6	6	6	6	6
Natural Gas	98	114	130	159	201
Other Gaseous Fuels 7/	7	7	7	7	8
Renewable Sources 4/	34	39	45	50	56
Other 8/	11	11	11	11	11
Total	180	201	222	257	305
Other End-Use Generators 9/	6	6	6	9	23
Generation for Own Use	-148	-160	-173	-200	-248
Total Sales to the Grid	37	47	55	66	80
Net Imports	29	29	26	17	7

1/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.
2/ Includes plants that only produce electricity.
3/ Includes electricity generation from fuel cells.
4/ Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power.
5/ Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report NAICS code 22).
6/ Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors.
7/ Other gaseous fuels include refinery and still gas.
8/ Other includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.
9/ Other end-use generators include 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.

Table 4. Electricity Supply, Disposition, Prices, and Emissions (Continued)

	2005	2010	2015	2020	2025
Electricity Sales by Sector					
Residential	1328	1445	1539	1636	1732
Commercial	1307	1458	1620	1784	1950
Industrial	1016	1158	1272	1361	1470
Transportation	24	27	31	36	42
Total	3676	4089	4461	4817	5194
End-Use Prices 10/ (2001 cents per kilowatthou					
Residential	7.8	7.6	7.8	7.9	7.9
Commercial	6.8	6.7	6.8	7.1	7.1
Industrial	4.4	4.3	4.4	4.6	4.6
Transportation	6.8	6.5	6.4	6.4	6.1
All Sectors Average	6.5	6.4	6.5	6.7	6.7
Prices by Service Category 10/					
(2001 cents per kilowatthour)					
Generation	3.9	3.8	4.0	4.2	4.2
Transmission	0.6	0.6	0.6	0.6	0.6
Distribution	2.0	2.0	1.9	1.9	1.9
Emissions					
Sulfur Dioxide (million tons)	10.67	9.55	8.95	8.95	8.95
Nitrogen Oxide (million tons)	3.60	3.93	4.00	4.07	4.13
Mercury (tons)	49.31	51.22	51.19	51.85	52.61

10/ Prices represent average revenue per kilowatthour.

Table 5. Electricity Generating Capacity
(Gigawatts)

	2005	2010	2015	2020	2025
Electric Power Sector 2/					
Power Only 3/					
Coal Steam	303.1	306.6	321.1	339.2	364.1
Other Fossil Steam 4/	118.3	81.5	76.8	75.2	74.3
Combined Cycle	103.3	143.1	194.3	221.3	260.8
Combustion Turbine/Diesel	126.0	120.5	125.3	129.8	131.8
Nuclear Power 5/	100.2	99.3	99.5	99.6	99.6
Pumped Storage	19.6	19.4	19.2	19.2	19.1
Fuel Cells	0.0	0.1	0.2	0.2	0.2
Renewable Sources 6/	92.2	93.3	94.7	96.1	97.3
Distributed Gen (Nat Gas) 7/	1.8	8.6	18.6	32.9	55.6
Total	864.5	872.4	949.7	1013.5	1102.7
Combined Heat and Power 8/					
Coal Steam	5.2	5.1	5.1	5.1	5.1
Other Fossil Steam	1.2	1.2	1.2	1.2	1.2
Combined Cycle	31.2	31.0	31.0	31.0	31.0
Combustion Turbine/Diesel	5.2	5.2	5.2	5.2	5.2
Renewable Sources	0.2	0.2	0.2	0.2	0.2
Total	43.0	42.8	42.8	42.8	42.8
Total Electric Power Industry	907.5	915.2	992.5	1056.3	1145.5
Cumulative Planned Additions 9/					
Coal Steam	0.0	0.0	0.0	0.0	0.0
Other Fossil Steam	0.0	0.0	0.0	0.0	0.0
Combined Cycle	63.1	63.1	63.1	63.1	63.1
Combustion Turbine/Diesel	27.8	27.8	27.8	27.8	27.8
Nuclear Power	0.0	0.0	0.0	0.0	0.0
Pumped Storage	0.3	0.3	0.3	0.3	0.3
Fuel Cells	0.0	0.1	0.2	0.2	0.2
Renewable Sources	3.8	4.9	5.8	6.4	6.5
Distributed Generation	0.0	0.0	0.0	0.0	0.0
Total	95.0	96.2	97.2	97.8	98.0
Cumulative Unplanned Additions 9/					
Coal Steam	0.0	7.1	22.1	41.5	67.4
Other Fossil Steam	0.0	0.0	0.0	0.0	0.0
Combined Cycle	4.0	44.1	95.3	122.3	161.8
Combustion Turbine/Diesel	3.7	6.5	12.4	19.1	24.3
Nuclear Power	0.0	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0	0.0
Renewable Sources	0.3	1.2	2.1	3.2	4.4
Distributed Generation	1.8	8.6	18.6	32.9	55.6
Total	9.7	67.5	150.5	219.1	313.5
Cumulative Total Additions	104.7	163.7	247.7	316.9	411.4
Cumulative Retirements 10/					
Coal Steam	2.1	5.8	6.3	7.6	8.7
Other Fossil Steam	14.0	50.8	55.5	57.1	58.0
Combined Cycle	0.0	0.5	0.5	0.5	0.5
Combustion Turbine/Diesel	3.0	11.3	12.4	14.7	17.8
Nuclear Power	0.0	1.8	2.8	2.8	2.8
Pumped Storage	0.0	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0	0.0
Renewable Sources	0.1	0.1	0.1	0.1	0.1
Total	19.2	70.4	77.7	82.8	88.0

1/ Net summer capacity is the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power), as demonstrated by tests during summer peak demand.

2/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.

3/ Includes plants that only produce electricity. Includes capacity increases (uprates) at existing units.

4/ Includes oil-, gas-, and dual-fired capacity.

5/ Nuclear capacity reflects operating capacity of existing units, including 4.3 gigawatts of uprates through 2025.

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

7/ Primarily peak-load capacity fueled by natural gas.

8/ Includes combined heat and power plants whose primary business is to sell electricity and heat to the public

Table 5. Electricity Generating Capacity (Continued)

	2005	2010	2015	2020	2025
End-Use Sector Generators 11/					
Combined Heat and Power					
Coal	4.8	4.8	4.8	4.8	4.8
Petroleum	1.0	1.0	1.0	1.0	1.0
Natural Gas	16.0	18.2	20.3	24.3	30.1
Other Gaseous Fuels	2.2	2.2	2.2	2.2	2.3
Renewable Sources	5.2	6.2	7.2	8.0	9.0
Other	0.7	0.7	0.7	0.7	0.7
Total	29.9	33.0	36.1	41.0	47.9
Other End-Use Generators 12/	0.0	0.0	0.0	0.0	0.0
Renewable Sources	1.7	1.7	1.7	3.2	10.1
Cumulative Additions 9/					
Combined Heat and Power	2.3	5.4	8.5	13.4	20.3
Other End-Use Generators	0.5	0.5	0.5	1.9	8.9

9/ Cumulative additions after December 31, 1999.

11/ Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors.

12/ Other end-use generators include 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.

Table 6. Carbon Dioxide Emissions by Sector and Source
(Million Metric Tons Carbon Equivalent, Unless Otherwise Noted)

	2005	2010	2015	2020	2025
Residential					
Petroleum	27.9	27.0	25.9	25.0	24.4
Natural Gas	78.7	81.7	84.4	88.0	92.1
Coal	0.4	0.4	0.4	0.4	0.3
Electricity	222.8	243.4	255.0	269.6	284.4
Total	329.8	352.5	365.7	383.0	401.3
Commercial					
Petroleum	12.6	13.0	13.2	13.3	13.4
Natural Gas	52.0	54.4	57.4	61.9	66.8
Coal	2.3	2.5	2.6	2.7	2.8
Electricity	219.3	245.5	268.5	293.9	320.2
Total	286.2	315.4	341.6	371.8	403.2
Industrial 1/					
Petroleum	93.3	98.7	102.4	106.9	110.8
Natural Gas 2/	136.9	148.8	159.5	169.1	183.0
Coal	53.9	56.2	56.6	56.2	56.2
Electricity	170.5	195.0	210.8	224.1	241.3
Total	454.6	498.7	529.3	556.3	591.4
Transportation					
Petroleum 3/	538.1	616.4	686.8	747.2	811.5
Natural Gas 4/	10.0	12.0	13.4	14.5	16.3
Other 5/	0.0	0.0	0.0	0.0	0.0
Electricity	4.0	4.6	5.2	5.9	6.8
Total 3/	552.2	633.1	705.4	767.6	834.6
Total by Delivered Fuel					
Petroleum 3/	671.9	755.2	828.3	892.4	960.1
Natural Gas	277.6	296.9	314.8	333.5	358.2
Coal	56.6	59.0	59.6	59.3	59.3
Other 5/	0.0	0.0	0.0	0.0	0.0
Electricity	616.6	688.5	739.4	793.6	852.8
Total 3/	1622.7	1799.6	1942.0	2078.7	2230.4
Electric Power Sector 6/					
Petroleum	7.1	8.9	10.0	10.8	11.5
Natural Gas	83.6	99.3	117.9	138.3	156.1
Coal	525.9	580.4	611.5	644.5	685.2
Total	616.6	688.5	739.4	793.6	852.8
Total by Primary Fuel 7/					
Petroleum 3/	679.0	764.0	838.2	903.2	971.7
Natural Gas	361.2	396.1	432.7	471.8	514.3
Coal	582.5	639.4	671.0	703.8	744.5
Other 5/	0.0	0.0	0.0	0.0	0.0
Total 3/	1622.7	1799.6	1942.0	2078.7	2230.4

1/ Fuel consumption includes energy for combined heat and power plants, except those plants whose primary business is to sell electricity, or electricity and heat, to the public.

2/ Includes lease and plant fuel.

3/ This includes international bunker fuel, which by convention are excluded from the international accounting of carbon dioxide emissions. In the years from 1990 through 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.

6/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. 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 the electric power sector are distributed to the primary fuels.