

CHAPTER 13. UTILITY IMPACT ANALYSIS

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CHAPTER 13. UTILITY IMPACT ANALYSIS

13.1 INTRODUCTION

DOE analyzed the effects of residential heating products standard levels on the electric and gas utility industry using a variant of the DOE/Energy Information Administration (EIA)'s National Energy Modeling System (NEMS).^a NEMS is a public domain, multi-sectored, partial equilibrium model of the U.S. energy sector. Each year, DOE/EIA uses NEMS to produce a baseline energy forecast for the United States, the *Annual Energy Outlook (AEO)*. The *AEO* for 2009 (*AEO2009*) forecasts energy supply and demand through 2030.¹ DOE used a variant of this model, referred to here as NEMS-BT,^b to account for the impacts of heating products energy conservation standards on the baseline energy forecast. DOE's utility impact analysis consists of a comparison between model results for the *AEO2009* Reference Case and for policy cases in which standards are in place, and applies the same basic set of assumptions as the *AEO2009*.

The utility impact analysis reports the changes in electric installed capacity and generation that result for each trial standard level (TSL) by plant type, as well as changes in residential electricity and natural gas consumption. The *AEO2009* reference case corresponds to medium economic growth. See appendix 13A for high and low growth forecast results.

NEMS-BT has several advantages that have led to its adoption as the forecasting tool in the analysis of energy conservation standards. NEMS-BT uses a set of assumptions that are well known and fairly transparent, due to the exposure and scrutiny each *AEO* receives. In addition, the comprehensiveness of NEMS-BT permits the modeling of interactions among the various energy supply and demand sectors, producing a complete picture of the effects of energy conservation standards. Perhaps most importantly, NEMS-BT can be used to estimate marginal effects, which yield a better estimate of the actual impact of energy conservation standards than considering only average effects.

13.2 METHOD

^a For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003*, DOE/EIA-0581(2003), March, 2003.

^b DOE/EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on DOE/EIA assumptions, DOE refers to it by the name NEMS-BT (BT is DOE's Building Technologies Program, under whose aegis this work has been performed). NEMS-BT was previously called NEMS-BRS.

The utility impact analysis uses the assumptions of the *AEO2009* and treats water heater, direct heating equipment, and pool heater energy conservation standards as variations in policy. The effects of the policy are calculated as the difference between the *AEO2009* Reference Case and each proposed standard case.

DOE used the national energy savings developed in the national impact analysis (chapter 10) for each TSL as input to NEMS-BT. The magnitude of the energy decrement that would be required for NEMS-BT to produce stable results out of the range of numerical noise is larger than the highest efficiency standard under consideration. Therefore, DOE estimated results corresponding to each TSL using interpolation. DOE ran higher energy use reduction levels in NEMS-BT, representing multipliers of each TSL, and used these outputs to linearly interpolate the results to estimate actual changes in generation and capacity due to the standard.

Policy runs are executed by reducing electricity and natural gas consumption in the NEMS-BT Residential Demand Module. Energy use reductions are applied to the residential water heating end use for water heaters and pool heaters and to the residential heating end use for direct heating equipment. The savings are also divided evenly amongst the nine U.S. Census divisions, such that each census division receives the same exact quantity of energy savings.

Although the current time horizon of NEMS-BT is 2030, other parts of the residential heating products energy conservation standards analysis extend to the year 2045 for water heaters, and 2043 for direct heating equipment and pool heaters. It is not feasible to extend the forecast period of NEMS-BT for the purposes of this analysis, nor does DOE/EIA have an approved method for extrapolation of many outputs beyond 2030. While it might seem reasonable to make simple linear extrapolations of results, in practice this is not advisable because outputs could be contradictory. For example, changes in the fuel mix implied by extrapolations of those outputs could be inconsistent with the extrapolation of marginal emissions factors. An analysis of various trends sufficiently detailed to guarantee consistency is beyond the scope of this work, and, in any case, would involve a great deal of uncertainty. Therefore, all extrapolations beyond 2030 are simple replications of year 2030 results. While this may seem unreasonable in some instances, in this way results are guaranteed to be consistent. To emphasize the extrapolated results wherever they appear, they are shaded in gray to distinguish them from actual NEMS-BT results.

13.3 RESULTS

The utility impact analysis reports NEMS-BT forecasts for residential-sector energy consumption, total electricity generation by fuel type, and installed capacity by fuel type. Results are presented in five-year increments to year 2030. Beyond year 2030, an extrapolation to 2045 for water heaters, and 2043 for direct heating equipment and pool heaters for each proposed TSL represents a simple replication of the year 2030 results.

The results from the *AEO2009* Reference Case are shown in Table 13.4.1.

A separate set of TSLs is modeled for each product. The results from the water heater TSLs are presented in Tables 13.4.2 through 13.4.9, the results from the direct heating equipment TSLs are presented in Tables 13.4.10 through 13.4.15, and the results from the pool heater TSLs are presented in Tables 13.4.16 through 13.4.21. Each table shows forecasts using interpolated results, as described in section 13.3, for total U.S. electricity generation and installed capacity.

The proposed residential water heater TSLs reduce both electricity and natural gas consumption compared to the *AEO2009* Reference Case. Water heaters provide the most significant energy savings of all the residential heating products. The electricity savings predicted by the NIA Model range from 0.10 to 4.08 percent of total residential electricity consumption by year 2030. The natural gas savings predicted by the NIA model range from 0.53 to 4.19 percent of total residential natural gas consumption by year 2030.

The proposed direct heating equipment TSLs reduce natural gas consumption, but modest increases can be seen in residential electricity consumption compared to the *AEO2009* Reference Case. The natural gas savings predicted by the NIA model range from 0.14 to 0.86 percent of total residential natural gas consumption by year 2030. The impacts on electricity increase use by a range of 0.00 to 0.02 percent of total residential electricity consumption by year 2030.

The proposed pool heater TSLs reduce natural gas consumption, changes in electricity consumption are negligible compared to the *AEO2009* Reference Case. The natural gas savings predicted by the NIA model range from 0.01 to 0.14 percent of total residential natural gas consumption by year 2030. Changes in electricity consumption are less than 0.00 percent of total residential electricity consumption by the year 2030.

Table 13.3.1 AEO2009 Reference Case Forecast

NEMS-BT Results: AEO2009 Reference						
	2005	2010	2015	2020	2025	2030
<i>Residential Sector Energy Consumption</i> ¹						
Electricity Sales (TWh) ²	1,359	1,403	1,407	1,477	1,571	1,661
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.32	5.28
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00
Other (Quads) ³	1.88	1.77	1.65	1.63	1.61	1.60
<i>Total U.S. Electric Generation</i> ⁴						
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305
Gas (TWh)	753	775	647	714	908	979
Petroleum (TWh)	123	56	47	49	49	50
Nuclear (TWh)	782	809	831	876	881	890
Renewables (TWh)	357	468	645	707	771	797
Total (TWh) ⁵	4,029	4,130	4,308	4,544	4,812	5,021
<i>Installed Generating Capacity</i> ⁶						
Coal (GW)	314	325	331	333	334	345
Other Fossil (GW) ⁷	439	471	443	452	499	542
Nuclear (GW)	100	101	104	110	110	110
Renewables (GW)	100	134	171	176	182	188
Total (GW) ⁸	952	1,030	1,049	1,072	1,126	1,185
<i>Residential Average Energy Prices</i> ⁹						
Electricity (¢/kWh)	10.00	9.77	10.55	11.08	11.24	11.79
Natural Gas (\$/GJ)	12.39	10.61	10.75	11.90	12.00	13.27
Petroleum Products (\$/GJ)	16.57	12.66	20.46	23.24	23.84	25.48
Natural Gas (\$/MBtu)	13.07	11.19	11.34	12.56	12.66	14.00
Petroleum Products (\$/MBtu)	17.48	13.36	21.59	24.52	25.15	26.88

¹Comparable to Table A2 of AEO2009: Energy Consumption, Residential²Comparable to Table A8 of AEO2009: Electricity Sales by Sector³Includes distillate fuel, commercial fuel, kerosene, LPG, motor gasoline, coal, and renewable energy⁴Comparable to Table A8 of AEO2009: Electric Generators and Cogenerators⁵Excludes "Other Gaseous Fuels" cogenerators and "Other" cogenerators⁶Comparable to Table A9 of AEO2009: Electric Generators and Cogenerators Capability⁷Includes "Other Gaseous Fuels" cogenerators⁸Excludes Pumped Storage and Fuel Cells⁹Comparable to Table A3 of AEO2009: Residential

Table 13.3.2 Water Heaters Trial Standard Level 1 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case												
	2005	2010	2015	2020	2025	2030		2005	2010	2014	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,359	1,403	1,407	1,476	1,570	1,659	Electricity Sales (TWh)	0.00	0.00	0.00	-0.14	-0.84	-1.43	-1.71	-1.80	-1.84	-1.87		
Natural Gas (EJ)	5.23	5.34	5.21	5.25	5.29	5.25	Natural Gas (EJ)	0.000	0.000	0.000	-0.002	-0.014	-0.023	-0.028	-0.030	-0.031	-0.032		
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002		
Natural Gas (Quads)	4.96	5.06	4.94	4.98	5.02	4.97	Natural Gas (Quads)	0.000	0.000	0.000	-0.002	-0.013	-0.022	-0.027	-0.028	-0.029	-0.030		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002		
Total U.S. Electric Generation							Total U.S. Electric Generation												
Coal (TWh)	2,014	2,022	2,138	2,198	2,202	2,304	Coal (TWh)	0.00	-0.10	-0.07	-0.23	-0.41	-0.88	-1.30	-1.30	-1.30	-1.30		
Gas (TWh)	753	775	647	713	907	978	Gas (TWh)	0.00	0.00	0.19	0.10	-0.55	-0.85	-0.57	-0.57	-0.57	-0.57		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	-0.11	-0.14	-0.33	-0.33	-0.33	-0.33		
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	-0.03	-0.16	-0.17	-0.27	-0.43	-0.39	-0.39	-0.39	-0.39		
Total (TWh)	4,029	4,130	4,308	4,543	4,810	5,018	Total (TWh)	0.00	-0.13	-0.01	-0.30	-1.35	-2.27	-2.58	-2.58	-2.58	-2.58		
Installed Generating Capacity							Installed Generating Capacity												
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.4	Coal (GW)	0.000	0.000	-0.034	-0.039	-0.036	-0.036	-0.165	-0.165	-0.165	-0.165		
Other Fossil (GW)	438.9	470.5	443.3	451.8	499.4	542.5	Other Fossil (GW)	0.000	-0.002	0.092	0.103	0.031	-0.030	0.097	0.097	0.097	0.097		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	-0.020	-0.020	-0.040	-0.040	-0.040	-0.040		
Renewables (GW)	99.5	133.5	171.0	176.0	182.2	188.2	Renewables (GW)	0.000	0.000	-0.053	-0.054	-0.053	-0.051	-0.061	-0.061	-0.061	-0.061		
Total (GW)	952.3	1,030.2	1,049.4	1,071.4	1,125.8	1,185.1	Total (GW)	0.000	-0.002	0.005	0.010	-0.078	-0.137	-0.168	-0.168	-0.168	-0.168		

Table 13.3.3 Water Heaters Trial Standard Level 2 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case											
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption											
Electricity Sales (TWh)	1,359	1,403	1,407	1,476	1,569	1,659	Electricity Sales (TWh)	0.00	0.00	-0.17	-1.06	-1.80	-2.16	-2.28	-2.33	-2.36		
Natural Gas (EJ)	5.23	5.34	5.21	5.24	5.28	5.23	Natural Gas (EJ)	0.000	0.000	-0.004	-0.023	-0.039	-0.047	-0.050	-0.051	-0.053		
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.68	Other (EJ)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004		
Natural Gas (Quads)	4.96	5.06	4.94	4.97	5.00	4.96	Natural Gas (Quads)	0.000	0.000	-0.004	-0.022	-0.037	-0.044	-0.047	-0.049	-0.050		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.004	-0.004		
Total U.S. Electric Generation							Total U.S. Electric Generation											
Coal (TWh)	2,014	2,022	2,138	2,197	2,202	2,303	Coal (TWh)	0.00	-0.16	-0.37	-0.66	-1.42	-2.08	-2.08	-2.08	-2.08		
Gas (TWh)	753	775	647	713	907	978	Gas (TWh)	0.00	-0.01	0.16	-0.89	-1.37	-0.91	-0.91	-0.91	-0.91		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	889	Nuclear (TWh)	0.00	0.00	0.00	-0.18	-0.22	-0.53	-0.53	-0.53	-0.53		
Renewables (TWh)	357	468	645	707	770	796	Renewables (TWh)	0.00	-0.05	-0.27	-0.43	-0.69	-0.62	-0.62	-0.62	-0.62		
Total (TWh)	4,029	4,130	4,308	4,542	4,808	5,017	Total (TWh)	0.00	-0.21	-0.49	-2.17	-3.65	-4.13	-4.13	-4.13	-4.13		
Installed Generating Capacity							Installed Generating Capacity											
Coal (GW)	313.8	325.0	330.9	333.2	333.8	344.3	Coal (GW)	0.000	0.000	-0.063	-0.058	-0.058	-0.263	-0.263	-0.263	-0.263		
Other Fossil (GW)	438.9	470.5	443.4	451.8	499.4	542.6	Other Fossil (GW)	0.000	-0.004	0.167	0.050	-0.048	0.155	0.155	0.155	0.155		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	109.9	Nuclear (GW)	0.000	0.000	0.000	-0.033	-0.033	-0.064	-0.064	-0.064	-0.064		
Renewables (GW)	99.5	133.5	171.0	176.0	182.2	188.2	Renewables (GW)	0.000	0.000	-0.088	-0.085	-0.081	-0.098	-0.098	-0.098	-0.098		
Total (GW)	952.3	1,030.2	1,049.4	1,071.4	1,125.7	1,185.0	Total (GW)	0.000	-0.004	0.016	-0.126	-0.220	-0.270	-0.270	-0.270	-0.270		

Table 13.3.4 Water Heaters Trial Standard Level 3 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,475	1,567	1,657	Electricity Sales (TWh)	0.00	0.00	-0.36	-2.18	-3.71	-4.45	-4.69	-4.80	-4.86
Natural Gas (EJ)	5.23	5.34	5.21	5.24	5.28	5.23	Natural Gas (EJ)	0.000	0.000	-0.004	-0.023	-0.039	-0.047	-0.050	-0.051	-0.053
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.68	Other (EJ)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004
Natural Gas (Quads)	4.96	5.06	4.94	4.97	5.00	4.96	Natural Gas (Quads)	0.000	0.000	-0.004	-0.022	-0.037	-0.044	-0.047	-0.049	-0.050
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,197	2,201	2,303	Coal (TWh)	0.00	-0.18	-0.42	-0.76	-1.62	-2.38	-2.38	-2.38	-2.38
Gas (TWh)	753	775	647	713	906	978	Gas (TWh)	0.00	-0.01	0.18	-1.02	-1.57	-1.04	-1.04	-1.04	-1.04
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	881	889	Nuclear (TWh)	0.00	0.00	0.00	-0.21	-0.25	-0.61	-0.61	-0.61	-0.61
Renewables (TWh)	357	468	645	707	770	796	Renewables (TWh)	0.00	-0.05	-0.31	-0.50	-0.79	-0.71	-0.71	-0.71	-0.71
Total (TWh)	4,029	4,130	4,307	4,542	4,808	5,016	Total (TWh)	0.00	-0.24	-0.56	-2.48	-4.18	-4.73	-4.73	-4.73	-4.73
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	330.9	333.2	333.8	344.3	Coal (GW)	0.000	0.000	-0.072	-0.066	-0.066	-0.301	-0.301	-0.301	-0.301
Other Fossil (GW)	438.9	470.5	443.4	451.9	499.3	542.6	Other Fossil (GW)	0.000	-0.004	0.190	0.057	-0.055	0.178	0.178	0.178	0.178
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	109.9	Nuclear (GW)	0.000	0.000	0.000	-0.037	-0.037	-0.073	-0.073	-0.073	-0.073
Renewables (GW)	99.5	133.5	171.0	176.0	182.2	188.2	Renewables (GW)	0.000	0.000	-0.100	-0.097	-0.093	-0.112	-0.112	-0.112	-0.112
Total (GW)	952.3	1,030.2	1,049.4	1,071.4	1,125.6	1,185.0	Total (GW)	0.000	-0.004	0.019	-0.144	-0.252	-0.309	-0.309	-0.309	-0.309

Table 13.3.5 Water Heaters Trial Standard Level 4 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case											
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption											
Electricity Sales (TWh)	1,359	1,403	1,406	1,474	1,566	1,655	Electricity Sales (TWh)	0.00	0.00	-0.51	-3.07	-5.23	-6.27	-6.62	-6.76	-6.85		
Natural Gas (EJ)	5.23	5.34	5.21	5.24	5.28	5.23	Natural Gas (EJ)	0.000	0.000	-0.004	-0.023	-0.039	-0.047	-0.050	-0.051	-0.053		
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.68	Other (EJ)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004		
Natural Gas (Quads)	4.96	5.06	4.94	4.97	5.00	4.96	Natural Gas (Quads)	0.000	0.000	-0.004	-0.022	-0.037	-0.044	-0.047	-0.049	-0.050		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004		
Total U.S. Electric Generation							Total U.S. Electric Generation											
Coal (TWh)	2,014	2,022	2,138	2,197	2,201	2,302	Coal (TWh)	0.00	-0.20	-0.47	-0.83	-1.78	-2.61	-2.61	-2.61	-2.61		
Gas (TWh)	753	775	647	713	906	978	Gas (TWh)	0.00	-0.01	0.20	-1.12	-1.72	-1.14	-1.14	-1.14	-1.14		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	889	Nuclear (TWh)	0.00	0.00	0.00	-0.23	-0.28	-0.67	-0.67	-0.67	-0.67		
Renewables (TWh)	357	468	645	706	770	796	Renewables (TWh)	0.00	-0.06	-0.34	-0.55	-0.87	-0.78	-0.78	-0.78	-0.78		
Total (TWh)	4,029	4,130	4,307	4,541	4,807	5,016	Total (TWh)	0.00	-0.27	-0.61	-2.73	-4.59	-5.20	-5.20	-5.20	-5.20		
Installed Generating Capacity							Installed Generating Capacity											
Coal (GW)	313.8	325.0	330.9	333.2	333.8	344.3	Coal (GW)	0.000	0.000	-0.079	-0.073	-0.073	-0.331	-0.331	-0.331	-0.331		
Other Fossil (GW)	438.9	470.5	443.4	451.9	499.3	542.6	Other Fossil (GW)	0.000	-0.004	0.209	0.063	-0.061	0.195	0.195	0.195	0.195		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	109.9	Nuclear (GW)	0.000	0.000	0.000	-0.041	-0.041	-0.080	-0.080	-0.080	-0.080		
Renewables (GW)	99.5	133.5	171.0	176.0	182.2	188.2	Renewables (GW)	0.000	0.000	-0.110	-0.107	-0.102	-0.123	-0.123	-0.123	-0.123		
Total (GW)	952.3	1,030.2	1,049.4	1,071.3	1,125.6	1,185.0	Total (GW)	0.000	-0.004	0.021	-0.158	-0.277	-0.339	-0.339	-0.339	-0.339		

Table 13.3.6 Water Heaters Trial Standard Level 5 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case												
	2005	2010	2015	2020	2025	2030		2005	2010	2014	2015	2020	2025	2030	Extrapolation				
															2035	2040	2044		
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>												
Electricity Sales (TWh)	1,359	1,403	1,406	1,472	1,563	1,651	Electricity Sales (TWh)	0.00	0.00	0.00	-0.81	-4.90	-8.34	-10.00	-10.55	-10.79	-10.94		
Natural Gas (EJ)	5.23	5.34	5.21	5.25	5.29	5.24	Natural Gas (EJ)	0.000	0.000	0.000	-0.003	-0.016	-0.027	-0.032	-0.034	-0.036	-0.037		
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003		
Natural Gas (Quads)	4.96	5.06	4.94	4.97	5.01	4.97	Natural Gas (Quads)	0.000	0.000	0.000	-0.003	-0.015	-0.025	-0.031	-0.033	-0.034	-0.035		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003		
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>												
Coal (TWh)	2,014	2,022	2,137	2,196	2,200	2,301	Coal (TWh)	0.00	-0.10	-0.18	-0.74	-1.96	-3.17	-3.62	-3.62	-3.62	-3.62		
Gas (TWh)	753	775	649	714	906	977	Gas (TWh)	0.00	-0.07	2.26	1.91	-0.47	-2.11	-2.42	-2.42	-2.42	-2.42		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	889	Nuclear (TWh)	0.00	0.00	0.00	0.00	-0.36	-0.44	-0.82	-0.82	-0.82	-0.82		
Renewables (TWh)	357	468	643	705	769	795	Renewables (TWh)	0.00	-0.18	-2.30	-2.30	-2.10	-2.46	-2.38	-2.38	-2.38	-2.38		
Total (TWh)	4,029	4,130	4,307	4,539	4,804	5,012	Total (TWh)	0.00	-0.35	-0.17	-1.13	-4.89	-8.13	-9.23	-9.23	-9.23	-9.23		
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>												
Coal (GW)	313.8	325.0	330.8	333.1	333.8	344.2	Coal (GW)	0.000	0.000	-0.158	-0.160	-0.153	-0.149	-0.401	-0.401	-0.401	-0.401		
Other Fossil (GW)	438.9	470.5	443.5	451.9	499.3	542.6	Other Fossil (GW)	0.000	-0.029	0.264	0.275	0.113	-0.126	0.152	0.152	0.152	0.152		
Nuclear (GW)	100.1	101.2	104.1	110.2	110.2	109.9	Nuclear (GW)	0.000	0.000	0.000	0.000	-0.061	-0.061	-0.101	-0.101	-0.101	-0.101		
Renewables (GW)	99.5	133.5	170.6	175.6	181.8	187.8	Renewables (GW)	0.000	-0.037	-0.534	-0.544	-0.537	-0.479	-0.471	-0.471	-0.471	-0.471		
Total (GW)	952.3	1,030.1	1,049.0	1,070.9	1,125.1	1,184.5	Total (GW)	0.000	-0.066	-0.427	-0.429	-0.638	-0.814	-0.821	-0.821	-0.821	-0.821		

Table 13.3.7 Water Heaters Trial Standard Level 6 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2044
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,406	1,472	1,563	1,651	Electricity Sales (TWh)	0.00	0.00	-0.79	-4.78	-8.13	-9.75	-10.29	-10.51	-10.66
Natural Gas (EJ)	5.23	5.34	5.21	5.24	5.27	5.22	Natural Gas (EJ)	0.000	0.000	-0.004	-0.025	-0.043	-0.051	-0.054	-0.056	-0.058
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.68	Other (EJ)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.005
Natural Gas (Quads)	4.96	5.06	4.94	4.97	5.00	4.95	Natural Gas (Quads)	0.000	0.000	-0.004	-0.024	-0.041	-0.049	-0.052	-0.053	-0.055
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,137	2,195	2,199	2,300	Coal (TWh)	0.00	-0.12	-0.95	-2.50	-4.04	-4.60	-4.60	-4.60	-4.60
Gas (TWh)	753	775	649	713	905	976	Gas (TWh)	0.00	-0.09	2.46	-0.60	-2.69	-3.08	-3.08	-3.08	-3.08
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	880	889	Nuclear (TWh)	0.00	0.00	0.00	-0.46	-0.57	-1.04	-1.04	-1.04	-1.04
Renewables (TWh)	357	468	642	704	768	794	Renewables (TWh)	0.00	-0.23	-2.96	-2.68	-3.14	-3.03	-3.03	-3.03	-3.03
Total (TWh)	4,029	4,130	4,307	4,538	4,802	5,009	Total (TWh)	0.00	-0.44	-1.45	-6.24	-10.36	-11.75	-11.75	-11.75	-11.75
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	330.8	333.1	333.7	344.1	Coal (GW)	0.000	0.000	-0.205	-0.196	-0.190	-0.510	-0.510	-0.510	-0.510
Other Fossil (GW)	438.9	470.5	443.6	451.9	499.2	542.6	Other Fossil (GW)	0.000	-0.037	0.353	0.145	-0.160	0.193	0.193	0.193	0.193
Nuclear (GW)	100.1	101.2	104.1	110.2	110.2	109.9	Nuclear (GW)	0.000	0.000	0.000	-0.078	-0.077	-0.129	-0.129	-0.129	-0.129
Renewables (GW)	99.5	133.5	170.4	175.4	181.7	187.7	Renewables (GW)	0.000	-0.047	-0.699	-0.686	-0.610	-0.599	-0.599	-0.599	-0.599
Total (GW)	952.3	1,030.1	1,048.8	1,070.7	1,124.9	1,184.3	Total (GW)	0.000	-0.085	-0.551	-0.815	-1.038	-1.045	-1.045	-1.045	-1.045

Table 13.3.8 Water Heaters Trial Standard Level 7 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2044
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,403	1,452	1,528	1,610	Electricity Sales (TWh)	0.00	0.00	-4.15	-25.11	-42.61	-50.93	-53.46	-54.38	-54.95
Natural Gas (EJ)	5.23	5.34	5.20	5.21	5.23	5.17	Natural Gas (EJ)	0.000	0.000	-0.009	-0.052	-0.088	-0.108	-0.117	-0.123	-0.128
Other (EJ)	1.98	1.87	1.74	1.72	1.69	1.68	Other (EJ)	0.000	0.000	-0.001	-0.004	-0.007	-0.008	-0.009	-0.009	-0.009
Natural Gas (Quads)	4.96	5.06	4.93	4.94	4.96	4.90	Natural Gas (Quads)	0.000	0.000	-0.008	-0.049	-0.084	-0.103	-0.111	-0.117	-0.121
Other (Quads)	1.88	1.77	1.65	1.63	1.60	1.59	Other (Quads)	0.000	0.000	-0.001	-0.004	-0.006	-0.008	-0.008	-0.009	-0.009
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,135	2,190	2,190	2,290	Coal (TWh)	0.00	-0.40	-3.07	-8.18	-13.32	-15.24	-15.24	-15.24	-15.24
Gas (TWh)	753	775	655	712	899	969	Gas (TWh)	0.00	-0.30	7.93	-1.98	-8.87	-10.18	-10.18	-10.18	-10.18
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	875	879	887	Nuclear (TWh)	0.00	0.00	0.00	-1.49	-1.86	-3.45	-3.45	-3.45	-3.45
Renewables (TWh)	357	467	635	698	761	787	Renewables (TWh)	0.00	-0.73	-9.54	-8.77	-10.35	-10.03	-10.03	-10.03	-10.03
Total (TWh)	4,029	4,129	4,303	4,524	4,778	4,982	Total (TWh)	0.00	-1.43	-4.69	-20.42	-34.15	-38.90	-38.90	-38.90	-38.90
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	330.3	332.7	333.3	342.9	Coal (GW)	0.000	0.000	-0.661	-0.641	-0.627	-1.689	-1.689	-1.689	-1.689
Other Fossil (GW)	438.9	470.4	444.3	452.3	498.9	543.0	Other Fossil (GW)	0.000	-0.120	1.138	0.474	-0.527	0.640	0.640	0.640	0.640
Nuclear (GW)	100.1	101.2	104.1	110.0	110.0	109.6	Nuclear (GW)	0.000	0.000	0.000	-0.254	-0.255	-0.426	-0.426	-0.426	-0.426
Renewables (GW)	99.5	133.3	168.8	173.9	180.3	186.3	Renewables (GW)	0.000	-0.153	-2.253	-2.243	-2.009	-1.985	-1.985	-1.985	-1.985
Total (GW)	952.3	1,029.9	1,047.6	1,068.8	1,122.5	1,181.8	Total (GW)	0.000	-0.273	-1.776	-2.665	-3.418	-3.459	-3.459	-3.459	-3.459

Table 13.3.9 Water Heaters Trial Standard Level 8 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2044
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,402	1,445	1,517	1,596	Electricity Sales (TWh)	0.00	0.00	-5.22	-31.74	-54.12	-65.11	-68.91	-70.68	-71.86
Natural Gas (EJ)	5.23	5.34	5.19	5.16	5.14	5.06	Natural Gas (EJ)	0.000	0.000	-0.018	-0.104	-0.176	-0.212	-0.226	-0.234	-0.240
Other (EJ)	1.98	1.87	1.74	1.71	1.69	1.67	Other (EJ)	0.000	0.000	-0.001	-0.008	-0.013	-0.016	-0.017	-0.017	-0.018
Natural Gas (Quads)	4.96	5.06	4.92	4.89	4.87	4.80	Natural Gas (Quads)	0.000	0.000	-0.017	-0.099	-0.167	-0.201	-0.214	-0.222	-0.228
Other (Quads)	1.88	1.77	1.65	1.62	1.60	1.59	Other (Quads)	0.000	0.000	-0.001	-0.007	-0.012	-0.015	-0.016	-0.016	-0.017
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,021	2,133	2,185	2,182	2,281	Coal (TWh)	0.00	-0.62	-4.81	-12.70	-20.60	-23.51	-23.51	-23.51	-23.51
Gas (TWh)	753	775	659	711	894	963	Gas (TWh)	0.00	-0.47	12.39	-3.06	-13.71	-15.71	-15.71	-15.71	-15.71
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	874	878	885	Nuclear (TWh)	0.00	0.00	0.00	-2.31	-2.88	-5.32	-5.32	-5.32	-5.32
Renewables (TWh)	357	467	630	693	755	782	Renewables (TWh)	0.00	-1.14	-14.91	-13.61	-16.00	-15.48	-15.48	-15.48	-15.48
Total (TWh)	4,029	4,128	4,301	4,512	4,759	4,961	Total (TWh)	0.00	-2.23	-7.32	-31.69	-52.81	-60.03	-60.03	-60.03	-60.03
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	330.0	332.3	332.9	342.0	Coal (GW)	0.000	0.000	-1.034	-0.995	-0.969	-2.605	-2.605	-2.605	-2.605
Other Fossil (GW)	438.9	470.3	445.0	452.5	498.6	543.4	Other Fossil (GW)	0.000	-0.187	1.779	0.735	-0.816	0.987	0.987	0.987	0.987
Nuclear (GW)	100.1	101.2	104.1	109.9	109.9	109.3	Nuclear (GW)	0.000	0.000	0.000	-0.395	-0.395	-0.657	-0.657	-0.657	-0.657
Renewables (GW)	99.5	133.3	167.6	172.6	179.2	185.2	Renewables (GW)	0.000	-0.239	-3.522	-3.481	-3.106	-3.062	-3.062	-3.062	-3.062
Total (GW)	952.3	1,029.8	1,046.6	1,067.4	1,120.6	1,180.0	Total (GW)	0.000	-0.426	-2.777	-4.135	-5.286	-5.338	-5.338	-5.338	-5.338

Table 13.3.10 Direct Heating Equipment Trial Standard Level 1 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.01	0.04	0.06	0.06	0.06	0.06	0.06
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.31	5.27	Natural Gas (EJ)	0.000	0.000	-0.002	-0.004	-0.007	-0.007	-0.007	-0.007	-0.007
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.03	4.99	Natural Gas (Quads)	0.000	0.000	-0.002	-0.004	-0.006	-0.007	-0.006	-0.006	-0.006
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	0.00	0.01	-0.01	0.03	-0.04	-0.04	-0.04	-0.04
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.00	-0.03	0.02	0.06	0.10	0.22	0.22	0.22	0.22
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.01	-0.02	-0.02	-0.02	-0.02
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	0.00	0.01	0.06	0.04	0.04	0.04	0.04	0.04
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.00	-0.03	0.03	0.11	0.18	0.20	0.20	0.20	0.20
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.001	0.002	0.002	-0.011	-0.011	-0.011	-0.011
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.001	0.006	0.003	0.019	0.023	0.023	0.023	0.023
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002	-0.002
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.005	0.006	0.014	0.014	0.014	0.014	0.014
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.001	0.012	0.011	0.036	0.024	0.024	0.024	0.024

Table 13.3.11 Direct Heating Equipment Trial Standard Level 2 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.01	0.04	0.06	0.06	0.06	0.06	0.06
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.31	5.27	Natural Gas (EJ)	0.000	0.000	-0.002	-0.005	-0.007	-0.008	-0.007	-0.007	-0.007
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.03	4.99	Natural Gas (Quads)	0.000	0.000	-0.002	-0.004	-0.007	-0.007	-0.007	-0.007	-0.007
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	0.00	0.01	-0.01	0.03	-0.05	-0.05	-0.05	-0.05
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.00	-0.03	0.02	0.07	0.11	0.24	0.24	0.24	0.24
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.01	-0.02	-0.02	-0.02	-0.02
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	0.00	0.01	0.06	0.04	0.05	0.05	0.05	0.05
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.00	-0.03	0.04	0.12	0.19	0.21	0.21	0.21	0.21
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.001	0.002	0.002	-0.011	-0.011	-0.011	-0.011
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.002	0.007	0.003	0.021	0.025	0.025	0.025	0.025
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002	-0.002
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.005	0.006	0.015	0.015	0.015	0.015	0.015
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.002	0.013	0.012	0.038	0.026	0.026	0.026	0.026

Table 13.3.12 Direct Heating Equipment Trial Standard Level 3 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.01	0.04	0.06	0.06	0.06	0.06	0.06
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.31	5.27	Natural Gas (EJ)	0.000	0.000	-0.002	-0.005	-0.008	-0.008	-0.008	-0.008	-0.007
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.03	4.99	Natural Gas (Quads)	0.000	0.000	-0.002	-0.005	-0.007	-0.008	-0.007	-0.007	-0.007
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	0.00	0.01	-0.01	0.04	-0.05	-0.05	-0.05	-0.05
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.00	-0.03	0.02	0.07	0.12	0.25	0.25	0.25	0.25
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.01	-0.02	-0.02	-0.02	-0.02
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	0.00	0.01	0.07	0.04	0.05	0.05	0.05	0.05
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.00	-0.03	0.04	0.13	0.20	0.23	0.23	0.23	0.23
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.001	0.003	0.003	-0.012	-0.012	-0.012	-0.012
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.002	0.007	0.004	0.022	0.026	0.026	0.026	0.026
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.003
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.005	0.006	0.016	0.016	0.016	0.016	0.016
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.002	0.014	0.012	0.040	0.028	0.028	0.028	0.028

Table 13.3.13 Direct Heating Equipment Trial Standard Level 4 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case											
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption											
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.06	0.15	0.23	0.25	0.24	0.23	0.23		
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.30	5.26	Natural Gas (EJ)	0.000	0.000	-0.004	-0.010	-0.015	-0.016	-0.015	-0.015	-0.015		
Other (EJ)	1.98	1.87	1.74	1.72	1.69	1.68	Other (EJ)	0.000	0.000	-0.001	-0.002	-0.004	-0.004	-0.004	-0.004	-0.004		
Natural Gas (Quads)	4.96	5.06	4.94	4.98	5.03	4.98	Natural Gas (Quads)	0.000	0.000	-0.003	-0.009	-0.014	-0.015	-0.014	-0.014	-0.014		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	-0.001	-0.002	-0.003	-0.004	-0.004	-0.003	-0.003		
Total U.S. Electric Generation							Total U.S. Electric Generation											
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	0.00	0.05	-0.03	0.06	-0.05	-0.05	-0.05	-0.05		
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.00	-0.06	0.03	0.14	0.26	0.46	0.46	0.46	0.46		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.01	-0.05	-0.05	-0.05	-0.05		
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	-0.01	0.01	0.13	0.09	0.11	0.11	0.11	0.11		
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.00	-0.08	0.08	0.23	0.42	0.48	0.48	0.48	0.48		
Installed Generating Capacity							Installed Generating Capacity											
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.002	0.005	0.005	-0.018	-0.018	-0.018	-0.018		
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.004	0.003	-0.007	0.027	0.027	0.027	0.027	0.027		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.006	-0.006	-0.006	-0.006		
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.011	0.011	0.029	0.034	0.034	0.034	0.034		
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,126.0	1,185.3	Total (GW)	0.000	0.004	0.015	0.010	0.062	0.036	0.036	0.036	0.036		

Table 13.3.14 Direct Heating Equipment Trial Standard Level 5 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.06	0.17	0.26	0.29	0.27	0.26	0.25
Natural Gas (EJ)	5.23	5.34	5.21	5.25	5.30	5.26	Natural Gas (EJ)	0.000	0.000	-0.004	-0.011	-0.017	-0.018	-0.017	-0.016	-0.016
Other (EJ)	1.98	1.87	1.74	1.72	1.69	1.68	Other (EJ)	0.000	0.000	-0.001	-0.003	-0.004	-0.005	-0.004	-0.004	-0.004
Natural Gas (Quads)	4.96	5.06	4.94	4.98	5.02	4.98	Natural Gas (Quads)	0.000	0.000	-0.004	-0.010	-0.016	-0.017	-0.016	-0.015	-0.015
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	-0.001	-0.003	-0.004	-0.004	-0.004	-0.004	-0.004
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	0.00	0.06	-0.04	0.07	-0.05	-0.05	-0.05	-0.05
Gas (TWh)	753	775	647	714	908	980	Gas (TWh)	0.00	-0.07	0.03	0.16	0.30	0.52	0.52	0.52	0.52
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.01	-0.06	-0.06	-0.06	-0.06
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	-0.01	0.01	0.14	0.10	0.13	0.13	0.13	0.13
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,022	Total (TWh)	0.00	-0.09	0.09	0.26	0.48	0.53	0.53	0.53	0.53
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.002	0.006	0.006	-0.020	-0.020	-0.020	-0.020
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.005	0.003	-0.008	0.031	0.030	0.030	0.030	0.030
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.007	-0.007	-0.007	-0.007
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.012	0.013	0.033	0.038	0.038	0.038	0.038
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,126.0	1,185.3	Total (GW)	0.000	0.005	0.017	0.011	0.070	0.041	0.041	0.041	0.041

Table 13.3.15 Direct Heating Equipment Trial Standard Level 6 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case											
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption											
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.00	0.00	0.09	0.23	0.35	0.38	0.36	0.35	0.34		
Natural Gas (EJ)	5.23	5.34	5.20	5.24	5.28	5.23	Natural Gas (EJ)	0.000	0.000	-0.010	-0.027	-0.041	-0.045	-0.042	-0.040	-0.040		
Other (EJ)	1.98	1.87	1.74	1.71	1.69	1.68	Other (EJ)	0.000	0.000	-0.003	-0.007	-0.011	-0.012	-0.011	-0.010	-0.010		
Natural Gas (Quads)	4.96	5.06	4.93	4.96	5.00	4.96	Natural Gas (Quads)	0.000	0.000	-0.010	-0.025	-0.039	-0.042	-0.040	-0.038	-0.038		
Other (Quads)	1.88	1.77	1.65	1.62	1.60	1.59	Other (Quads)	0.000	0.000	-0.002	-0.007	-0.010	-0.011	-0.010	-0.010	-0.010		
Total U.S. Electric Generation							Total U.S. Electric Generation											
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.00	-0.01	0.15	-0.10	0.17	-0.14	-0.14	-0.14	-0.14		
Gas (TWh)	753	775	647	714	909	980	Gas (TWh)	0.00	-0.18	0.07	0.41	0.76	1.33	1.33	1.33	1.33		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00		
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.00	0.00	0.00	0.00	0.03	-0.15	-0.15	-0.15	-0.15		
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.00	-0.03	0.02	0.36	0.24	0.32	0.32	0.32	0.32		
Total (TWh)	4,029	4,130	4,308	4,545	4,813	5,022	Total (TWh)	0.00	-0.22	0.24	0.67	1.21	1.36	1.36	1.36	1.36		
Installed Generating Capacity							Installed Generating Capacity											
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.5	Coal (GW)	0.000	0.000	0.005	0.014	0.014	-0.052	-0.052	-0.052	-0.052		
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.5	542.5	Other Fossil (GW)	0.000	0.013	0.007	-0.019	0.079	0.076	0.076	0.076	0.076		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.017	-0.017	-0.017	-0.017		
Renewables (GW)	99.5	133.5	171.1	176.1	182.4	188.4	Renewables (GW)	0.000	0.000	0.030	0.032	0.084	0.096	0.096	0.096	0.096		
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,126.1	1,185.4	Total (GW)	0.000	0.013	0.042	0.028	0.177	0.103	0.103	0.103	0.103		

Table 13.3.16 Pool Heaters Trial Standard Level 1 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.32	5.27	Natural Gas (EJ)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00	Natural Gas (Quads)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	0.000	0.000	-0.001	0.001	-0.004	-0.004	-0.004	-0.004
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.001	0.002	0.004	0.005	0.012	0.012	0.012	0.012
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	0.000	0.000	0.003	0.002	0.002	0.002	0.002	0.002
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.002	0.002	0.006	0.009	0.009	0.009	0.009	0.009
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.000	0.001	0.001	0.002	0.001	0.001	0.001	0.001

Table 13.3.17 Pool Heaters Trial Standard Level 2 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.32	5.27	Natural Gas (EJ)	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00	Natural Gas (Quads)	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	0.000	0.000	-0.002	0.001	-0.007	-0.007	-0.007	-0.007
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.002	0.003	0.007	0.009	0.021	0.021	0.021	0.021
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.001	-0.002	-0.002	-0.002	-0.002
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	0.000	0.001	0.005	0.004	0.004	0.004	0.004	0.004
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.003	0.003	0.011	0.016	0.017	0.017	0.017	0.017
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.000	0.001	0.000	0.002	0.002	0.002	0.002	0.002
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.000	0.001	0.001	0.003	0.002	0.002	0.002	0.002

Table 13.3.18 Pool Heaters Trial Standard Level 3 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
														2035	2040	2042
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.003	0.007	0.009	0.009	0.009	0.009	0.009
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.32	5.27	Natural Gas (EJ)	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00	Natural Gas (Quads)	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	-0.001	0.000	-0.004	0.003	-0.015	-0.015	-0.015	-0.015
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.005	0.006	0.017	0.021	0.047	0.047	0.047	0.047
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.001	-0.004	-0.004	-0.004	-0.004
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	-0.001	0.002	0.012	0.009	0.010	0.010	0.010	0.010
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.007	0.008	0.024	0.036	0.038	0.038	0.038	0.038
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.003
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.000	0.001	0.001	0.004	0.005	0.005	0.005	0.005
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.001	0.001	0.003	0.003	0.003	0.003	0.003
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.000	0.003	0.003	0.007	0.005	0.005	0.005	0.005

Table 13.3.19 Pool Heaters Trial Standard Level 4 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.003	0.007	0.009	0.009	0.009	0.009	0.009
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.32	5.27	Natural Gas (EJ)	0.000	0.000	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00	Natural Gas (Quads)	0.000	0.000	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	-0.001	0.003	-0.007	-0.002	-0.024	-0.024	-0.024	-0.024
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.008	0.004	0.018	0.027	0.058	0.058	0.058	0.058
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.002	-0.003	-0.003	-0.003	-0.003
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	-0.002	-0.001	0.013	0.009	0.010	0.010	0.010	0.010
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.010	0.006	0.024	0.037	0.040	0.040	0.040	0.040
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.001	0.001	-0.004	-0.004	-0.004	-0.004
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.001	0.003	0.002	0.006	0.008	0.008	0.008	0.008
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.001	0.001	0.003	0.003	0.003	0.003	0.003
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.001	0.004	0.004	0.010	0.007	0.007	0.007	0.007

Table 13.3.20 Pool Heaters Trial Standard Level 5 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case									
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation		
<i>Residential Sector Energy Consumption</i>							<i>Residential Sector Energy Consumption</i>									
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.002	0.006	0.008	0.009	0.009	0.009	0.009
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.31	5.27	Natural Gas (EJ)	0.000	0.000	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
Natural Gas (Quads)	4.96	5.06	4.94	4.99	5.04	5.00	Natural Gas (Quads)	0.000	0.000	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
<i>Total U.S. Electric Generation</i>							<i>Total U.S. Electric Generation</i>									
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	-0.001	0.004	-0.010	-0.002	-0.037	-0.037	-0.037	-0.037
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.013	0.007	0.027	0.041	0.088	0.088	0.088	0.088
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.003	-0.005	-0.005	-0.005	-0.005
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	-0.002	-0.002	0.020	0.014	0.015	0.015	0.015	0.015
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.016	0.009	0.037	0.056	0.061	0.061	0.061	0.061
<i>Installed Generating Capacity</i>							<i>Installed Generating Capacity</i>									
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.001	0.001	-0.006	-0.006	-0.006	-0.006
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.001	0.005	0.003	0.009	0.012	0.012	0.012	0.012
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.002	0.002	0.005	0.005	0.005	0.005	0.005
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.001	0.006	0.006	0.016	0.010	0.010	0.010	0.010

Table 13.3.21 Pool Heaters Trial Standard Level 6 Forecast

NEMS-BT Results:							Difference from AEO2009 Reference Case											
	2005	2010	2015	2020	2025	2030		2005	2010	2015	2020	2025	2030	Extrapolation				
Residential Sector Energy Consumption							Residential Sector Energy Consumption											
Electricity Sales (TWh)	1,359	1,403	1,407	1,477	1,571	1,661	Electricity Sales (TWh)	0.000	0.000	0.002	0.006	0.007	0.008	0.008	0.008	0.008		
Natural Gas (EJ)	5.23	5.34	5.21	5.26	5.31	5.27	Natural Gas (EJ)	0.000	0.000	-0.002	-0.005	-0.007	-0.007	-0.007	-0.007	-0.007		
Other (EJ)	1.98	1.87	1.74	1.72	1.70	1.69	Other (EJ)	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001		
Natural Gas (Quads)	4.96	5.06	4.94	4.98	5.03	4.99	Natural Gas (Quads)	0.000	0.000	-0.002	-0.005	-0.006	-0.007	-0.007	-0.007	-0.007		
Other (Quads)	1.88	1.77	1.65	1.63	1.61	1.60	Other (Quads)	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001		
Total U.S. Electric Generation							Total U.S. Electric Generation											
Coal (TWh)	2,014	2,022	2,138	2,198	2,203	2,305	Coal (TWh)	0.000	-0.002	0.011	-0.026	-0.006	-0.092	-0.092	-0.092	-0.092		
Gas (TWh)	753	775	647	714	908	979	Gas (TWh)	0.000	-0.031	0.017	0.066	0.102	0.220	0.220	0.220	0.220		
Petroleum (TWh)	123	56	47	49	49	50	Petroleum (TWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Nuclear (TWh)	782	809	831	876	881	890	Nuclear (TWh)	0.000	0.000	0.000	0.000	0.008	-0.012	-0.012	-0.012	-0.012		
Renewables (TWh)	357	468	645	707	771	797	Renewables (TWh)	0.000	-0.006	-0.004	0.050	0.034	0.036	0.036	0.036	0.036		
Total (TWh)	4,029	4,130	4,308	4,544	4,812	5,021	Total (TWh)	0.000	-0.039	0.023	0.091	0.138	0.152	0.152	0.152	0.152		
Installed Generating Capacity							Installed Generating Capacity											
Coal (GW)	313.8	325.0	331.0	333.3	333.9	344.6	Coal (GW)	0.000	0.000	0.000	0.002	0.002	-0.016	-0.016	-0.016	-0.016		
Other Fossil (GW)	438.9	470.5	443.2	451.8	499.4	542.4	Other Fossil (GW)	0.000	0.002	0.012	0.008	0.024	0.030	0.030	0.030	0.030		
Nuclear (GW)	100.1	101.2	104.1	110.3	110.3	110.0	Nuclear (GW)	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001		
Renewables (GW)	99.5	133.5	171.1	176.1	182.3	188.3	Renewables (GW)	0.000	0.000	0.004	0.004	0.013	0.012	0.012	0.012	0.012		
Total (GW)	952.3	1,030.2	1,049.4	1,071.5	1,125.9	1,185.3	Total (GW)	0.000	0.002	0.016	0.015	0.038	0.025	0.025	0.025	0.025		

13.4 IMPACT OF STANDARDS ON NATURAL GAS AND ELECTRICITY PRICES AND ASSOCIATED BENEFITS FOR CONSUMERS

As an addition to the utility impact analysis, DOE analyzed the potential impact on natural gas prices and electricity resulting from amended standards on water heaters and the associated benefits for all natural gas and electricity users in all sectors of the economy.

DOE's analysis of energy price impacts used NEMS-BT in a similar manner as described in section 13.3. Like other widely-used energy-economic models, NEMS uses elasticities to estimate the energy price change that would result from a change (increase or decrease) in energy demand. The elasticity of price to a decrease in demand is the "inverse price elasticity." The calculated inverse price elasticity based on NEMS-BT simulations differs throughout the forecast period in response to the dynamics of supply and demand for natural gas or electricity.

The average inverse gas price elasticity during 2013–2030 is 1.38 with TSL 4 (the proposed standard). A value of 1.38 means that, given a one-percent decrease in demand, the price of gas would decline by 1.38 percent.

In a review of such studies that used versions of NEMS to examine the impacts on natural gas prices resulting from reductions in natural gas demand, Wiser and Bollinger² examined analyses that reported the reductions in natural gas demand caused by certain energy policies, and the resulting decline in the average U.S. wellhead gas price. Wiser and Bollinger found that the average values of the inverse price elasticity throughout the forecast period in each study ranged from 0.7 to 4.7. The average inverse price elasticities in 13 of 19 analyses were between 0.8 and 2.0. The value from DOE's current analysis (1.38 for TSL 4) is in the middle of that range.

Other widely used, complex energy demand/supply models produce price elasticities that are similar to those incorporated in NEMS. Table 13.5.1 compares the results of several studies that modeled the response of natural gas prices to changes in gas consumption. These results are summarized in a 2003 study by Stanford's Energy Modeling Forum (EMF).³ Although the magnitude of the price response (as summarized by the inverse price elasticity) varies considerably among the models, they generally confirm a sizable price effect associated with changes in natural gas consumption.^c It is worth noting that the NEMS average value determined by the EMF study is smaller than that of most of the other models. Therefore, it is reasonable to conclude that the impacts estimated by NEMS are conservative.

^c The EMF scenarios modeled the effect of increased gas demand on price. Assuming a smooth supply curve over the long term, however, the elasticities implied by an increase in demand should be equivalent to those implied by a decrease in demand. For undetermined reasons, two of the models studied in the Wiser and Bollinger report (NANGAS and NARG) report somewhat anomalous inverse elasticities.

Table 13.4.1 Natural Gas Inverse Price Elasticity from Seven Energy Models

	2005	2010	2015	2020	Average
NEMS	1.8	2.2	0.53	0.11	1.2
POEMS	2.4	1.8	2.5	1.8	2.1
CRA	3.5	2.5	1.1	0.9	2.0
NANGAS	5.4	7.0	7.6	5.1	6.3
E2020	1.5	1.0	1.0	0.7	1.1
MARKAL	N/A	2.0	N/A	2.1	2.1
NARG	8.7	12.4	5.6	2.4	7.3

Source: Based on EMF, 2003.

NEMS (National Energy Modeling System, 2002); POEMS (Policy Office Electricity Modeling System); CRA (Charles River Associates); NANGAS (North American Natural Gas Analysis System), E2020 (Energy 2020); MARKAL (MARKet ALlocation); NARG (North American Regional Gas model).

In addition to the models listed above, studies have been conducted by the National Petroleum Council⁴ and the National Commission on Energy Policy⁵ that are based on the EEA model. The EEA model has higher inverse price elasticities (between 4.0 and 16.8) than those predicted by NEMS and most other national energy models, leading to larger natural gas price reductions for a given decrease in demand.

13.4.2 Impact on Natural Gas Prices

Figure 13.5.1 shows the annual change in U.S. natural gas consumption, relative to the base case involving no new standards, for the proposed standard (TSL 4) and for the chosen standard (TSL 5). Because standards may decrease electricity demand, and a significant percentage of electricity is generated using natural gas, the standards may reduce natural gas consumption in the utility sector as well as in the residential sector.

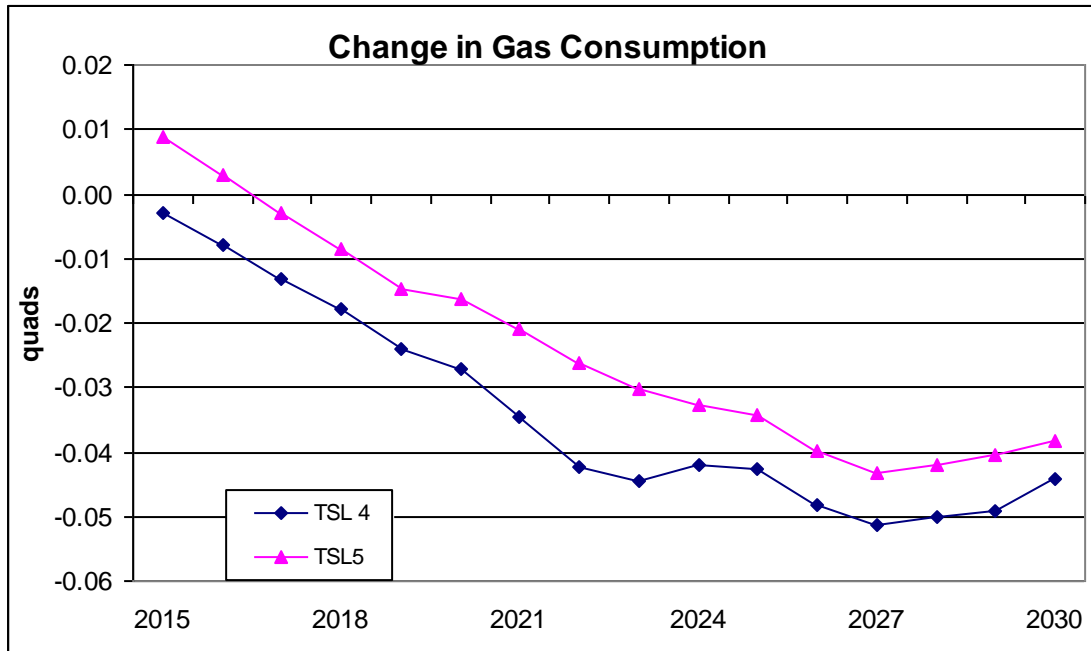


Figure 13.4.1 Change in U.S. Natural Gas Consumption Associated with Considered Water Heater Energy Conservation Standards

As described in section 13.3, using NEMS-BT to analyze impacts of relatively small annual changes in energy consumption typically involves using higher-decrements to isolate the impacts of the standards from numerical noise (i.e., larger energy savings quantities than those resulting from the considered standards). After generating results using higher decrements to gas consumption, DOE utilized a regressed interpolation toward the origin to derive the price effects associated with the energy savings resulting from each considered TSL.

Figure 13.5.2 shows the annual change in average U.S. wellhead price for natural gas, relative to the base case, for TSL 4 and TSL 5. The price reduction averages 1.5 cents per MMBtu (in 2009\$) under TSL 4 and 1.2 cents per MMBtu (in 2009\$) under TSL 5. These average price reductions equal 0.21 percent and 0.17 percent, respectively.

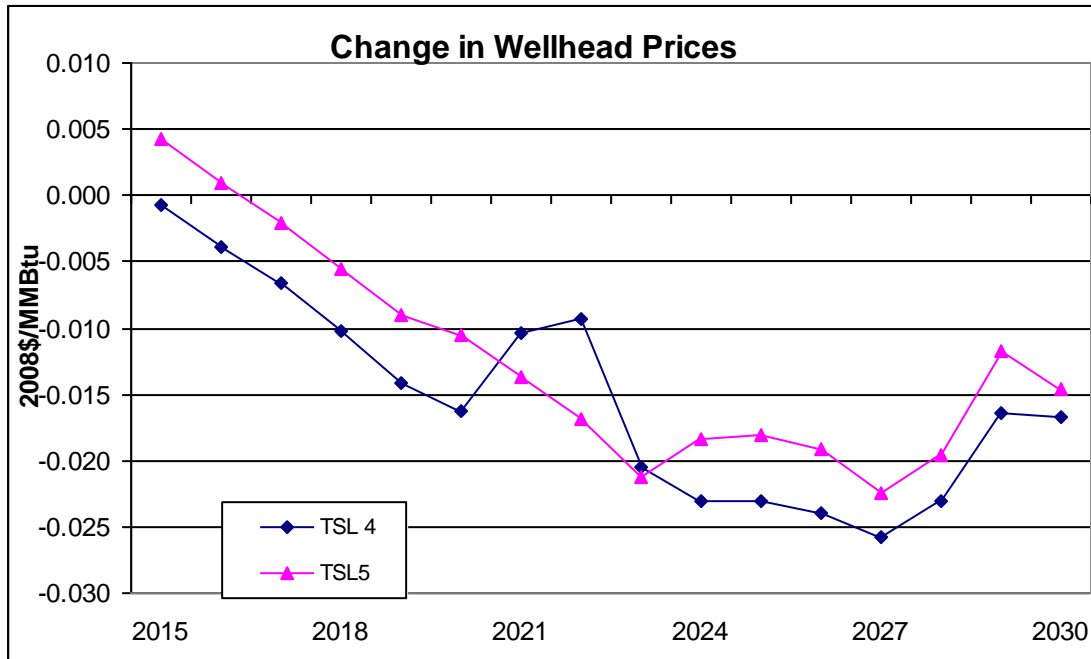


Figure 13.4.2 Effects of Considered Water Heater Energy Conservation Standards on Average U.S. Wellhead Natural Gas Prices

13.4.3 Impact of Changes in Natural Gas Price on Gas Users

Although NEMS indicates that amended standards for water heaters would reduce natural gas prices by only a small amount, the associated economy-wide savings in natural gas expenditures during the forecast period are substantial. For each TSL, DOE calculated the nominal savings in total natural gas expenditures in each year by multiplying the annual change in the average-user price for natural gas by the total annual U.S. natural gas consumption forecast by NEMS.^d The amended standards would continue to reduce demand for natural gas after 2030 (which is the last year in the NEMS forecast). DOE's estimate for 2031–2045 (the period used to estimate the NPV of the national consumer benefits from amended standards) multiplied the average gas price reduction in 2015–2030 by estimated total annual gas consumption in 2031–2045.^e DOE then discounted the stream of reduced expenditures to calculate a NPV.

Table 13.5.2 shows the calculated NPV of the economy-wide savings in natural gas expenditures for each considered TSL at 3-percent and 7-percent discount rates. The need to

^d The average user includes electric utilities. Presumably the decrease in expenditures of natural gas that they experience would largely be passed on to electricity consumers.

^e The estimation of gas consumption after 2030 uses the average annual growth rate in 2026–2030 from the AEO 2009 Reference projection.

extrapolate price effects and gas consumption beyond 2030 suggests that one should interpret the post-2030 results as a rough indication of the benefits to natural gas users in the post-2030 period.

Table 13.4.2 Cumulative NPV of the Economy-Wide Savings in Natural Gas Expenditures Due to the Projected Decline in Natural Gas Prices Resulting from Amended Standards for Water Heaters*

Discount Rate	TSL 4	TSL 5
	<i>billion \$2008</i>	
3 percent	5.347	6.976
7 percent	2.596	3.528

* Impacts for units sold from 2015 to 2045

13.4.4 Discussion of Savings in Natural Gas Expenditures

A decline in natural gas consumption may lower natural gas prices for two primary reasons. One reason is that decreasing consumption would lower the output of existing natural gas production capacity, leading to increased competition and downward pressure on prices. A second reason is that reduced consumption slows the depletion of low-cost gas reserves, lowers the future cost of finding and extracting natural gas resources, and dampens expectations for future prices.

When gas prices drop in response to a lower output of existing natural gas production capacity, consumers benefit, but producers suffer. In economic terms, the situation represents a benefits transfer to consumers (whose expenditures fall) from producers (whose revenue falls equally).^f When prices decrease because extraction costs decline, however, consumers and producers both benefit, and the change in natural gas prices represents a net gain to society. Consumers benefit from the lower prices, and producers, whose revenues and costs both fall, are made no worse off.

The short-term impact of lower consumption on natural gas price likely results from changes in the utilization of natural gas production and capacity. It is likely that reduced consumption has only a short-term impact on capacity utilization in the natural gas industry. Producers can adjust to changes in consumption in the long term by either increasing or decreasing investments in infrastructure to bring capacity utilization rates back to original levels.

The long-term impact on natural gas prices probably results from changes in extraction costs. Natural gas is an exhaustible resource, and conventional natural gas sources are limited. When those low-cost sources are depleted, producers must turn to higher-cost sources of natural gas, at which point extraction costs and wellhead prices will increase. Reduced demand creates

^f Gas producers include domestic, other North American, and overseas LNG producers. The proportion of domestic producers is expected to decline in the future.

downward pressure on extraction costs and prices because it delays the depletion of low-cost reserves and forestalls a shift toward higher-cost sources.

Because the NEMS is a complex model, it is difficult to determine exactly how much of the model-estimated drop in natural gas price in any given year is explained by a decrease in utilization of capacity, and how much is explained by a decrease in extraction costs. One would expect, however, that most of the forecasted price decline after 2015 is caused by a decline in extraction costs. Supporting evidence for this conclusion derives from comparing the sources of natural gas drawn upon to supply consumers in the base case (without standards) and the standards cases of the model runs. The three principal sources of natural gas considered in NEMS for 2030 are termed conventional sources, unconventional sources, and imports [primarily liquefied natural gas (LNG) imports]. Conventional sources are the lowest-cost, and imports are the highest-cost source of natural gas, as forecast by NEMS.

The effect of standards on extraction costs is revealed by comparing the rate of natural gas production from the three natural gas sources in model runs for the base case with the rates for the standards cases. As shown in DOE's furnace/boiler rulemaking (see the TSD, chapter 10), NEMS indicates that standards produce decreases in natural gas production from all three sources, but production from the higher-cost sources declines most of all. This result suggests that, based on the NEMS model, energy conservation standards decrease future costs for natural gas extraction because they result in decreased rates of depletion of low-cost natural gas supplies and decreased imports of high-cost LNG. This result further suggests that a significant part of the long-term decreases in wellhead prices forecasted by the NEMS represents both a benefit to consumers of natural gas and a net benefit to society.

13.4.5 Impact on Electricity Prices

Figure 13.5.3 shows the annual change in U.S. electricity consumption, relative to the base case involving no new standards, for the proposed standard (TSL 4) and for the chosen standard (TSL 5).

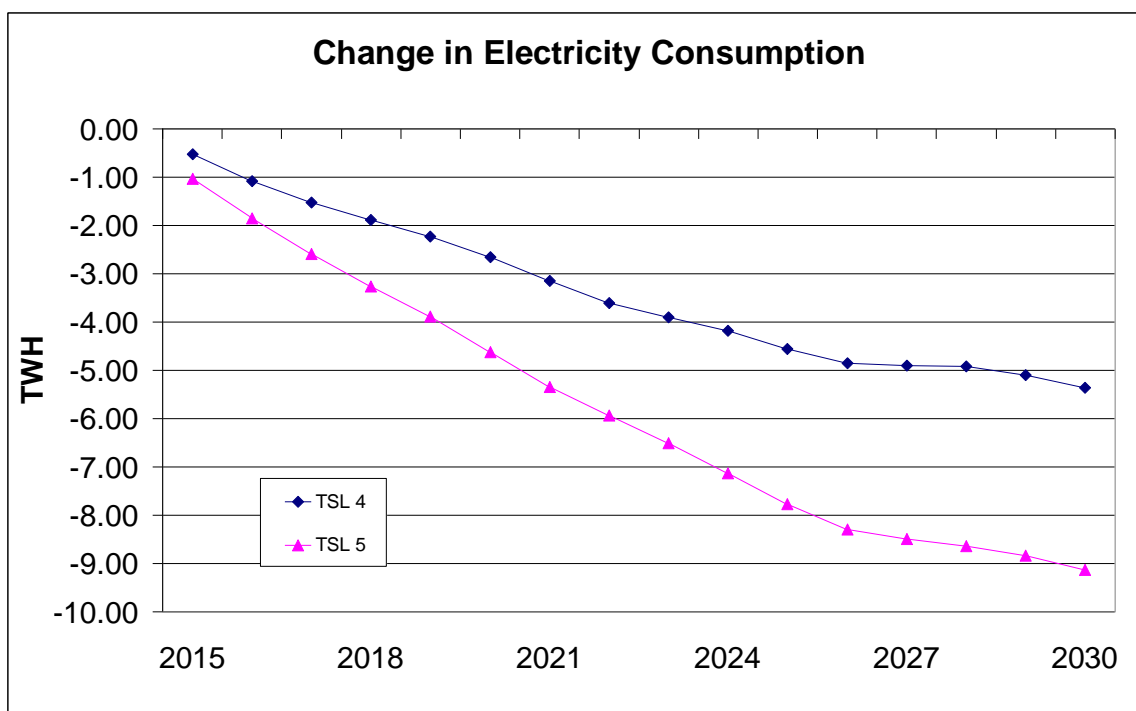


Figure 13.4.3 Change in U.S. Electricity Consumption Associated with Considered Water Heater Energy Conservation Standards

After generating results using higher decrements to electricity consumption, DOE utilized a regressed interpolation toward the origin to derive the price effects associated with the energy savings resulting from each considered TSL.

Figure 13.5.4 shows the annual change in average U.S. price for electricity, relative to the base case, for TSL 4 and TSL 5. The price reduction averages 0.007 cents per kWh (in 2008\$) under TSL 4 and 0.004 cents per kWh (in 2008\$) under TSL 5. These average price reductions equal 0.07 percent and 0.04 percent, respectively.

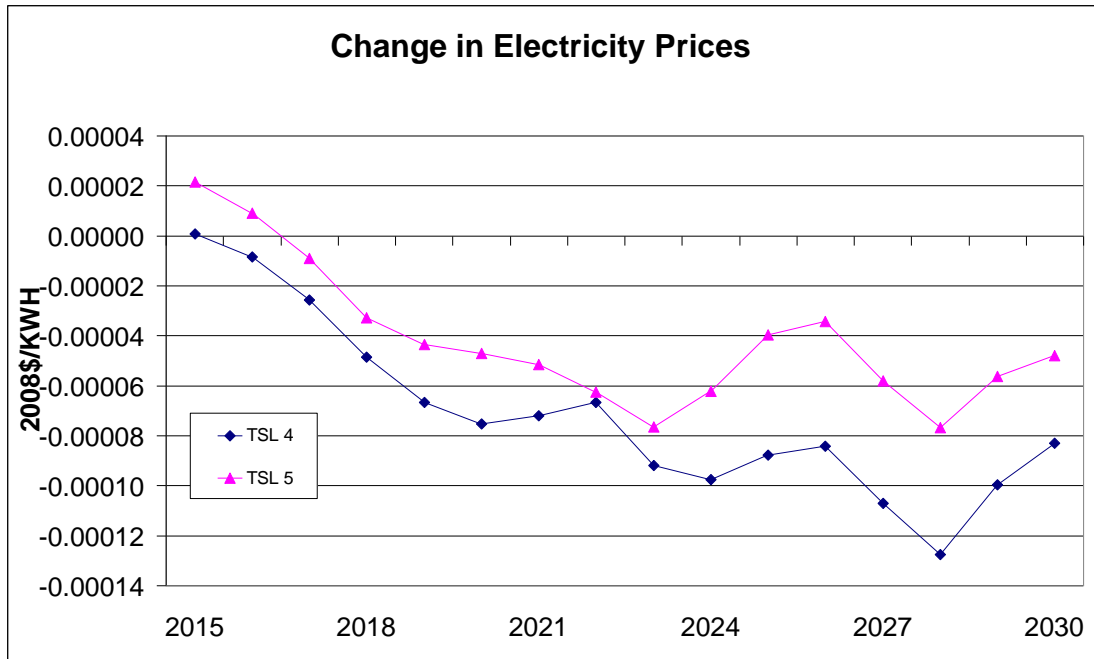


Figure 13.4.4 Effects of Considered Water Heater Energy Conservation Standards on Average U.S. Electricity Price (All Users)

13.4.6 Impact of Changes in Electricity Price on Electricity Users

For each TSL, DOE calculated the nominal savings in total electricity expenditures in each year by multiplying the annual change in the average-user price for electricity by the total annual U.S. electricity consumption forecast by NEMS. The amended standards would continue to reduce demand for electricity after 2030 (which is the last year in the NEMS forecast). DOE's estimate for 2031–2045 (the period used to estimate the NPV of the national consumer benefits from amended standards) multiplied the average electricity price reduction in 2015–2030 by estimated total annual electricity consumption in 2031–2045.^g DOE then discounted the stream of reduced expenditures to calculate a NPV.

Table 13.5.3 shows the calculated NPV of the economy-wide savings in electricity expenditures for each considered TSL at 3-percent and 7-percent discount rates. The need to extrapolate price effects and electricity consumption beyond 2030 suggests that one should interpret the post-2030 results as a rough indication of the benefits to electricity users in the post-2030 period.

^g The estimation of electricity consumption after 2030 uses the average annual growth rate in 2026–2030 from the AEO 2009 Reference projection.

Table 13.4.3 Cumulative NPV of the Economy-Wide Savings in Electricity Expenditures Due to the Projected Decline in Electricity Prices Resulting from Amended Standards for Water Heaters*

Discount Rate	TSL 4	TSL 5
	<i>billion \$2008</i>	
3 percent	5.483	3.196
7 percent	2.627	1.516

* Impacts for units sold from 2015 to 2045

13.4.7 Discussion of Savings in Electricity Expenditures

Although the aggregate benefits for all electricity users are potentially large, DOE has some concerns about the robustness of the estimates presented above. In addition, DOE believes that there is uncertainty about the extent to which the calculated impacts from reduced electricity prices are a benefits transfer from the actors involved in electricity supply. Investigation conducted for the rulemaking for general service fluorescent lamps and incandescent reflector lamps^h found that whereas natural gas markets exhibit a fairly simple chain of agents from producers to consumers, the electric power industry is a complex mix of fuel suppliers, producers, and distributors. While the distribution of electricity is regulated everywhere, its institutional structure varies, and upstream actors are more diverse. DOE is continuing to investigate the extent to which change in electricity prices projected to result from standards represents a net gain to society.

^h See U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Energy Conservation Standards for General Service Fluorescent Lamps and Incandescent Reflector Lamps; Proposed Rule," 74 FR 16920, 1697879 (April 13, 2009).

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