

Appendix B. Summary Tables

Table B1. The HCES compared to the Reference case

	2009	2025		2035	
		Reference	HCES	Reference	HCES
Generation (billion kilowatthours)					
Coal	1,772	2,049	1,156	2,184	951
Petroleum	41	45	44	47	45
Natural Gas	931	1,002	1,386	1,293	1,676
Nuclear	799	871	928	868	1,127
Conventional Hydropower	274	306	320	314	321
Geothermal	15	25	26	42	49
Municipal Waste	18	17	17	17	17
Wood and Other Biomass	38	162	291	181	281
Solar	3	18	18	21	23
Wind	71	153	277	159	301
Other	18	16	16	16	16
Total Generation	3,981	4,665	4,479	5,142	4,807
Capacity (gigawatts)					
Coal	317	323	262	330	267
Petroleum	116	87	87	87	86
Natural Gas	351	382	384	455	444
Nuclear	101	110	117	110	143
Conventional Hydropower	78	79	82	81	82
Geothermal	2	3	4	6	6
Municipal Waste	4	4	4	4	4
Wood and Other Biomass	7	17	17	20	20
Solar	2	11	11	13	14
Wind	32	53	92	55	100
Other (including pumped storage)	24	25	25	25	25
Total	1,033	1,095	1,086	1,185	1,193
Prices (2009 cents/kWh)					
Credit Price			8.1		10.8
Electricity Price	9.8	9.0	10.5	9.4	12.1
Residential	11.5	10.7	12.2	10.9	13.6
Commercial	10.1	9.3	10.8	9.4	12.2
Industrial	6.8	6.3	7.5	6.6	8.9
Average Delivered Natural Gas Price (2009 dollars/Mcf)	7.5	8.1	8.8	9.2	9.7
Expenditures (billion 2009 dollars except as noted)					
Total Electricity Expenditures	350	373	414	417	494
Residential Electricity Expenditures	156	157	172	176	207
Household Electricity Expenditures (2009 Dollars/Household)	1379	1162	1277	1196	1407
Total Natural Gas Expenditures	156	187	225	227	264
Electricity Sector Natural Gas Expenditures	34	39	65	55	77
Non-Electricity Sector Natural Gas Expenditures	122	148	160	171	188

Table B1. The HCES compared to the Reference case (cont.)

	2009	2025		2035	
		Reference	HCES	Reference	HCES
CES Compliance					
Credits Required (percent of sales)			64		80
Credits Achieved (percent of sales)			64		78
Generation Achieved (percent of sales)			64		78
Total Electricity Sales (billion kilowatthours)	3,556	4,105	3,913	4,428	4,064
Emissions					
Sulfur Dioxide (million tons)	5.7	4.1	3.1	3.7	2.4
Nitrogen Oxide (million tons)	2.0	2.0	1.5	2.0	1.2
Mercury (tons)	41	29	16	29	15
Carbon Dioxide (million metric tons CO ₂)	2,160	2,345	1,525	2,500	991
Macroeconomic					
GDP (billion 2005 dollars)	12,881	20,012	19,885	25,686	25,612
Per Capita GDP (thousand 2005 dollars/person)	42	56	56	66	66
Employment, Non-Farm (million)	131	156	156	171	171
Employment, Manufacturing (million)	12	16	15	13	13

Source: U.S. Energy Information Administration. National Energy Modeling System, runs refhall.d082611b, ceshallnb.d083011a.

Table B2. Low and high-cost renewable scenarios: the HCES compared to the sensitivity base cases

	2009		2025				2035			
			Low Cost Renewable		High Cost Renewable		Low Cost Renewable		High Cost Renewable	
			Base	HCES	Base	HCES	Base	HCES	Base	HCES
Generation (billion kilowatthours)										
Coal	1,772	2,030	1,238	2,034	1,126	2,142	559	2,134	762	
Petroleum	41	45	44	46	43	47	43	48	44	
Natural Gas	931	979	1,155	994	1,409	1,192	1,687	1,308	1,917	
Nuclear	799	877	877	877	938	874	898	874	1,097	
Conventional Hydropower	274	313	324	306	316	326	340	314	321	
Geothermal	15	27	34	25	26	44	36	29	27	
Municipal Waste	18	17	17	17	17	17	17	17	17	
Wood and Other Biomass	38	182	344	150	236	205	341	145	182	
Solar	3	24	25	16	16	48	75	17	18	
Wind	71	168	478	158	277	261	787	186	287	
Other	18	16	16	16	16	16	16	16	16	
Total Generation	3,981	4,680	4,552	4,640	4,419	5,173	4,800	5,089	4,689	
Capacity (gigawatts)										
Coal	317	322	260	321	261	330	229	327	260	
Petroleum	116	87	87	88	86	87	86	86	86	
Natural Gas	351	378	375	384	386	439	433	460	454	
Nuclear	101	110	110	110	119	110	114	110	139	
Conventional Hydropower	78	80	83	79	81	84	88	80	82	
Geothermal	2	4	5	3	4	6	5	4	4	
Municipal Waste	4	4	4	4	4	4	4	4	4	
Wood and Other Biomass	7	18	24	11	11	22	38	12	12	
Solar	2	15	15	10	10	27	41	11	11	
Wind	32	58	165	55	91	88	277	64	95	
Other (including pumped storage)	24	25	25	25	25	25	25	25	25	
Total	1,033	1,101	1,153	1,090	1,077	1,222	1,339	1,183	1,171	
Prices (2009 cents/kWh)										
Credit Price			6.6		8.6		12.4		14.0	
Electricity Price	9.8	8.9	10.0	9.1	10.9	9.1	11.9	9.5	13.1	
Residential	11.5	10.6	11.7	10.8	12.5	10.6	13.4	11.1	14.6	
Commercial	10.1	9.0	10.2	9.4	11.2	9.1	12.1	9.6	13.3	
Industrial	6.8	6.1	7.1	6.3	7.8	6.4	8.8	6.7	9.9	
Average Delivered Natural Gas Price (2009 dollars/MCF)	7.5	8.0	8.6	8.1	9.1	8.9	9.1	9.3	9.9	
Expenditures (billion 2009 dollars)										
Total Electricity Expenditures	350	366	398	377	423	406	482	423	524	
Residential Electricity Expenditures	156	154	166	158	175	171	201	178	219	
Household Electricity Expenditures (2009 Dollars/Household)	1,379	1,143	1,231	1,173	1,303	1,162	1,369	1,210	1,489	
Total Natural Gas Expenditures	156	185	206	189	232	216	251	230	288	
Electricity Sector Natural Gas Expenditures	34	38	50	39	68	49	72	57	92	
Non-Electricity Sector Natural Gas Expenditures	122	147	156	149	165	167	179	174	195	

Table B2. Low and high-cost renewable scenarios: the HCES compared to the sensitivity base cases (cont.)

	2009		2025				2035			
			Low Cost Renewable		High Cost Renewable		Low Cost Renewable		High Cost Renewable	
			Base	HCES	Base	HCES	Base	HCES	Base	HCES
CES Compliance										
Credits Required (percent of sales)				64		64		80		80
Credits Achieved (percent of sales)				64		63		79		78
Generation Achieved (percent of sales)				64		63		79		78
Total Electricity Sales (billion kilowatthours)	3,556	4,112	3,961	4,101	3,876	4,446	4,016	4,416	3,971	
Emissions										
Sulfur Dioxide (million tons)	5.7	4.1	3.3	4.2	3.1	3.8	1.3	3.8	1.8	
Nitrogen Oxide (million tons)	2.0	2.0	1.5	2.0	1.4	2.0	0.7	2.0	1.0	
Mercury (tons)	41	29	16	29	15	29	7	28	12	
Carbon Dioxide (million metric tons CO ₂)	2,160	2,318	1,563	2,333	1,491	2,421	914	2,475	914	
Macroeconomic										
GDP (billion 2005 dollars)	12,881	20,019	19,930	19,988	19,861	25,703	25,595	25,674	25,521	
Per Capita GDP (thousand 2005 dollars/person)	42	56	56	56	55	66	66	66	65	
Employment, Non-Farm (million)	131	156	156	156	155	171	171	171	170	
Employment, Manufacturing (million)	12	16	16	16	15	13	13	13	13	

Sources: U.S. Energy Information Administration. National Energy Modeling System, runs rehall.d082611b, ceshallnb.d083011a, rehallhc.d082611b, ceshallnbhr.d083011a, rehallr.d082611b, ceshallnblr.d083011a.

Table B3. Low and high-cost nuclear scenarios: the HCES compared to the sensitivity base cases

	2009		2025				2035			
			Low Cost Nuclear		High Cost Nuclear		Low Cost Nuclear		High Cost Nuclear	
	Base	HCES	Base	HCES	Base	HCES	Base	HCES	Base	HCES
Generation (billion kilowatthours)										
Coal	1,772	2,047	1,110	2,060	1,062	2,169	897	2,185	838	
Petroleum	41	45	43	45	44	47	44	46	45	
Natural Gas	931	999	1,417	996	1,486	1,184	1,559	1,290	1,943	
Nuclear	799	877	1,023	871	877	1,012	1,564	868	874	
Conventional Hydropower	274	305	315	305	315	312	315	314	322	
Geothermal	15	24	26	25	29	39	41	43	49	
Municipal Waste	18	17	17	17	17	17	17	17	17	
Wood and Other Biomass	38	162	283	159	284	183	265	178	265	
Solar	3	18	18	18	18	21	23	21	26	
Wind	71	154	180	154	280	158	198	161	391	
Other	18	16	16	16	16	16	16	16	16	
Total Generation	3,981	4,666	4,449	4,667	4,431	5,159	4,940	5,140	4,789	
Capacity (gigawatts)										
Coal	317	322	260	322	265	330	257	330	265	
Petroleum	116	87	88	87	87	87	85	86	84	
Natural Gas	351	381	382	383	385	438	423	457	471	
Nuclear	101	110	130	110	110	128	200	110	110	
Conventional Hydropower	78	78	81	78	81	80	81	81	83	
Geothermal	2	3	4	3	4	5	5	6	6	
Municipal Waste	4	4	4	4	4	4	4	4	4	
Wood and Other Biomass	7	17	17	17	17	20	20	20	21	
Solar	2	11	11	11	11	13	14	13	15	
Wind	32	54	61	54	94	55	67	56	131	
Other (including pumped storage)	24	25	25	25	25	25	25	25	25	
Total	1,033	1,093	1,062	1,095	1,083	1,185	1,181	1,187	1,215	
Prices (2009 cents/kWh)										
Credit Price			9.2		9.7		8.5		12.4	
Electricity Price	9.8	9.0	10.6	9.0	10.8	9.3	11.0	9.4	12.4	
Residential	11.5	10.7	12.2	10.7	12.5	10.8	12.5	10.9	13.9	
Commercial	10.1	9.3	10.9	9.2	11.1	9.3	11.1	9.5	12.5	
Industrial	6.8	6.3	7.6	6.2	7.8	6.5	8.0	6.6	9.1	
Average Delivered Natural Gas Price (2009 dollars/MCF)	7.5	8.1	9.1	8.0	9.1	9.0	8.6	9.1	9.5	
Expenditures (billion 2009 dollars)										
Total Electricity Expenditures	350	373	416	372	422	414	461	419	502	
Residential Electricity Expenditures	156	156	172	156	175	174	194	176	210	
Household Electricity Expenditures (2009 Dollars/Household)	1,379	1,159	1,277	1,160	1,298	1,186	1,317	1,199	1,431	
Total Natural Gas Expenditures	156	187	233	187	239	217	232	226	279	
Electricity Sector Natural Gas Expenditures	34	39	69	39	74	48	61	55	92	
Non-Electricity Sector Natural Gas Expenditures	122	148	164	148	165	168	171	171	187	

Table B3. Low and high-cost nuclear scenarios: the HCES compared to the sensitivity base cases (cont.)

	2009		2025				2035			
			Low Cost Nuclear		High Cost Nuclear		Low Cost Nuclear		High Cost Nuclear	
			Base	HCES	Base	HCES	Base	HCES	Base	HCES
CES Compliance										
Credits Required (percent of sales)				64		64		80		80
Credits Achieved (percent of sales)				63		64		80		79
Generation Achieved (percent of sales)				63		64		80		79
Total Electricity Sales (billion kilowatthours)	3,556	4,105	3,907	4,106	3,886	4,441	4,168	4,424	4,030	
Emissions										
Sulfur Dioxide (million tons)	5.7	4.2	2.9	4.3	3.0	3.8	2.1	3.9	2.0	
Nitrogen Oxide (million tons)	2.0	2.0	1.5	2.0	1.4	2.0	1.1	2.0	1.0	
Mercury (tons)	41	29	15	29	16	29	14	30	13	
Carbon Dioxide (million metric tons CO ₂)	2,160	2,342	1,511	2,352	1,477	2,447	978	2,498	947	
Macroeconomic										
GDP (billion 2005 dollars)	12,881	20,011	19,862	20,012	19,860	25,708	25,705	25,684	25,588	
Per Capita GDP (thousand 2005 dollars/person)	42	56	55	56	55	66	66	66	66	
Employment, Non-Farm (million)	131	156	156	156	156	171	171	171	171	
Employment, Manufacturing (million)	12	16	15	16	15	13	13	13	13	

Sources: U.S. Energy Information Administration. National Energy Modeling System, runs rehall.d082611b, ceshallnb.d083011a, rehallhn.d082611b, ceshallnbhn.d083011a, rehallln.d082611b, ceshallnbn.d083011a.

Table B4. Low and high-cost natural gas scenarios: the HCES compared to the sensitivity base cases

	2009		2025				2035			
			Low Cost Natural Gas		High Cost Natural Gas		Low Cost Natural Gas		High Cost Natural Gas	
	Base	HCES	Base	HCES	Base	HCES	Base	HCES	Base	HCES
Generation (billion kilowatthours)										
Coal	1,772	1,948	987	2,134	1,078	2,078	771	2,239	941	
Petroleum	41	46	45	45	43	47	45	48	44	
Natural Gas	931	1,138	1,674	856	1,304	1,475	1,996	1,166	1,503	
Nuclear	799	862	910	877	970	860	1,074	874	1,210	
Conventional Hydropower	274	305	321	308	315	312	323	314	322	
Geothermal	15	25	29	27	29	39	50	44	48	
Municipal Waste	18	17	17	17	17	17	17	17	17	
Wood and Other Biomass	38	168	256	155	289	184	248	165	283	
Solar	3	18	18	18	19	21	23	22	25	
Wind	71	145	186	161	291	152	280	180	319	
Other	18	16	16	16	16	16	16	16	16	
Total Generation	3,981	4,690	4,461	4,616	4,371	5,201	4,844	5,086	4,730	
Capacity (gigawatts)										
Coal	317	314	257	327	271	321	256	336	273	
Petroleum	116	93	87	86	84	93	86	86	84	
Natural Gas	351	386	394	375	368	468	469	440	421	
Nuclear	101	109	115	110	123	109	136	110	154	
Conventional Hydropower	78	78	82	79	81	80	83	80	83	
Geothermal	2	3	4	4	4	5	6	6	6	
Municipal Waste	4	4	4	4	4	4	4	4	4	
Wood and Other Biomass	7	17	17	17	17	20	20	20	20	
Solar	2	11	11	11	12	12	14	13	15	
Wind	32	51	63	56	97	53	92	62	106	
Other (including pumped storage)	24	25	25	25	25	25	25	25	25	
Total	1,033	1,091	1,060	1,095	1,086	1,191	1,191	1,182	1,191	
Prices (2009 cents/kWh)										
Credit Price			9.2		13.1		11.0		13.6	
Electricity Price	9.8	8.8	10.6	9.4	11.4	8.9	11.9	9.8	12.8	
Residential	11.5	10.6	12.3	11.1	13.0	10.5	13.4	11.3	14.3	
Commercial	10.1	9.0	10.9	9.7	11.8	8.9	11.9	10.0	13.1	
Industrial	6.8	6.1	7.6	6.6	8.3	6.2	8.7	7.0	9.6	
Average Delivered Natural Gas Price (2009 dollars/MCF)	7.5	7.3	8.3	9.4	10.8	8.1	8.7	10.3	11.1	
Expenditures (billion 2009 dollars)										
Total Electricity Expenditures	350	366	415	386	444	401	484	436	519	
Residential Electricity Expenditures	156	155	173	161	181	171	204	181	214	
Household Electricity Expenditures (2009 Dollars/Household)	1,379	1,147	1,285	1,192	1,346	1,164	1,391	1,232	1,458	
Total Natural Gas Expenditures	156	179	232	205	264	215	259	243	283	
Electricity Sector Natural Gas Expenditures	34	41	78	40	76	59	80	55	83	
Non-Electricity Sector Natural Gas Expenditures	122	138	153	166	188	156	179	189	201	

Table B4. Low and high-cost natural gas scenarios: the HCES compared to the sensitivity base cases (cont.)

	2009		2025				2035			
			Low Cost Natural Gas		High Cost Natural Gas		Low Cost Natural Gas		High Cost Natural Gas	
			Base	HCES	Base	HCES	Base	HCES	Base	HCES
CES Compliance										
Credits Required (percent of sales)				64		64		80		80
Credits Achieved (percent of sales)				63		65		79		79
Generation Achieved (percent of sales)				63		65		79		79
Total Electricity Sales (billion kilowatthours)	3,556	4,112	3,880	4,081	3,869	4,460	4,061	4,408	4,022	
Emissions										
Sulfur Dioxide (million tons)	5.7	3.9	2.8	4.0	3.0	3.8	1.8	3.7	2.2	
Nitrogen Oxide (million tons)	2.0	2.0	1.4	2.0	1.4	2.0	1.0	2.1	1.1	
Mercury (tons)	41	27	15	29	15	27	12	30	15	
Carbon Dioxide (million metric tons CO ₂)	2,160	2,290	1,487	2,387	1,434	2,450	945	2,527	948	
Macroeconomic										
GDP (billion 2005 dollars)	12,881	20,030	19,835	19,962	19,846	25,704	25,643	25,677	25,573	
Per Capita GDP (thousand 2005 dollars/person)	42	56	55	56	55	66	66	66	66	
Employment, Non-Farm (million)	131	156	155	156	156	171	171	171	171	
Employment, Manufacturing (million)	12	16	15	16	15	13	13	13	13	

Sources: U.S. Energy Information Administration. National Energy Modeling System, runs rehall.d082611b, ceshallnb.d083011a, rehallhs.d082611b, ceshallnbhs.d083011a, rehallls.d082611b, ceshallnbls.d083011a.

Table B5. Low and high-cost coal scenarios: the HCES compared to the sensitivity base cases

	2009	2025				2035			
		Low Cost Coal		High Cost Coal		Low Cost Coal		High Cost Coal	
		Base	HCES	Base	HCES	Base	HCES	Base	HCES
Generation (billion kilowatthours)									
Coal	1,772	2,132	1,095	1,906	978	2,260	878	1,876	447
Petroleum	41	45	44	46	44	47	45	48	45
Natural Gas	931	952	1,476	1,071	1,486	1,267	1,783	1,456	2,056
Nuclear	799	877	933	877	961	874	1,118	874	1,201
Conventional Hydropower	274	306	323	304	319	314	324	311	319
Geothermal	15	27	27	25	29	42	48	37	48
Municipal Waste	18	17	17	17	17	17	17	17	17
Wood and Other Biomass	38	156	282	180	257	169	268	219	196
Solar	3	18	19	18	18	21	24	21	26
Wind	71	156	190	153	301	164	293	158	318
Other	18	16	16	16	16	16	16	16	16
Total Generation	3,981	4,703	4,422	4,614	4,426	5,192	4,814	5,035	4,691
Capacity (gigawatts)									
Coal	317	327	273	308	247	338	279	312	212
Petroleum	116	86	87	88	89	86	87	88	86
Natural Gas	351	381	378	383	384	454	444	456	453
Nuclear	101	110	118	110	122	110	142	110	153
Conventional Hydropower	78	79	83	78	82	81	83	80	82
Geothermal	2	4	4	3	4	5	6	5	6
Municipal Waste	4	4	4	4	4	4	4	4	4
Wood and Other Biomass	7	17	17	17	17	20	20	20	20
Solar	2	11	11	11	11	13	14	13	16
Wind	32	54	64	53	99	57	96	55	105
Other (including pumped storage)	24	25	25	25	25	25	25	25	25
Total	1,033	1,098	1,065	1,083	1,083	1,192	1,201	1,168	1,161
Prices (2009 cents/kWh)									
Credit Price			11.1		8.2		13.2		14.6
Electricity Price	9.8	8.8	10.9	9.4	10.9	9.1	12.1	10.0	13.2
Residential	11.5	10.4	12.5	11.1	12.6	10.6	13.6	11.6	14.7
Commercial	10.1	9.0	11.2	9.6	11.2	9.1	12.2	10.0	13.4
Industrial	6.8	6.0	7.8	6.5	7.8	6.3	9.0	7.1	10.0
Average Delivered Natural Gas Price (2009 dollars/MCF)	7.5	8.0	9.3	8.2	9.1	9.2	9.2	9.4	9.7
Expenditures (billion 2009 dollars)									
Total Electricity Expenditures	350	365	425	382	424	409	495	434	522
Residential Electricity Expenditures	156	154	176	160	176	172	207	183	218
Household Electricity Expenditures (2009 Dollars/Household)	1,379	1,139	1,304	1,190	1,306	1,171	1,407	1,247	1,487
Total Natural Gas Expenditures	156	184	242	193	239	225	260	241	290
Electricity Sector Natural Gas Expenditures	34	37	75	43	73	55	79	64	98
Non-Electricity Sector Natural Gas Expenditures	122	147	166	150	166	170	181	177	192

Table B5. Low and high-cost coal scenarios: the HCES compared to the sensitivity base cases (cont.)

	2009		2025				2035			
			Low Cost Coal		High Cost Coal		Low Cost Coal		High Cost Coal	
			Base	HCES	Base	HCES	Base	HCES	Base	HCES
CES Compliance										
Credits Required (percent of sales)				64		64		80		80
Credits Achieved (percent of sales)				63		64		80		78
Generation Achieved (percent of sales)				63		64		80		78
Total Electricity Sales (billion kilowatthours)	3,556	4,148	3,885	4,050	3,881	4,494	4,070	4,324	3,928	
Emissions										
Sulfur Dioxide (million tons)	6	4.1	3.1	3.9	2.9	3.6	2.1	3.7	1.2	
Nitrogen Oxide (million tons)	2.0	2.0	1.4	2.0	1.2	2.1	1.1	2.0	0.7	
Mercury (tons)	41	30	16	27	13	31	14	25	6	
Carbon Dioxide (million metric tons CO ₂)	2160	2,417	1,501	2,220	1,430	2,583	941	2,248	879	
Macroeconomic										
GDP (billion 2005 dollars)	12,881	20,016	19,860	19,973	19,867	25,710	25,591	25,623	25,514	
Per Capita GDP (thousand 2005 dollars/person)	42	56	55	56	55	66	66	66	65	
Employment, Non-Farm (million)	131	156	156	156	156	171	171	171	170	
Employment, Manufacturing (million)	12	16	15	16	15	13	13	13	13	

Sources: U.S. Energy Information Administration. National Energy Modeling System, runs rehall.d082611b, ceshallnb.d083011a, rehallhc.d082611b, ceshallnbhc.d083011a, rehallc.d082611b, ceshallnbc.d083011a.