

## Appendix D: Avoided Costs of Other Fuels

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Exhibit D-1. AESC 2013 Forecast Weighted Average Avoided Cost of Petroleum Fuels by Sector, and Other Fuels

Year	Fuel Oils							Other Fuels				
	Residential	Commercial			Industrial			Residential				Industrial
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel Oil	Weighted Average	Distillate Fuel Oil	Residual Fuel Oil	Weighted Average	Cord Wood	Pellets	Kerosene	Propane	Kerosene
	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu
2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$
2013	27.02	\$26.70	\$19.81	\$25.56	\$26.81	\$19.38	\$24.12	\$9.79	\$16.32	\$29.68	\$27.94	\$26.88
2014	24.90	\$23.66	\$13.93	\$21.87	\$23.00	\$13.93	\$19.65	\$9.02	\$15.04	\$27.36	\$25.81	\$23.06
2015	24.66	\$23.50	\$13.80	\$21.78	\$22.90	\$13.80	\$19.57	\$8.94	\$14.90	\$27.10	\$24.83	\$22.96
2016	25.76	\$24.58	\$14.50	\$22.78	\$23.97	\$14.50	\$20.50	\$9.34	\$15.56	\$28.30	\$25.67	\$24.03
2017	26.45	\$25.30	\$14.81	\$23.41	\$24.72	\$14.81	\$21.03	\$9.59	\$15.98	\$29.06	\$26.75	\$24.78
2018	26.81	\$25.71	\$15.29	\$23.82	\$25.16	\$15.29	\$21.47	\$9.72	\$16.19	\$29.46	\$27.29	\$25.22
2019	27.24	\$26.18	\$15.52	\$24.22	\$25.66	\$15.52	\$21.85	\$9.87	\$16.45	\$29.92	\$27.80	\$25.73
2020	27.62	\$26.54	\$15.93	\$24.57	\$25.99	\$15.93	\$22.20	\$10.01	\$16.68	\$30.35	\$28.28	\$26.06
2021	28.05	\$27.03	\$16.28	\$25.03	\$26.54	\$16.28	\$22.65	\$10.16	\$16.94	\$30.81	\$28.62	\$26.61
2022	28.47	\$27.56	\$16.65	\$25.51	\$27.15	\$16.65	\$23.15	\$10.32	\$17.19	\$31.27	\$29.00	\$27.23
2023	28.91	\$27.98	\$17.02	\$25.90	\$27.54	\$17.02	\$23.53	\$10.48	\$17.46	\$31.76	\$29.33	\$27.62
2024	29.37	\$28.41	\$17.43	\$26.31	\$27.96	\$17.43	\$23.96	\$10.64	\$17.74	\$32.26	\$29.62	\$28.03
2025	29.86	\$28.88	\$17.76	\$26.74	\$28.41	\$17.76	\$24.39	\$10.82	\$18.03	\$32.80	\$29.90	\$28.49
2026	30.30	\$29.29	\$18.20	\$27.15	\$28.81	\$18.20	\$24.82	\$10.98	\$18.30	\$33.29	\$30.18	\$28.89
2027	30.75	\$29.71	\$18.65	\$27.56	\$29.20	\$18.65	\$25.26	\$11.14	\$18.57	\$33.78	\$30.41	\$29.28
2028	31.22	\$30.14	\$19.11	\$27.99	\$29.61	\$19.11	\$25.70	\$11.31	\$18.85	\$34.29	\$30.64	\$29.69
2029	31.69	\$30.63	\$19.56	\$28.44	\$30.08	\$19.56	\$26.16	\$11.48	\$19.14	\$34.82	\$30.97	\$30.16
2030	32.18	\$31.13	\$20.02	\$28.91	\$30.57	\$20.02	\$26.64	\$11.66	\$19.43	\$35.35	\$31.31	\$30.65
2031	32.67	\$31.63	\$20.49	\$29.37	\$31.06	\$20.49	\$27.13	\$11.84	\$19.73	\$35.89	\$31.65	\$31.14
2032	33.17	\$32.14	\$20.97	\$29.85	\$31.55	\$20.97	\$27.62	\$12.02	\$20.03	\$36.44	\$31.99	\$31.64
2033	33.67	\$32.67	\$21.46	\$30.33	\$32.06	\$21.46	\$28.12	\$12.20	\$20.34	\$36.99	\$32.34	\$32.14
2034	34.19	\$33.19	\$21.96	\$30.83	\$32.57	\$21.96	\$28.63	\$12.39	\$20.65	\$37.56	\$32.69	\$32.66
2035	34.71	\$33.73	\$22.48	\$31.33	\$33.10	\$22.48	\$29.15	\$12.58	\$20.96	\$38.13	\$33.05	\$33.18
2036	35.24	\$34.28	\$23.00	\$31.83	\$33.63	\$23.00	\$29.69	\$12.77	\$21.28	\$38.71	\$33.41	\$33.72
2037	35.78	\$34.83	\$23.54	\$32.35	\$34.17	\$23.54	\$30.23	\$12.96	\$21.61	\$39.31	\$33.77	\$34.26
2038	36.32	\$35.40	\$24.09	\$32.87	\$34.71	\$24.09	\$30.78	\$13.16	\$21.94	\$39.91	\$34.14	\$34.80
2039	36.88	\$35.97	\$24.66	\$33.41	\$35.27	\$24.66	\$31.34	\$13.36	\$22.27	\$40.52	\$34.51	\$35.36
2040	37.44	\$36.56	\$25.23	\$33.95	\$35.84	\$25.23	\$31.91	\$13.57	\$22.61	\$41.13	\$34.88	\$35.93
2041	38.01	\$37.15	\$25.82	\$34.50	\$36.41	\$25.82	\$32.49	\$13.78	\$22.96	\$41.76	\$35.26	\$36.51
2042	38.59	\$37.75	\$26.43	\$35.06	\$36.99	\$26.43	\$33.08	\$13.99	\$23.31	\$42.40	\$35.64	\$37.09
2043	39.18	\$38.36	\$27.05	\$35.63	\$37.59	\$27.05	\$33.68	\$14.20	\$23.66	\$43.05	\$36.03	\$37.69
<b>Levelized Costs</b>												
2014-2023	26.84	25.75	15.33	23.84	25.20	15.33	21.51	9.72	16.21	29.48	27.28	25.27
2014-2028	27.91	26.84	16.23	24.86	26.32	16.23	22.54	10.11	16.86	30.66	28.17	26.39
2014-2043	31.18	30.16	19.27	27.97	29.58	19.27	25.73	11.30	18.83	34.25	30.50	29.66
<b>Notes</b>												
Amended August 27, 2013 to correct Industrial Sector avoided cost of fuel oil and to correct 10 and 15-year levelization calculations												
Calculation based on fuel oil forecast percentages by sector (Appendix D-3) multiplied by fuel oil forecast price by sector (Appendix D-2)												
2029-2041 costs extrapolated based on 2019-2028 compound annual growth rate												

Exhibit D-2. Crude Oil and Fuel Prices by Sector in New England - AESC 2013 Forecast (2013\$)

Year	Crude Oil Prices				Fuel Prices for Electric Generation in New England			Residential			Commercial			Industrial			
	AEO 2013 Forecast Imported Low Sulfur Crude	WTI NYMEX Futures Swaps as of March 15 2013 (e)	AESC 2013 Forecast Imported Low-Sulfur Crude	AESC 2013 Forecast Imported Low-Sulfur Crude	Distillate Fuel Oil	Residual Fuel Oil	Steam Coal	Distillate Fuel Oil	Kerosene	Cord Wood	Distillate Fuel Oil	Residual Fuel	Kerosene	Distillate Fuel Oil	Residual Fuel Oil	Kerosene	
	\$/bbl	\$/bbl	\$/bbl	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu
	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$	2013\$
2013	100.01	93.46		16.11	23.59	12.74	3.98	27.02	29.68	9.79	26.70	19.81	29.68	26.81	19.38	26.88	
2014	100.21	88.65	88.65	15.29	20.89	10.77	3.75	24.90	27.36	9.02	23.66	13.93	27.36	23.00	13.93	23.06	
2015	99.08	84.36	87.75	15.13	20.69	10.66	3.99	24.66	27.10	8.94	23.50	13.80	27.10	22.90	13.80	22.96	
2016	100.21	81.13	93.50	16.12	21.68	11.27	3.77	25.76	28.30	9.34	24.58	14.50	28.30	23.97	14.50	24.03	
2017	102.36	78.67	99.26	17.11	22.33	11.56	3.80	26.45	29.06	9.59	25.30	14.81	29.06	24.72	14.81	24.78	
2018	104.55	76.63	101.96	17.58	22.69	12.03	3.76	26.81	29.46	9.72	25.71	15.29	29.46	25.16	15.29	25.22	
2019	106.78	74.92	104.61	18.04	23.11	12.26	3.70	27.24	29.92	9.87	26.18	15.52	29.92	25.66	15.52	25.73	
2020	109.07	73.29	107.00	18.45	23.50	12.67	3.71	27.62	30.35	10.01	26.54	15.93	30.35	25.99	15.93	26.06	
2021	111.40	71.85	109.34	18.85	23.92	13.02	3.71	28.05	30.81	10.16	27.03	16.28	30.81	26.54	16.28	26.61	
2022	113.79		111.72	19.26	24.34	13.39	3.75	28.47	31.27	10.32	27.56	16.65	31.27	27.15	16.65	27.23	
2023	116.22		114.16	19.68	24.79	13.77	3.78	28.91	31.76	10.48	27.98	17.02	31.76	27.54	17.02	27.62	
2024	118.71		116.64	20.11	25.24	14.18	3.81	29.37	32.26	10.64	28.41	17.43	32.26	27.96	17.43	28.03	
2025	121.25		119.18	20.55	25.73	14.50	3.83	29.86	32.80	10.82	28.88	17.76	32.80	28.41	17.76	28.49	
2026	123.84		121.78	21.00	26.18	14.95	3.87	30.30	33.29	10.98	29.29	18.20	33.29	28.81	18.20	28.89	
2027	126.50		124.43	21.45	26.63	15.39	3.90	30.75	33.78	11.14	29.71	18.65	33.78	29.20	18.65	29.28	
2028	129.20		127.14	21.92	27.09	15.86	3.94	31.22	34.29	11.31	30.14	19.11	34.29	29.61	19.11	29.69	
<b>Levelized Costs</b>																	
2014-2023				17.49	22.74	12.10	3.77	26.84	29.48	9.72	25.75	15.33	29.48	25.20	15.33	25.27	
2014-2028				18.58	23.81	12.99	3.80	27.91	30.66	10.11	26.84	16.23	30.66	26.32	16.23	26.39	
2014-2043				21.93	27.11	16.11	3.96	31.18	34.25	11.30	30.16	19.27	34.25	29.58	19.27	29.66	
<b>Notes</b>	Amended August 27, 2013 to correct Distillate, Residual, and Kerosene prices for the Industrial sector																
	Crude Oil forecasts based on EIA historical and projected values from AEO 2013 Table A12; West Texas Intermediate																
	Electric Generation Forecast based on AEO 2013-ER Table S11; Sector fuel price forecast based on low-sulfur fuel price																

Exhibit D-3. Forecast mix of petroleum related fuels by grade by sector, as a percentage of 2013 forecast

Year	Residential	Commercial		Industrial	
	Distillate Fuel Oil	Distillate Fuel Oil	Residual Fuel	Distillate Fuel Oil	Residual Fuel Oil
	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu	\$/MMBtu
	Percent	Percent	Percent	Percent	Percent
2013	100%	84%	16%	64%	36%
2014	100%	82%	18%	63%	37%
2015	100%	82%	18%	63%	37%
2016	100%	82%	18%	63%	37%
2017	100%	82%	18%	63%	37%
2018	100%	82%	18%	63%	37%
2019	100%	82%	18%	62%	38%
2020	100%	81%	19%	62%	38%
2021	100%	81%	19%	62%	38%
2022	100%	81%	19%	62%	38%
2023	100%	81%	19%	62%	38%
2024	100%	81%	19%	62%	38%
2025	100%	81%	19%	62%	38%
2026	100%	81%	19%	62%	38%
2027	100%	81%	19%	63%	37%
2028	100%	80%	20%	63%	37%

**Notes**

Amended August 27, 2013 to correct Industrial sector fuel use percentages  
 Calculations based on AEO 2013 Supplemental Table One for New England  
 Fuel and Sector Consumption

[http://www.eia.gov/forecasts/aeo/er/supplement/suptab\\_1.xlsx](http://www.eia.gov/forecasts/aeo/er/supplement/suptab_1.xlsx)

**Exhibit D-4. Pollutant Emission Values by Year in 2013\$/MMBtu**

	Pollutant Emission Values by Year in 2013\$/MMBtu											
	Residential				Commercial				Industrial			
	SO2 (2013\$/MMBtu)	NOx (2013\$/MMBtu)	CO2 (2013\$/MMBtu)	CO2 at \$100/ton (2013\$/MMBtu)	SO2 (2013\$/MMBtu)	NOx (2013\$/MMBtu)	CO2 (2013\$/MMBtu)	CO2 at \$100/ton (2013\$/MMBtu)	SO2 (2013\$/MMBtu)	NOx (2013\$/MMBtu)	CO2 (2013\$/MMBtu)	CO2 at \$100/ton (2013\$/MMBtu)
2013	\$0.0000	\$0.0018	\$0.2422	\$8.6500	\$0.0000	\$0.0023	\$0.2296	\$8.2000	\$0.0000	\$0.0023	\$0.2254	\$8.0500
2014	\$0.0000	\$0.0018	\$0.3724	\$8.6500	\$0.0000	\$0.0024	\$0.3530	\$8.2000	\$0.0000	\$0.0024	\$0.3465	\$8.0500
2015	\$0.0000	\$0.0018	\$0.4748	\$8.6500	\$0.0000	\$0.0024	\$0.4501	\$8.2000	\$0.0000	\$0.0024	\$0.4418	\$8.0500
2016	\$0.0000	\$0.0019	\$0.5811	\$8.6500	\$0.0000	\$0.0025	\$0.5509	\$8.2000	\$0.0000	\$0.0025	\$0.5408	\$8.0500
2017	\$0.0000	\$0.0019	\$0.6915	\$8.6500	\$0.0000	\$0.0025	\$0.6556	\$8.2000	\$0.0000	\$0.0025	\$0.6436	\$8.0500
2018	\$0.0000	\$0.0019	\$0.8061	\$8.6500	\$0.0000	\$0.0026	\$0.7642	\$8.2000	\$0.0000	\$0.0026	\$0.7502	\$8.0500
2019	\$0.0000	\$0.0020	\$0.9250	\$8.6500	\$0.0000	\$0.0026	\$0.8769	\$8.2000	\$0.0000	\$0.0026	\$0.8609	\$8.0500
2020	\$0.0000	\$0.0020	\$2.0170	\$8.6500	\$0.0000	\$0.0027	\$1.9121	\$8.2000	\$0.0000	\$0.0027	\$1.8771	\$8.0500
2021	\$0.0000	\$0.0021	\$2.2888	\$8.6500	\$0.0000	\$0.0028	\$2.1698	\$8.2000	\$0.0000	\$0.0028	\$2.1301	\$8.0500
2022	\$0.0000	\$0.0021	\$2.5707	\$8.6500	\$0.0000	\$0.0028	\$2.4370	\$8.2000	\$0.0000	\$0.0028	\$2.3924	\$8.0500
2023	\$0.0000	\$0.0021	\$2.8629	\$8.6500	\$0.0000	\$0.0029	\$2.7140	\$8.2000	\$0.0000	\$0.0029	\$2.6643	\$8.0500
2024	\$0.0000	\$0.0022	\$3.1658	\$8.6500	\$0.0000	\$0.0029	\$3.0011	\$8.2000	\$0.0000	\$0.0029	\$2.9462	\$8.0500
2025	\$0.0000	\$0.0022	\$3.4796	\$8.6500	\$0.0000	\$0.0030	\$3.2986	\$8.2000	\$0.0000	\$0.0030	\$3.2383	\$8.0500
2026	\$0.0000	\$0.0023	\$3.8048	\$8.6500	\$0.0000	\$0.0030	\$3.6068	\$8.2000	\$0.0000	\$0.0030	\$3.5409	\$8.0500
2027	\$0.0000	\$0.0023	\$4.1415	\$8.6500	\$0.0000	\$0.0031	\$3.9261	\$8.2000	\$0.0000	\$0.0031	\$3.8543	\$8.0500
2028	\$0.0000	\$0.0024	\$4.4902	\$8.6500	\$0.0000	\$0.0032	\$4.2566	\$8.2000	\$0.0000	\$0.0032	\$4.1788	\$8.0500
<b>Levelized (2013\$/MMBtu)</b>												
5 year (2014-18)	\$0.0000	\$0.0019	\$0.5823	\$8.6500	\$0.0000	\$0.0025	\$0.5520	\$8.2000	\$0.0000	\$0.0025	\$0.5419	\$8.0500
10 year (2014-23)	\$0.0000	\$0.0020	\$1.3256	\$8.6500	\$0.0000	\$0.0026	\$1.2567	\$8.2000	\$0.0000	\$0.0026	\$1.2337	\$8.0500
15 year (2014-28)	\$0.0000	\$0.0021	\$2.0977	\$8.6500	\$0.0000	\$0.0027	\$1.9886	\$8.2000	\$0.0000	\$0.0027	\$1.9522	\$8.0500
<b>Notes</b>												
Based on pollution emission rates for Number 2 fuel oil												
Pollutant values based on emission allowance prices detailed in Exhibit 4-1.												