

CHP Systems

	Cumulative Increase in Annual Gas Demand MMBtu	Cumulative kWh Displacement (Electricity Generation) kWh	Cumulative CHP Thermal MMBtu
2020	17,224	3,527,555	10,921
2021	51,569	10,555,928	32,681
2022	120,053	24,564,953	76,053
2023	222,470	45,501,608	140,873
2024	358,617	73,313,161	226,978
2025	528,290	107,947,170	334,204
2026	731,287	149,351,474	462,392
2027	933,675	190,565,921	589,992
2028	1,135,455	231,591,278	717,007
2029	1,336,631	272,428,309	843,438
2030	1,537,203	313,077,774	969,289
2031	1,737,173	353,540,431	1,094,561
2032	1,936,543	393,817,035	1,219,258
2033	2,135,315	433,908,338	1,343,380
2034	2,333,491	473,815,089	1,466,932
2035	2,514,607	510,165,931	1,579,474
2036	2,678,764	542,987,163	1,681,088
2037	2,826,062	572,304,944	1,771,856
2038	2,956,601	598,145,292	1,851,858
2039	3,070,480	620,534,085	1,921,174
2040	3,167,797	639,497,060	1,979,883
2041	3,248,652	655,059,816	2,028,065
2042	3,329,264	670,549,737	2,076,022
2043	3,409,634	685,967,120	2,123,754
2044	3,489,764	701,312,262	2,171,263
2045	3,569,653	716,585,456	2,218,549
2046	3,649,302	731,786,997	2,265,613
2047	3,728,712	746,917,177	2,312,456
2048	3,807,884	761,976,288	2,359,079
2049	3,886,818	776,964,619	2,405,482
2050	3,965,516	791,882,459	2,451,668

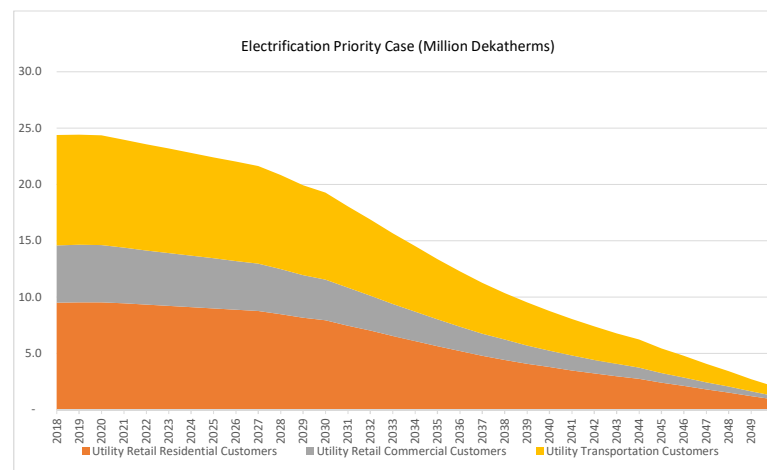
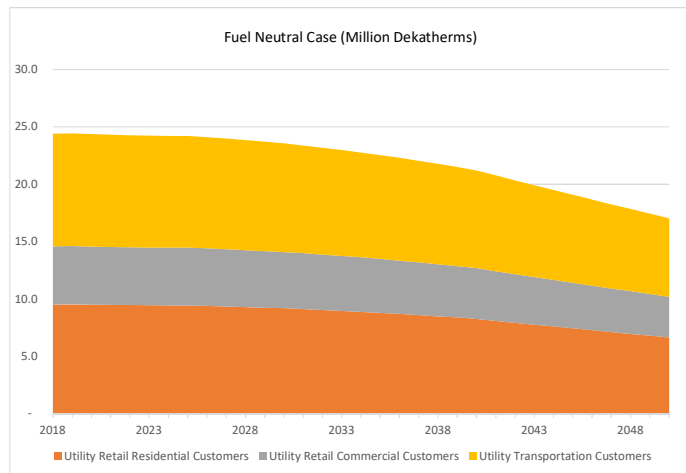
**Climate Business Plan
Gas Deliveries (MDt)**

	Utility Retail		Utility Transportation
	Residential Customers	Commercial Customers	Customers
2018	9.5	5.1	9.8
2019	9.5	5.1	9.8
2020	9.5	5.1	9.8
2021	9.5	5.1	9.8
2022	9.5	5.0	9.8
2023	9.5	5.0	9.7
2024	9.4	5.0	9.7
2025	9.4	5.0	9.7
2026	9.4	5.0	9.7
2027	9.3	5.0	9.6
2028	9.3	5.0	9.6
2029	9.2	4.9	9.5
2030	9.2	4.9	9.5
2031	9.1	4.9	9.4
2032	9.0	4.8	9.3
2033	9.0	4.8	9.2
2034	8.9	4.7	9.2
2035	8.8	4.7	9.1
2036	8.7	4.6	9.0
2037	8.6	4.6	8.9
2038	8.5	4.5	8.8
2039	8.4	4.5	8.6
2040	8.3	4.4	8.5
2041	8.1	4.3	8.4
2042	7.9	4.2	8.2
2043	7.8	4.1	8.0
2044	7.6	4.1	7.8
2045	7.4	4.0	7.7
2046	7.3	3.9	7.5
2047	7.1	3.8	7.3
2048	7.0	3.7	7.2
2049	6.8	3.6	7.0
2050	6.6	3.5	6.8

**Policy-Driven Electrification Case
Gas Deliveries (MDt)**

	Utility Retail		Utility Transportation
	Residential Customers	Commercial Customers	Customers
2018	9.5	5.1	9.8
2019	9.5	5.1	9.8
2020	9.6	5.1	9.7
2021	9.4	4.9	9.6
2022	9.3	4.8	9.4
2023	9.2	4.7	9.3
2024	9.1	4.6	9.1
2025	9.0	4.4	9.0
2026	8.9	4.3	8.8
2027	8.8	4.2	8.7
2028	8.5	4.0	8.3
2029	8.2	3.8	8.0
2030	7.9	3.6	7.7
2031	7.5	3.4	7.2
2032	7.0	3.1	6.8
2033	6.6	2.9	6.3
2034	6.1	2.6	5.8
2035	5.6	2.4	5.4
2036	5.2	2.2	4.9
2037	4.8	2.0	4.5
2038	4.4	1.8	4.2
2039	4.1	1.6	3.8
2040	3.8	1.5	3.5
2041	3.5	1.3	3.2
2042	3.2	1.2	3.0
2043	3.0	1.1	2.7
2044	2.7	1.0	2.5
2045	2.4	0.9	2.2
2046	2.1	0.7	1.9
2047	1.8	0.6	1.6
2048	1.5	0.5	1.4
2049	1.2	0.4	1.1
2050	0.9	0.3	0.8

WGL Delivered Gas Volumes (Million Dekatherms)



Year	ASHP Capital Cost
2020	\$3,568
2025	\$3,457
2030	\$3,345
2035	\$3,212
2040	\$3,078
2045	\$2,922
2050	\$2,766

Construction	Household Type	Baseline HVAC Building Category	Current Fuel	Fuel Choice	Household Size	Total System Product Life Difference	Annualized - Total System Costs	Total System Costs
New	Single Family			Natural Gas	2250 sq. ft.	\$9,202	\$511	\$10,174
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Natural Gas	2250 sq. ft.	\$8,942	\$497	\$9,828
New	Single Family			Electric System	2250 sq. ft.	\$10,228	\$568	\$9,333
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Electric System	2250 sq. ft.	\$11,422	\$635	\$10,526

Construction	Household Type	Baseline HVAC Building Category	Current Fuel	Fuel Choice	Household Size	Furnace Unit Size	Space Heating/AC Upfront Cost	2050 Heating Equipment Costs	A/C Unit Costs	HVAC Installation Costs	HVAC Annual Operating Cost (\$)	HVAC - Product Lifetime
New	Single Family			Natural Gas	2250 sq. ft.	90,000 Btu	\$6,683	\$1,973	\$2,522	\$2,188	\$45	24
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Natural Gas	2250 sq. ft.	90,000 Btu	\$6,337	\$1,745	\$2,522	\$2,070	\$45	24
New	Single Family			Electric System	2250 sq. ft.	3 Ton	\$4,854	\$2,766	\$0	\$2,088	\$76	18
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Electric System	2250 sq. ft.	3 Ton	\$6,047	\$2,766	\$0	\$3,281	\$76	18

Construction	Household Type	Baseline HVAC Building Category	Current Fuel	Fuel Choice	Household Size	Water Heater Size	Water Heater Cost	Water System Annual Operating Cost (\$)	Water Heating - Product Lifetime	Other Systems Costs	Cooking Range	Clothes Dryer	Other Product Lifetime
New	Single Family			Natural Gas	2250 sq. ft.	50 Gallons	\$1,392	\$14	15	\$1,214	\$525	\$689	15
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Natural Gas	2250 sq. ft.	50 Gallons	\$1,392	\$14	15	\$1,214	\$525	\$689	15
New	Single Family			Electric System	2250 sq. ft.	50 Gallons	\$1,651	\$16	15	\$1,448	\$799	\$649	15
Existing	Single Family	Average of Forced Air Furnace / Non-Forced Air Systems, AC / No-AC SFHs	Natural Gas	Electric System	2250 sq. ft.	50 Gallons	\$1,651	\$16	15	\$1,448	\$799	\$649	15

Construction	Household Type	Current Fuel	Fuel Choice	Household Size	Total System Product Life Difference	Annualized - Total System Costs	Total System Costs
New	Apartment		Natural Gas	1000 sq. ft.	\$6,671	\$371	\$6,800
Existing	Apartment	Natural Gas	Natural Gas	1000 sq. ft.	\$6,815	\$379	\$6,991
New	Apartment		Electric System	1000 sq. ft.	\$8,622	\$479	\$7,726
Existing	Apartment	Natural Gas	Electric System	1000 sq. ft.	\$9,233	\$513	\$8,331

Construction	Household Type	Current Fuel	Fuel Choice	Household Size	Furnace Unit Size	Space Heating/AC Upfront Cost	2050 Heating Equipment Costs	A/C Unit Costs	HVAC Installation Costs	HVAC Annual Operating Cost (\$)	HVAC - Product Lifetime
New	Apartment		Natural Gas	1000 sq. ft.	30,000 Btu	\$3,309	\$1,243	\$1,222	\$844	\$45	24
Existing	Apartment	Natural Gas	Natural Gas	1000 sq. ft.	30,000 Btu	\$3,500	\$1,243	\$2,522	\$1,035	\$45	24
New	Apartment		Electric System	1000 sq. ft.	1 Ton	\$3,247	\$2,203	\$0	\$1,044	\$76	18
Existing	Apartment	Natural Gas	Electric System	1000 sq. ft.	1 Ton	\$3,825	\$2,203	\$0	\$1,622	\$76	18

Construction	Household Type	Current Fuel	Fuel Choice	Household Size	Water Heater Size	Water Heater Cost	Water System Annual Operating Cost (\$)	Water Heating - Product Lifetime	Other Systems Costs	Cooking Range	Clothes Dryer	Other Product Lifetime
New	Apartment		Natural Gas	1000 sq. ft.	50 Gallons	\$1,392	\$14	15	\$1,214	\$525	\$689	15
Existing	Apartment	Natural Gas	Natural Gas	1000 sq. ft.	50 Gallons	\$1,392	\$14	15	\$1,214	\$525	\$689	15
New	Apartment		Electric System	1000 sq. ft.	50 Gallons	\$1,651	\$16	15	\$1,448	\$799	\$649	15
Existing	Apartment	Natural Gas	Electric System	1000 sq. ft.	50 Gallons	\$1,651	\$16	15	\$1,448	\$799	\$649	15

Building Type	Vintage	End Use	Baseline Equipment	Upgrade Equipment	Base Case Cost (\$/ft2)	Upgrade Cost (\$/ft2)	Incremental Cost (\$/ft2)
Federal Building	New Construction	HVAC	(2) 1,000 MBH boiler & (1) 50 ton water cooled chiller	180 ton VRF ASHP	\$7.59	\$8.00	\$0.41
Federal Building	New Construction	DHW	400 MBH boiler	400 MBH equ. HP	\$0.13	\$0.27	\$0.13
Institutional	New Construction	HVAC	(2) 1,500 MBH boiler & (1) 75 ton water cooled chiller	300 ton VRF ASHP	\$5.75	\$8.00	\$2.25
Institutional	New Construction	DHW	600 MBH boiler	600 MBH equ. HP	\$0.13	\$0.27	\$0.13
Large Commercial	New Construction	HVAC	(2) 750 MBH boiler & (1) 30 ton air cooled chiller	120 ton VRF ASHP	\$6.08	\$9.60	\$3.52
Large Commercial	New Construction	DHW	200 MBH boiler	200 MBH equ. HP	\$0.16	\$0.33	\$0.16
Small Commercial	New Construction	HVAC	(3) 5 ton, 112MBH gas fired RTU	(3) 5 ton ASHP RTUs	\$2.68	\$3.21	\$0.54
Small Commercial	New Construction	DHW	(2) 60 gallon tank	19 MBH ASHP	\$0.48	\$0.81	\$0.33
Federal Building	Retrofit (EOL)	HVAC	(2) 1,000 MBH boiler & (1) 50 ton water cooled chiller	(15) 12 ton ASHP	\$1.23	\$2.68	\$1.44
Federal Building	Retrofit (EOL)	DHW	400 MBH boiler	400 MBH equ. HP	\$0.13	\$0.27	\$0.13
Institutional	Retrofit (EOL)	HVAC	(2) 1,500 MBH boiler & (1) 75 ton water cooled chiller	(25) 12 ton ASHP	\$0.99	\$2.68	\$1.68
Institutional	Retrofit (EOL)	DHW	600 MBH boiler	600 MBH equ. HP	\$0.13	\$0.27	\$0.13
Large Commercial	Retrofit (EOL)	HVAC	(2) 750 MBH boiler & (1) 30 ton air cooled chiller	(10) 12 ton ASHP	\$1.32	\$3.21	\$1.89
Large Commercial	Retrofit (EOL)	DHW	200 MBH boiler	200 MBH equ. HP	\$0.16	\$0.33	\$0.16
Small Commercial	Retrofit (EOL)	HVAC	(3) 5 ton, 112MBH gas fired RTU	(3) 5 ton ASHP RTUs	\$2.68	\$3.21	\$0.54
Small Commercial	Retrofit (EOL)	DHW	(2) 60 gallon tank	19 MBH ASHP	\$0.48	\$0.81	\$0.33