

APPENDIX L:

On-Site Generation and Electrification

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This appendix relates CEUS findings on potential trends in building electrification, on the number and types of electric vehicle (EV) chargers found during the survey, and on behind-the-meter (BTM) generation. It is important to note that there are better sources than the 2022 CEUS for each of these topics. The CEUS survey relies on sampling to develop estimates of floorspace, energy usage, and energy intensity by Forecast Zone and Building-type. For a given combination of Forecast Zone and Building-type, the sampling precision alone is, on average, $\pm 20\%$. However, fewer than 10% of sites have BTM generation and far fewer still have electric vehicle chargers (at least as of 2019, when most of the on-site data collection occurred for CEUS). The statistical precision for parameters related to these topics then is much worse than $\pm 20\%$.

Evidence of Electrification

Unlike BTM generation or EV chargers, most sites have some sort of space heating and water heating, and many sites have commercial food service equipment. The CEUS survey collected fuel saturation data for thousands of sites. Therefore, it is plausible that the CEUS data would evince building electrification if significant amounts of electrification occurred prior to 2020. Table 1 shows electric space heating, water heating, and commercial cooking fuel shares by building construction period. There seems to be no trend toward electrification (as expected).

Table 1: Electric Fuel Shares by Building Construction Date

Site Construction Date	Electric Space Heating Saturation	Electric Water Heating Saturation	Electric Commercial Cooking Saturation
Pre-1990	23%	35%	27%
1990-1994	22%	47%	27%
1995-1999	14%	48%	29%
2000-2004	17%	50%	33%
2005-2009	20%	50%	34%
2010-2015	16%	41%	34%
2016 and Newer	17%	41%	32%

Perhaps one reason that Table 1 did not show any significant trend is that equipment expire and are replaced multiple times in a building's lifecycle. Perhaps focusing on buildings that have had recent renovations would reveal fuel preferences in recent retrofits. Table 2 below shows fuel shares for electric space heating, electric water heating, and electric commercial cooking equipment for buildings that have either had relevant equipment renovations since 2014, or not. The data indicates that buildings that have been renovated have opted for gas over electricity. This finding is consistent with the discussion related to long term price

elasticity responses: natural gas prices have declined significantly over the last 15 years, and the economic response is a shift toward gas-fueled variants of commercial equipment.

Table 2: Electric Fuel Shares by Recent Renovation Status

Status	Electric Space Heating Saturation	Electric Water Heating Saturation	Electric Commercial Cooking Saturation
Updated Since 2014	18%	37%	55%
Not Updated Since 2014	30%	51%	61%

Onsite Generation

The CEUS survey found evidence of on-site generation at 1,046 surveyed sites (approximately 4.6% of all surveyed sites). The CEUS team estimated typical annual generation by estimating system capacity (either through documentation review or panel counts or area estimates) and application of Forecast Zone-specific equivalent full-load hours of generation for solar panels, and typical hours of use for combined heat and power or fuel cells. The team also estimated natural gas usage for gas-powered generators and fuel cells by applying typical technology-specific efficiency factors to the annual generation amounts. In some cases, particularly with large generators at universities, participants provided actual annual generation records. Table 3 lists the total annual on-site generation energy by Forecast Zone and generator technology and shows the associated gas fuel input for CHP and Fuel Cells.

Table 3: On-site Generation Amounts and Associated Gas Fuel Input by Zone

Forecast Zone	CHP GWh	Fuel Cell GWh	PV GWh	Natural Gas Input (kilo-therms)
1	242	81	1,006	30,510
2	4	0	101	475
3	0	0	91	0
4	170	29	424	19,143
5	53	0	415	5,621
6	0	0	89	0
7	158	83	577	19,336
8	0	0	59	0
9	0	142	113	8,061
10	65	186	402	17,291
11	0	0	173	0
12	348	176	362	42,274
13	0	0	86	0
16	510	0	19	54,358

17	0	0	32	0
Total	1,551	697	3,948	197,069

As previously discussed, the main uncertainty associated with onsite generation is statistical. The CEUS team used data from the Energy Commission’s Quarterly Fuel and Energy Report (QFER) data tables to construct a similar table for the year 2019 – which is the year that most closely aligns with CEUS data collection. Table 4 below shows annual electric generation by generator technology and Forecast Zone as constructed by the Energy Commission’s QFER Team.

Table 4: On-site Generation Amounts from QFER Reports

Forecast Zone	CHP GWh	Fuel Cell GWh	PV GWh
1	272	72	613
2	5	25	139
3	4	6	72
4	25	30	347
5	32	3	463
6	41	11	129
7	248	115	446
8	15	6	62
9	2	32	108
10	80	33	286
11	9	11	202
12	485	41	365
13	1	4	142
16	283	22	63
17	14	11	66
Total	1,514	421	3,502

Electric Vehicle Charging

The CEUS survey found evidence of on-site generation at 789 surveyed sites (approximately 3.4% of all surveyed sites). Table 5 lists key characteristics for EV chargers as collected by the survey. In the table, “L1” refers to Level 1 or 120V chargers, “L2” refers to Level 2, or 240V chargers, and “L3” refers to Level 3 or direct current (DC) chargers.

Table 5: Statewide Commercial-Sector EV Charging Characteristics

EV Charging Parameter	L1	L2	L3
Percentage of Sites with EV Charging	0.3%	1.0%	0.1%
Percentage with Dedicated Meters	14.1%	9.8%	4.6%
Total Charging Ports in Commercial Sector (Circa 2020)	8,307	30,236	2,033