

# Net-Zero America - district of columbia state report

Larson et al. 2020

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These data underlie graphs and tables presented in the Princeton Net-Zero America study (E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, interim report, Princeton University, Princeton, NJ, December 15, 2020. Report available at <https://netzeroamerica.princeton.edu>.)

## Notes

- These data are a subset of all data from the study available at <https://netzeroamerica.princeton.edu>.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one “no new policies” reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not state-level results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- Some results are not model outputs, but rather they are limits that apply across all scenarios (e.g., maximum carbon storage potential in agricultural soils).

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Table 1: E+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.402	0.417	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.7	65.1	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.3	34.9	5.97	0.3	0	0	0
Sales of space heating units - Electric Heat Pump (%)	16.5	34.9	77.8	87.4	87.8	87.8	87.7
Sales of space heating units - Electric Resistance (%)	22.8	22.2	9.26	6.35	6.2	6.29	6.29
Sales of space heating units - Fossil (%)	1.63	2.49	1.11	0.815	0.808	0.783	0.781
Sales of space heating units - Gas (%)	59	40.4	11.8	5.45	5.16	5.18	5.18
Sales of water heating units - Electric Heat Pump (%)	0	9.33	49.4	58.4	58.8	58.8	58.8
Sales of water heating units - Electric Resistance (%)	37.1	50.9	42.3	40.4	40.3	40.2	40.2
Sales of water heating units - Gas Furnace (%)	61.4	38.7	7.32	0.309	0	0	0
Sales of water heating units - Other (%)	1.49	1.09	0.957	0.942	0.957	0.984	1

Table 2: E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	66.3	174	275	420	454	434
Public EV charging plugs - DC Fast (1000 units)	0.087	0	0.099	0	0.395	0	0.632
Public EV charging plugs - L2 (1000 units)	0.517	0	2.37	0	9.48	0	15.2
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	0.809	1.15	0.981	0.307	0.063	0.013	0
Vehicle sales - Light-duty - EV (%)	6.39	22.9	57.2	86	96.8	99.3	100
Vehicle sales - Light-duty - gasoline (%)	85.8	69.2	37.6	12.2	2.74	0.574	0
Vehicle sales - Light-duty - hybrid (%)	6.82	6.32	3.99	1.4	0.353	0.08	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.106	0.296	0.147	0.043	0.01	0.002	0
Vehicle sales - Light-duty - other (%)	0.069	0.062	0.036	0.012	0.003	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 3: E+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46	43.8	40.6	38.1	37.2	37.7
Final energy use - Industry (PJ)	5.02	4.93	5.03	5.16	5.31	5.5	5.74
Final energy use - Residential (PJ)	19.8	18.7	17.2	15.1	13.5	12.5	12.1
Final energy use - Transportation (PJ)	31	28.7	26.1	22.8	19.8	18	17.2

Table 4: E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,166	5,788	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.05	28.4	70.8	84.1	85.4	85.4	85.4
Sales of space heating units - Electric Resistance (%)	2.42	8.17	10.2	12.3	12.6	12.7	12.7
Sales of space heating units - Fossil (%)	1.05	3.87	0.737	0.031	0	0	0

Table 4: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	94.5	59.5	18.2	3.63	1.98	1.93	1.91
Sales of water heating units - Electric Heat Pump (%)	0.085	10.5	54.6	64.5	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	2.17	10.8	28.3	32.3	32.4	32.4	32.4
Sales of water heating units - Gas Furnace (%)	96.6	74.7	14.1	0.595	0	0	0
Sales of water heating units - Other (%)	1.11	3.93	2.93	2.68	2.68	2.68	2.68

Table 5: *E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.425	0.429	0.84	0.893	0.835	0.874

Table 6: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0.01	0	0	0	0	0

Table 7: *E+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025
Solar - Base land use assumptions (GWh)	16	0

Table 8: *E+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

Table 9: *E+ scenario - PILLAR 4: CCUS - CO2 storage*

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)	0	0	0	0	0	0	0

Table 10: *E+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	0	0	0
Cumulative investment - All (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	0
Trunk (km)	0	0	0	0	0	0	0

Table 11: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	73.5	0.05	0.05	0.045	0.032	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	32.3	24.1	15.2	14	8.48	3.59
Monetary damages from air pollution - Transportation (million 2019\$)	0	411	374	279	160	70.5	25.3
Premature deaths from air pollution - Coal (deaths)	0	8.25	0.006	0.006	0.005	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.65	2.73	1.72	1.58	0.958	0.406
Premature deaths from air pollution - Transportation (deaths)	0	46.2	42.1	31.4	17.9	7.93	2.84

Table 12: *E+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	6.78	7.81	15.9	6.06	4.7	3.46	2.57
By economic sector - Construction (jobs)	88.3	99.3	91.7	176	170	138	139
By economic sector - Manufacturing (jobs)	34	35.7	33.4	48.8	44.3	34.6	32.9
By economic sector - Mining (jobs)	74.9	60	41.4	25.8	14.6	6.81	2.93
By economic sector - Other (jobs)	1.1	1.84	2.08	8.47	8.7	7.36	7.68
By economic sector - Pipeline (jobs)	23.2	23	19.1	14.8	10.7	6.48	4.14
By economic sector - Professional (jobs)	37.2	42.9	42	63.7	59.8	48.3	46.9
By economic sector - Trade (jobs)	34.4	33.3	27.2	39.1	35	27.4	26.3
By economic sector - Utilities (jobs)	97.8	117	111	264	260	213	215
By education level - All sectors - Associates degree or some college (jobs)	123	131	119	211	200	160	158
By education level - All sectors - Bachelors degree (jobs)	86.6	89	78.3	124	115	90.5	88.2
By education level - All sectors - Doctoral degree (jobs)	2.75	2.84	2.54	3.54	3.21	2.52	2.41
By education level - All sectors - High school diploma or less (jobs)	165	176	165	278	262	210	208
By education level - All sectors - Masters or professional degree (jobs)	20.6	21.4	19	30.3	28.1	22.3	21.8
By resource sector - Biomass (jobs)	28.1	33.5	43.7	17.3	14.2	12.6	11
By resource sector - CO2 (jobs)	0	0	0	0	0	0	0
By resource sector - Grid (jobs)	42.3	82.9	97.3	450	469	398	424
By resource sector - Natural Gas (jobs)	225	220	180	140	103	66.1	42.7
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	103	84.6	63	39.5	21	8.21	0
Median wages - Annual - All (\$2019 per job)	73,995	74,628	74,875	75,338	76,225	77,229	78,280
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	65.3	69.7	63.1	111	105	83.7	82.7
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	28.5	30.7	27.7	49.2	46.4	37.1	36.6
On-Site or In-Plant Training - Total jobs - None (jobs)	63.4	66.7	60.8	99.3	92.7	73.8	72.4
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	3.36	3.69	3.38	6.22	5.91	4.74	4.7
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	237	250	229	382	358	286	281
On-the-Job Training - All sectors - 1 to 4 years (jobs)	84.6	90.4	81.6	144	136	109	107
On-the-Job Training - All sectors - 4 to 10 years (jobs)	27.2	29.7	26.9	49	46.4	37.2	36.8
On-the-Job Training - All sectors - None (jobs)	21.3	22.1	19.8	32.1	29.8	23.7	23.3
On-the-Job Training - All sectors - Over 10 years (jobs)	3.71	3.86	3.41	5.5	5.1	4.03	3.93
On-the-Job Training - All sectors - Up to 1 year (jobs)	261	275	252	417	390	311	306
Related work experience - All sectors - 1 to 4 years (jobs)	146	154	140	234	219	175	172

Table 12: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - 4 to 10 years (jobs)	94.6	100	89.6	153	143	114	112
Related work experience - All sectors - None (jobs)	58	61.9	57.1	96.5	90.7	72.5	71.4
Related work experience - All sectors - Over 10 years (jobs)	24.9	26.1	23.2	39.6	37.1	29.6	29.1
Related work experience - All sectors - Up to 1 year (jobs)	74.3	79.2	74.3	124	117	93.8	92.9
Wage income - All (million \$2019)	29.4	31.4	28.7	48.8	46.3	37.4	37.4

Table 13: *E+ scenario - IMPACTS - Fossil fuel industries*

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	24	24.4	20.5	16.5	12.4	7.8	5.41
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	496
Natural gas production - Annual (tcf)	0	0	0	0	0	0	0
Oil consumption - Annual (million bbls)	2.11	1.9	1.54	1.05	0.601	0.251	0
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	33.1
Oil production - Annual (million bbls)	0	0	0	0	0	0	0

Table 14: *E- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.401	0.411	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.5	56.7	60.7	71.5	86.4	95.6	98.8
Sales of cooking units - Gas (%)	44.5	43.3	39.3	28.5	13.6	4.39	1.18
Sales of space heating units - Electric Heat Pump (%)	16.5	26.6	31.6	45.8	67.3	81.3	86.2
Sales of space heating units - Electric Resistance (%)	22.8	24.7	23	18.6	12.2	8.08	6.66
Sales of space heating units - Fossil (%)	1.63	2.76	2.65	2.23	1.53	1.04	0.878
Sales of space heating units - Gas (%)	59	45.9	42.7	33.4	19	9.58	6.31
Sales of water heating units - Electric Heat Pump (%)	0	1.61	6.17	19.3	39.5	52.6	57.2
Sales of water heating units - Electric Resistance (%)	37.1	52.6	51.5	48.6	44.3	41.5	40.6
Sales of water heating units - Gas Furnace (%)	61.4	44.7	41.2	31	15.2	4.85	1.26
Sales of water heating units - Other (%)	1.49	1.12	1.13	1.1	1.04	1.01	1.01

Table 15: *E- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	0	11.4	22.4	77.3	238	349
Public EV charging plugs - DC Fast (1000 units)	0.087	0	0.036	0	0.151	0	0.405
Public EV charging plugs - L2 (1000 units)	0.517	0	0.857	0	3.61	0	9.71
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	0.829	1.35	1.93	1.5	0.908	0.457	0.198
Vehicle sales - Light-duty - EV (%)	2.75	6.64	15.5	31.7	54.6	75.9	89.2
Vehicle sales - Light-duty - gasoline (%)	89.1	83.7	73.8	59.3	39.2	20.8	9.31
Vehicle sales - Light-duty - hybrid (%)	7.13	7.85	8.37	7.26	5.08	2.79	1.29
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.358	0.285	0.204	0.136	0.073	0.034
Vehicle sales - Light-duty - other (%)	0.071	0.073	0.065	0.055	0.038	0.02	0.009
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141

Table 15: E- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 16: E- scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46.1	45.5	44.7	43.2	41.6	40.7
Final energy use - Industry (PJ)	5.02	4.93	5.04	5.23	5.42	5.65	5.91
Final energy use - Residential (PJ)	19.8	18.8	18.3	17.7	16.6	15.3	14
Final energy use - Transportation (PJ)	31.1	29	27.3	25.8	24.6	23.1	21.2

Table 17: E- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,159	5,728	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	2.05	20.4	25.2	39.3	61.5	77.1	83.1
Sales of space heating units - Electric Resistance (%)	2.42	7.86	8.12	8.85	10.2	11.6	12.4
Sales of space heating units - Fossil (%)	1.05	4.47	4.15	3.13	1.52	0.487	0.128
Sales of space heating units - Gas Furnace (%)	94.5	67.3	62.5	48.8	26.8	10.8	4.39
Sales of water heating units - Electric Heat Pump (%)	0.085	2.04	7.05	21.5	43.6	58.1	63.1
Sales of water heating units - Electric Resistance (%)	2.17	7.4	9.35	15.1	24	29.7	31.7
Sales of water heating units - Gas Furnace (%)	96.6	86.4	79.5	59.7	29.2	9.32	2.43
Sales of water heating units - Other (%)	1.11	4.12	4.12	3.71	3.21	2.85	2.73

Table 18: E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.36	0.356	0.467	0.477	0.862	0.916

Table 19: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	73.5	0.05	0.05	0.045	0.032	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	33.6	21.8	10.1	4.92	1.65	1.07
Monetary damages from air pollution - Transportation (million 2019\$)	0	420	418	402	358	281	189
Premature deaths from air pollution - Coal (deaths)	0	8.25	0.006	0.006	0.005	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.8	2.47	1.14	0.556	0.187	0.121
Premature deaths from air pollution - Transportation (deaths)	0	47.2	47.1	45.2	40.2	31.6	21.2

Table 20: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.402	0.417	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.7	65.1	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.3	34.9	5.97	0.3	0	0	0
Sales of space heating units - Electric Heat Pump (%)	16.5	34.9	77.8	87.4	87.8	87.8	87.7

Table 20: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Resistance (%)	22.8	22.2	9.26	6.35	6.2	6.29	6.29
Sales of space heating units - Fossil (%)	1.63	2.49	1.11	0.815	0.808	0.783	0.781
Sales of space heating units - Gas (%)	59	40.4	11.8	5.45	5.16	5.18	5.18
Sales of water heating units - Electric Heat Pump (%)	0	9.33	49.4	58.4	58.8	58.8	58.8
Sales of water heating units - Electric Resistance (%)	37.1	50.9	42.3	40.4	40.3	40.2	40.2
Sales of water heating units - Gas Furnace (%)	61.4	38.7	7.32	0.309	0	0	0
Sales of water heating units - Other (%)	1.49	1.09	0.957	0.942	0.957	0.984	1

Table 21: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	66.3	174	275	420	454	434
Public EV charging plugs - DC Fast (1000 units)	0.087	0	0.099	0	0.395	0	0.632
Public EV charging plugs - L2 (1000 units)	0.517	0	2.37	0	9.48	0	15.2
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	0.809	1.15	0.981	0.307	0.063	0.013	0
Vehicle sales - Light-duty - EV (%)	6.39	22.9	57.2	86	96.8	99.3	100
Vehicle sales - Light-duty - gasoline (%)	85.8	69.2	37.6	12.2	2.74	0.574	0
Vehicle sales - Light-duty - hybrid (%)	6.82	6.32	3.99	1.4	0.353	0.08	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.106	0.296	0.147	0.043	0.01	0.002	0
Vehicle sales - Light-duty - other (%)	0.069	0.062	0.036	0.012	0.003	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 22: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46	43.8	40.6	38.1	37.2	37.7
Final energy use - Industry (PJ)	5.02	4.93	5.03	5.16	5.31	5.5	5.74
Final energy use - Residential (PJ)	19.8	18.7	17.2	15.1	13.5	12.5	12.1
Final energy use - Transportation (PJ)	31	28.7	26.1	22.8	19.8	18	17.2

Table 23: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,166	5,788	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.05	28.4	70.8	84.1	85.4	85.4	85.4
Sales of space heating units - Electric Resistance (%)	2.42	8.17	10.2	12.3	12.6	12.7	12.7
Sales of space heating units - Fossil (%)	1.05	3.87	0.737	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	94.5	59.5	18.2	3.63	1.98	1.93	1.91
Sales of water heating units - Electric Heat Pump (%)	0.085	10.5	54.6	64.5	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	2.17	10.8	28.3	32.3	32.4	32.4	32.4
Sales of water heating units - Gas Furnace (%)	96.6	74.7	14.1	0.595	0	0	0



Table 23: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	1.11	3.93	2.93	2.68	2.68	2.68	2.68

Table 24: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.425	0.429	0.84	0.893	0.835	0.874

Table 25: E+RE+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025
Solar - Base land use assumptions (GWh)	16	0
Solar - Constrained land use assumptions (GWh)	16	0

Table 26: E+RE+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	73.5	0.05	0.05	0.045	0.032	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	30.8	20.5	13.2	9.43	3.31	0.589
Monetary damages from air pollution - Transportation (million 2019\$)	0	411	374	279	160	70.5	25.3
Premature deaths from air pollution - Coal (deaths)	0	8.25	0.006	0.006	0.005	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.48	2.32	1.49	1.07	0.374	0.066
Premature deaths from air pollution - Transportation (deaths)	0	46.2	42.1	31.4	17.9	7.93	2.84

Table 27: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.402	0.417	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.7	65.1	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.3	34.9	5.97	0.3	0	0	0
Sales of space heating units - Electric Heat Pump (%)	16.5	34.9	77.8	87.4	87.8	87.8	87.7
Sales of space heating units - Electric Resistance (%)	22.8	22.2	9.26	6.35	6.2	6.29	6.29
Sales of space heating units - Fossil (%)	1.63	2.49	1.11	0.815	0.808	0.783	0.781
Sales of space heating units - Gas (%)	59	40.4	11.8	5.45	5.16	5.18	5.18
Sales of water heating units - Electric Heat Pump (%)	0	9.33	49.4	58.4	58.8	58.8	58.8
Sales of water heating units - Electric Resistance (%)	37.1	50.9	42.3	40.4	40.3	40.2	40.2
Sales of water heating units - Gas Furnace (%)	61.4	38.7	7.32	0.309	0	0	0
Sales of water heating units - Other (%)	1.49	1.09	0.957	0.942	0.957	0.984	1

Table 28: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	66.3	174	275	420	454	434
Public EV charging plugs - DC Fast (1000 units)	0.087	0	0.099	0	0.395	0	0.632
Public EV charging plugs - L2 (1000 units)	0.517	0	2.37	0	9.48	0	15.2
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0

Table 28: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - diesel (%)	0.809	1.15	0.981	0.307	0.063	0.013	0
Vehicle sales - Light-duty - EV (%)	6.39	22.9	57.2	86	96.8	99.3	100
Vehicle sales - Light-duty - gasoline (%)	85.8	69.2	37.6	12.2	2.74	0.574	0
Vehicle sales - Light-duty - hybrid (%)	6.82	6.32	3.99	1.4	0.353	0.08	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.106	0.296	0.147	0.043	0.01	0.002	0
Vehicle sales - Light-duty - other (%)	0.069	0.062	0.036	0.012	0.003	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 29: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46	43.8	40.6	38.1	37.2	37.7
Final energy use - Industry (PJ)	5.02	4.93	5.03	5.16	5.31	5.5	5.74
Final energy use - Residential (PJ)	19.8	18.7	17.2	15.1	13.5	12.5	12.1
Final energy use - Transportation (PJ)	31	28.7	26.1	22.8	19.8	18	17.2

Table 30: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,166	5,788	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.05	28.4	70.8	84.1	85.4	85.4	85.4
Sales of space heating units - Electric Resistance (%)	2.42	8.17	10.2	12.3	12.6	12.7	12.7
Sales of space heating units - Fossil (%)	1.05	3.87	0.737	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	94.5	59.5	18.2	3.63	1.98	1.93	1.91
Sales of water heating units - Electric Heat Pump (%)	0.085	10.5	54.6	64.5	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	2.17	10.8	28.3	32.3	32.4	32.4	32.4
Sales of water heating units - Gas Furnace (%)	96.6	74.7	14.1	0.595	0	0	0
Sales of water heating units - Other (%)	1.11	3.93	2.93	2.68	2.68	2.68	2.68

Table 31: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.425	0.429	0.84	0.893	0.835	0.874

Table 32: *E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0	0	0	0	0	0

Table 33: *E+RE- scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025
Solar - Base land use assumptions (GWh)	16	0
Solar - Constrained land use assumptions (GWh)	16	0

Table 34: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	73.5	0.05	0.05	0.045	0.032	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	21.1	16.5	18.7	14.2	4.88	1.57
Monetary damages from air pollution - Transportation (million 2019\$)	0	411	374	279	160	70.5	25.3
Premature deaths from air pollution - Coal (deaths)	0	8.25	0.006	0.006	0.005	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	2.38	1.87	2.11	1.6	0.551	0.178
Premature deaths from air pollution - Transportation (deaths)	0	46.2	42.1	31.4	17.9	7.93	2.84

Table 35: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.401	0.411	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.5	56.7	60.7	71.5	86.4	95.6	98.8
Sales of cooking units - Gas (%)	44.5	43.3	39.3	28.5	13.6	4.39	1.18
Sales of space heating units - Electric Heat Pump (%)	16.5	26.6	31.6	45.8	67.3	81.3	86.2
Sales of space heating units - Electric Resistance (%)	22.8	24.7	23	18.6	12.2	8.08	6.66
Sales of space heating units - Fossil (%)	1.63	2.76	2.65	2.23	1.53	1.04	0.878
Sales of space heating units - Gas (%)	59	45.9	42.7	33.4	19	9.58	6.31
Sales of water heating units - Electric Heat Pump (%)	0	1.61	6.17	19.3	39.5	52.6	57.2
Sales of water heating units - Electric Resistance (%)	37.1	52.6	51.5	48.6	44.3	41.5	40.6
Sales of water heating units - Gas Furnace (%)	61.4	44.7	41.2	31	15.2	4.85	1.26
Sales of water heating units - Other (%)	1.49	1.12	1.13	1.1	1.04	1.01	1.01

Table 36: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	0	11.4	22.4	77.3	238	349
Public EV charging plugs - DC Fast (1000 units)	0.087	0	0.036	0	0.151	0	0.405
Public EV charging plugs - L2 (1000 units)	0.517	0	0.857	0	3.61	0	9.71
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	0.829	1.35	1.93	1.5	0.908	0.457	0.198
Vehicle sales - Light-duty - EV (%)	2.75	6.64	15.5	31.7	54.6	75.9	89.2
Vehicle sales - Light-duty - gasoline (%)	89.1	83.7	73.8	59.3	39.2	20.8	9.31
Vehicle sales - Light-duty - hybrid (%)	7.13	7.85	8.37	7.26	5.08	2.79	1.29
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.358	0.285	0.204	0.136	0.073	0.034
Vehicle sales - Light-duty - other (%)	0.071	0.073	0.065	0.055	0.038	0.02	0.009
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 37: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46.1	45.5	44.7	43.2	41.6	40.7
Final energy use - Industry (PJ)	5.02	4.93	5.04	5.23	5.42	5.65	5.91
Final energy use - Residential (PJ)	19.8	18.8	18.3	17.7	16.6	15.3	14
Final energy use - Transportation (PJ)	31.1	29	27.3	25.8	24.6	23.1	21.2

Table 38: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,159	5,728	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	2.05	20.4	25.2	39.3	61.5	77.1	83.1
Sales of space heating units - Electric Resistance (%)	2.42	7.86	8.12	8.85	10.2	11.6	12.4
Sales of space heating units - Fossil (%)	1.05	4.47	4.15	3.13	1.52	0.487	0.128
Sales of space heating units - Gas Furnace (%)	94.5	67.3	62.5	48.8	26.8	10.8	4.39
Sales of water heating units - Electric Heat Pump (%)	0.085	2.04	7.05	21.5	43.6	58.1	63.1
Sales of water heating units - Electric Resistance (%)	2.17	7.4	9.35	15.1	24	29.7	31.7
Sales of water heating units - Gas Furnace (%)	96.6	86.4	79.5	59.7	29.2	9.32	2.43
Sales of water heating units - Other (%)	1.11	4.12	4.12	3.71	3.21	2.85	2.73

Table 39: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.36	0.356	0.467	0.477	0.862	0.916

Table 40: E-B+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

Table 41: E-B+ scenario - PILLAR 4: CCUS - CO2 storage

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)	0	0	0	0	0	0	0

Table 42: E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	0	0	0
Cumulative investment - All (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	0
Trunk (km)	0	0	0	0	0	0	0

Table 43: REF scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	0.375	0.389	0	0	0	0
Sales of cooking units - Electric Resistance (%)	55.1	55.1	55.1	55.1	55.1	55.1	55.1
Sales of cooking units - Gas (%)	44.9	44.9	44.9	44.9	44.9	44.9	44.9
Sales of space heating units - Electric Heat Pump (%)	14.5	42.1	43.3	45	46.3	47.7	49.7
Sales of space heating units - Electric Resistance (%)	23.5	20.4	19.9	19.2	18.5	17.2	14.9
Sales of space heating units - Fossil (%)	1.66	2.13	1.42	1.13	1.1	1.11	1.16
Sales of space heating units - Gas (%)	60.3	35.3	35.4	34.6	34.1	34	34.2
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	37.1	52.9	52.8	52.7	52.7	52.6	52.5
Sales of water heating units - Gas Furnace (%)	61.4	46	46	46.1	46.1	46.2	46.2
Sales of water heating units - Other (%)	1.49	1.13	1.16	1.18	1.2	1.22	1.24

Table 44: REF scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.119	0.138	0.16	0.186	0.216	0.25	0.29
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	0.812	1.33	2.07	1.93	1.72	1.6	1.52
Vehicle sales - Light-duty - EV (%)	6	8.83	9.58	11.9	14.2	15.7	17.1
Vehicle sales - Light-duty - gasoline (%)	86.2	81.8	79	76.4	74	72.4	71.1
Vehicle sales - Light-duty - hybrid (%)	6.85	7.63	8.97	9.46	9.8	9.98	10
Vehicle sales - Light-duty - hydrogen FC (%)	0.107	0.35	0.305	0.262	0.254	0.252	0.26
Vehicle sales - Light-duty - other (%)	0.069	0.072	0.07	0.07	0.069	0.068	0.069
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

Table 45: REF scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	46	46.7	47.1	47.1	47.3	48.7	51.4
Final energy use - Industry (PJ)	5.02	5.07	5.32	5.71	6.12	6.59	7.12
Final energy use - Residential (PJ)	19.8	18.9	18.7	18.7	18.9	19.4	20
Final energy use - Transportation (PJ)	31	28.9	27.4	26.4	26.6	27.2	27.9

Table 46: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)	0	5,089	5,292	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric Heat Pump (%)	2.05	24.3	48.7	68.8	72.1	72.4	72.4
Sales of space heating units - Electric Resistance (%)	2.42	8.6	12.6	19.8	24.7	25.6	25.7
Sales of space heating units - Fossil (%)	1.05	4.35	3.2	1.36	0.197	0.016	0
Sales of space heating units - Gas Furnace (%)	94.5	62.7	35.5	10	2.95	1.99	1.92
Sales of water heating units - Electric Heat Pump (%)	0.085	0.274	0.27	0.271	0.273	0.271	0.272

Table 46: *REF scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	2.17	6.7	6.64	6.64	6.67	6.65	6.67
Sales of water heating units - Gas Furnace (%)	96.6	88.9	88.8	88.9	88.8	88.8	88.8
Sales of water heating units - Other (%)	1.11	4.16	4.29	4.22	4.28	4.31	4.29

Table 47: *REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	0.398	0.398	0.818	0.868	0.949	1

Table 48: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	194	120	112	109	107	98.4
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	27.3	29.7	34.2	34.7	32.1	31.5
Monetary damages from air pollution - Transportation (million 2019\$)	0	418	422	427	435	442	447
Premature deaths from air pollution - Coal (deaths)	0	21.8	13.5	12.6	12.2	12	11
Premature deaths from air pollution - Natural Gas (deaths)	0	3.09	3.36	3.87	3.92	3.63	3.56
Premature deaths from air pollution - Transportation (deaths)	0	47	47.5	48	48.9	49.7	50.2