Net-Zero America - connecticut state report v2

Larson et al. 2020

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Reading guide

IN DRAFT

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr	0	3.134	3.499	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.075	0.149	0.623	0.888	0.924	0.926	0.926
Sale of space heating units by type - Electric Resistance	0.049	0.064	0.05	0.022	0.017	0.016	0.018
Sale of space heating units by type - Fossil	0.531	0.588	0.186	0.066	0.056	0.056	0.054
Sale of space heating units by type - Gas	0.344	0.198	0.14	0.024	0.003	0.002	0.002
Sales of cooking units - Electric Resistance	0.718	0.778	0.962	0.998	1	1	1
Sales of cooking units - Gas	0.282	0.222	0.038	0.002	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.016	0.132	0.307	0.337	0.339	0.339
Sales of water heating units by type - Electric Resistance	0.355	0.546	0.604	0.652	0.66	0.66	0.66
Sales of water heating units by type - Gas Furnace	0.468	0.335	0.243	0.039	0.002	0	0
Sales of water heating units by type - Other	0.176	0.103	0.021	0.002	0.001	0.001	0.001

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

variable_name	2020	2025	2030	2035	2040	2045	2050
End-use technology sales by technology - HDV - diesel	0.972	0.921	0.67	0.233	0.042	0.006	0
End-use technology sales by technology - HDV - EV	0.006	0.038	0.19	0.456	0.574	0.596	0.6
End-use technology sales by technology - HDV - gasoline	0.002	0.002	0.002	0.001	0	0	0
End-use technology sales by technology - HDV - hybrid	0.001	0.001	0.001	0	0	0	0
End-use technology sales by technology - HDV - hydrogen FC	0.004	0.025	0.127	0.304	0.382	0.397	0.4
End-use technology sales by technology - HDV - other	0.015	0.012	0.011	0.006	0.002	0	0
End-use technology sales by technology - LDV - diesel	0.013	0.016	0.012	0.004	0.001	0	0
End-use technology sales by technology - LDV - EV	0.047	0.176	0.501	0.832	0.965	0.993	1
End-use technology sales by technology - LDV - gasoline	0.886	0.752	0.451	0.151	0.031	0.006	0
End-use technology sales by technology - LDV - hybrid	0.052	0.051	0.035	0.013	0.003	0.001	0
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.003	0.002	0.001	0	0	0
End-use technology sales by technology - LDV - other	0.001	0.001	0.001	0	0	0	0
End-use technology sales by technology - MDV - diesel	0.647	0.597	0.423	0.144	0.026	0.004	0
End-use technology sales by technology - MDV - EV	0.008	0.051	0.253	0.608	0.765	0.795	0.8
End-use technology sales by technology - MDV - gasoline	0.337	0.333	0.255	0.093	0.018	0.003	0
End-use technology sales by technology - MDV - hybrid	0.004	0.004	0.003	0.001	0	0	0
End-use technology sales by technology - MDV - hydrogen FC	0.002	0.013	0.063	0.152	0.191	0.199	0.2
End-use technology sales by technology - MDV - other	0.003	0.003	0.002	0.001	0	0	0
Light-duty vehicle capital costs - Cumulative 5-yr	0	548632501	1419003920	2278698036	3460018979	3756805561	3586759051
Number of public EV charging plugs - DC Fast Charging	229	0	879.171	0	3721.4	0	5992.7
Number of public EV charging plugs - L2 Charging	794	0	21107.1	0	89344.4	0	143873.2

Table 3: *E- scenario - PILLAR 2: Clean Electricity - Generating capacity*

variable_name	2020	2025	2030	2035	2040	2045	2050
Power generation capital investment - biomass power plant	0	0	0	0	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0	0	0	0
Power generation capital investment - biomass w/ccu power plant	0	0	0	0	0	0	0
Power generation capital investment - Solar PV - Base	0	0	3.532	1.918	1.049	1.09	0
Power generation capital investment - Solar PV - Constrained	0	0.09	2.853	0.72	0.909	1.603	0
Power generation capital investment - Wind - Base	0	0	0.755	0.336	0.169	0	0.073
Power generation capital investment - Wind - Constrained	0	0	0.822	0.087	0.108	0	0

Table 4: *E- scenario - PILLAR 2: Clean Electricity - Generation*

variable_name	2020	2025	2030	2035	2040	2045	2050
Power generation by technology - biomass power plant	0	0	0	0	0	0	0
Power generation by technology - biomass w/ccu allam power plant	0	0	0	0	0	0	0
Power generation by technology - biomass w/ccu power plant	0	0	0	0	0	0	0

Table 5: *E- scenario - PILLAR 2: Clean Electricity - Transmission*

variable_name	2020	2025	2030	2035	2040	2045	2050
HV transmission for wind and solar - base all	0	138.219	1187.5	2960	4944.6	7047.3	12205.7
HV transmission for wind and solar - base other intra-state	0	69.117	467.473	1109.2	1921.7	3043.4	6064.1
HV transmission for wind and solar - base spur intra-state	0	3.345	312.463	453.569	624.443	624.443	627.728
HV transmission for wind and solar - constrained all	0	174.219	862.293	1543.4	2017.8	2251.6	4525.9
HV transmission for wind and solar - constrained other intra-state	0	0	64.44	64.44	64.44	64.44	64.44
HV transmission for wind and solar - constrained spur intra-state	0	1.373	422.908	572.672	888.441	909.939	909.939

Table 6: *E- scenario - PILLAR 3: Bioenergy and Hydrogen - Bioconversion*

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0	0	0	0.052
Capital investment	0	0	0	0	0	0	1.508
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	0	0	0	0
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	0	0	0	0

Table 6: *E- scenario - PILLAR 3: Bioenergy and Hydrogen - Bioconversion (continued)*

variable_name	2020	2025	2030	2035	2040	2045	2050
Number of facilities - power	0	0	0	0	0	0	0
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	0	0	0	1
Number of facilities - pyrolysis ccu	0	0	0	0	0	0	0
Number of facilities - sng	0	0	0	0	0	0	0
Number of facilities - sng ccu	0	0	0	0	0	0	0

Table 7: *E- scenario - PILLAR 4: CO2 capture, use, storage - CO2 capture*

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0	0	0	0	0.01
Annual - BECCS	0	0	0	0	0	0
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0.01
Cumulative - All	0	0	0	0	0	0.01
Cumulative - BECCS	0	0	0	0	0	0
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0	0	0	0.01

Table 8: *E- scenario - PILLAR 4: CO2 capture, use, storage - CO2 storage*

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	0	0	0	0	0
Injection wells	0	0	0	0	0	0
Resource characterization, appraisal and permitting costs cumulative	0	0	0	0	0	0
Wells and facilities construction costs cumulative	0	0	0	0	0	0

Table 9: *E- scenario - PILLAR 4: CO2 capture, use, storage - CO2 transportation*

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	262468.379	262468.279	262468.479	262468.379	262469.179
CO2 pipelines - Spur	0	703.155	703.058	703.203	703.076	703.942
CO2 pipelines - Trunk	0	261765.272	261765.272	261765.272	261765.272	261765.272

Table 10: *E- scenario - IMPACTS - Jobs*

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	68.671	79.169	160.741	61.439	47.659	35.03	121.882
Jobs by economic sector - construction	5605.3	4586.1	5887.3	5803.4	5929.1	5614.3	7066
Jobs by economic sector - manufacturing	1612	2162.7	3527.7	3390.7	3757.8	4875.5	7050.6
Jobs by economic sector - mining	1333	1036.6	731.68	463.264	270.976	142.374	70.812
Jobs by economic sector - other	749.275	612.68	906.622	885.44	922.376	986.858	1477.5
Jobs by economic sector - pipeline	266.997	261.634	251.554	171.138	124.243	77.872	50.258
Jobs by economic sector - professional	2259.4	1973	2470.4	2382.3	2473.4	2387.7	3228.1
Jobs by economic sector - trade	1728.7	1460.8	1702	1627.3	1647.4	1616.3	2201.1
Jobs by economic sector - utilities	3892.4	3809.9	4405.5	5112.7	5821.4	5366.5	6156.1
Jobs by resource sector - Biomass	284.661	339.783	443.203	174.987	143.469	127.758	520.484
Jobs by resource sector - CO2	0	0	258.389	0.7	1.78	1.775	1.314
Jobs by resource sector - Coal	168.81	54.118	0	0	0	0	0
Jobs by resource sector - Grid	3766.9	3873.4	5650.3	8552.5	10077.7	9741.6	11892.3
Jobs by resource sector - Natural Gas	2841.8	2665.4	2096.3	1726.3	2136.5	1481.8	950.088
Jobs by resource sector - Nuclear	1109.6	1091.7	888.671	360.974	0	0	0
Jobs by resource sector - Oil	2745.7	2326.5	1810.9	1242.5	785.219	462.726	240.014
Jobs by resource sector - Solar	6499.2	5521	7776.3	6104.5	6252.7	7768.1	10626.9
Jobs by resource sector - Wind	99.035	110.675	1119.5	1735.3	1597	1518.9	3191.1
Median wages - All	68623.9	69495.1	69356.6	70701.6	71735.2	71920.7	72237.6
Required Level of Education - Associates degree or some college	5462.5	4996.7	6340.3	6403.9	6837.9	6871.7	8884.9
Required Level of Education - Bachelors degree	3605.8	3308.8	3995.7	3878.7	4038.7	4054.1	5278.2
Required Level of Education - Doctoral degree	131.821	115.926	136.957	126.4	126.808	123.096	163.341
Required Level of Education - High school diploma or less	7435.6	6761.4	8613.1	8556.9	9021.8	9096.4	11851.2
Required Level of Education - Masters or professional degree	879.899	799.668	957.521	931.903	969.251	957.262	1244.6
Wage income - All	1202134226	1110826493	1390325728	1406973040	1506217041	1517899547	1981194841

Table 11: *E- scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	95.611
Carbon sink enhancement potential - All (not counting overlap)	5015.9
Carbon sink enhancement potential - Avoid deforestation	1216.081
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-120.473
Carbon sink enhancement potential - Extend rotation length	1959.426
Carbon sink enhancement potential - Improve plantations	18.184
Carbon sink enhancement potential - Increase retention of HWP	600.219
Carbon sink enhancement potential - Increase trees outside forests	239.882
Carbon sink enhancement potential - permanent conservation cover	-4.717
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	344.612

Table 11: *E- scenario - PILLAR 6: Land carbon sinks - Agriculture (continued)*

variable_name	2050
Carbon sink enhancement potential - Restore productivity	541.848
Carbon sink enhancement potential - total	-125.19
Land impacted for carbon sink enhancement - Accelerate regeneration	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	326.441
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	83.13
Land impacted for carbon sink enhancement - Extend rotation length	1079.433
Land impacted for carbon sink enhancement - Improve plantations	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	67.669
Land impacted for carbon sink enhancement - permanent conservation cover	8.58
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	26.058
Land impacted for carbon sink enhancement - Restore productivity	305.77
Land impacted for carbon sink enhancement - total	91.71
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1071.962

Table 12: *E- scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	211977.4	215125.5	181338.6	145441.1	109485.9	68884.8	47776.7
Oil consumption	56326.9	52332.2	44389.7	32989.1	22447.5	14160.5	7819

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.12	0.114	0.109	0.101	0.093	0.088	0.085
Final energy demand by sector - industry	0.065	0.063	0.062	0.061	0.061	0.062	0.062
Final energy demand by sector - residential	0.155	0.143	0.13	0.112	0.094	0.082	0.074
Final energy demand by sector - transportation	0.228	0.212	0.186	0.152	0.122	0.104	0.096

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr	0	7080309106	7732161838	0	0	0	0
Sales of cooking units - Electric Resistance	0.369	0.499	0.812	0.874	0.877	0.877	0.877
Sales of cooking units - Gas	0.631	0.501	0.188	0.126	0.123	0.123	0.123
Sales of space heating units - Electric Heat Pump	0.048	0.11	0.393	0.724	0.778	0.781	0.781
Sales of space heating units - Electric Resistance	0.023	0.045	0.165	0.213	0.219	0.219	0.219
Sales of space heating units - Fossil	0.422	0.312	0.06	0.003	0	0	0
Sales of space heating units - Gas Furnace	0.507	0.534	0.382	0.061	0.004	0	0
Sales of water heating units - Electric Heat Pump	0.028	0.035	0.159	0.41	0.455	0.459	0.459
Sales of water heating units - Electric Resistance	0.138	0.126	0.24	0.481	0.523	0.525	0.525
Sales of water heating units - Gas Furnace	0.782	0.8	0.582	0.093	0.005	0	0
Sales of water heating units - Other	0.052	0.04	0.019	0.016	0.016	0.016	0.016

Table 16: *E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

variable_name	2025	2030	2035	2040	2045	2050
Electricity distribution peak load (capital invested) - Cumulative 5-yr	1.303	1.337	3.785	4.106	3.37	3.565

Table 17: *RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

variable_name	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr	0	3.057	3.197	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.073	0.088	0.091	0.096	0.098	0.1	0.103
Sale of space heating units by type - Electric Resistance	0.049	0.063	0.062	0.061	0.061	0.058	0.056
Sale of space heating units by type - Fossil	0.533	0.579	0.311	0.123	0.111	0.11	0.11
Sale of space heating units by type - Gas	0.345	0.271	0.536	0.72	0.73	0.732	0.731
Sales of cooking units - Electric Resistance	0.715	0.715	0.715	0.715	0.715	0.715	0.715
Sales of cooking units - Gas	0.285	0.285	0.285	0.285	0.285	0.285	0.285
Sales of water heating units by type - Electric Heat Pump	0	0	0	0	0	0	0
Sales of water heating units by type - Electric Resistance	0.355	0.535	0.534	0.535	0.534	0.534	0.534
Sales of water heating units by type - Gas Furnace	0.468	0.343	0.343	0.342	0.342	0.342	0.342
Sales of water heating units by type - Other	0.176	0.123	0.123	0.123	0.123	0.123	0.123

Table 18: *RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

variable_name	2020	2025	2030	2035	2040	2045	2050
End-use technology sales by technology - HDV - diesel	0.981	0.982	0.979	0.97	0.956	0.935	0.916
End-use technology sales by technology - HDV - EV	0	0	0	0	0	0	0
End-use technology sales by technology - HDV - gasoline	0.002	0.002	0.003	0.003	0.003	0.003	0.003
End-use technology sales by technology - HDV - hybrid	0.001	0.001	0.001	0.001	0.002	0.002	0.002
End-use technology sales by technology - HDV - hydrogen FC	0.001	0.001	0.002	0.002	0.002	0.002	0.003
End-use technology sales by technology - HDV - other	0.015	0.013	0.016	0.024	0.037	0.057	0.076
End-use technology sales by technology - LDV - diesel	0.013	0.018	0.021	0.02	0.018	0.017	0.016
End-use technology sales by technology - LDV - EV	0.043	0.066	0.074	0.092	0.111	0.127	0.139
End-use technology sales by technology - LDV - gasoline	0.889	0.851	0.827	0.806	0.783	0.765	0.75
End-use technology sales by technology - LDV - hybrid	0.052	0.06	0.073	0.079	0.084	0.088	0.091
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	0.003	0.003	0.003	0.003	0.003
End-use technology sales by technology - LDV - other	0.001	0.001	0.001	0.001	0.001	0.001	0.001
End-use technology sales by technology - MDV - diesel	0.652	0.635	0.616	0.596	0.58	0.565	0.552
End-use technology sales by technology - MDV - EV	0	0.001	0.003	0.007	0.009	0.01	0.01
End-use technology sales by technology - MDV - gasoline	0.34	0.355	0.37	0.385	0.397	0.408	0.417
End-use technology sales by technology - MDV - hybrid	0.004	0.004	0.005	0.006	0.007	0.008	0.009
End-use technology sales by technology - MDV - hydrogen FC	0.002	0.002	0.002	0.003	0.003	0.004	0.005
End-use technology sales by technology - MDV - other	0.003	0.003	0.003	0.003	0.004	0.005	0.007

Table 19: *RE- scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2020	2030	2050
Carbon sink enhancement potential - Accelerate regeneration	0	0	95.611
Carbon sink enhancement potential - All (not counting overlap)	0	0	5015.9
Carbon sink enhancement potential - Avoid deforestation	0	0	1216.081
Carbon sink enhancement potential - Extend rotation length	0	0	1959.426
Carbon sink enhancement potential - Improve plantations	0	0	18.184
Carbon sink enhancement potential - Increase retention of HWP	0	0	600.219
Carbon sink enhancement potential - Increase trees outside forests	0	0	239.882
Carbon sink enhancement potential - Reforest cropland	0	0	0
Carbon sink enhancement potential - Reforest pasture	0	0	344.612
Carbon sink enhancement potential - Restore productivity	0	0	541.848
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	326.441
Land impacted for carbon sink enhancement - Extend rotation length	0	0	1079.433
Land impacted for carbon sink enhancement - Improve plantations	0	0	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	67.669
Land impacted for carbon sink enhancement - Natural uptake	-10.16	-1.573	-1.407
Land impacted for carbon sink enhancement - Reforest cropland	0	0	0
Land impacted for carbon sink enhancement - Reforest pasture	0	0	26.058
Land impacted for carbon sink enhancement - Restore productivity	0	0	305.77
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-0.098	-0.176	-0.183
Land impacted for carbon sink enhancement - Total	-10.258	-1.749	-1.59
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	1071.962

Table 20: *RE- scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838

Table 20: *RE- scenario - PILLAR 6: Land carbon sinks - Forests (continued)*

variable_name	2050
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 21: *RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.12	0.116	0.117	0.116	0.115	0.117	0.121
Final energy demand by sector - industry	0.065	0.066	0.068	0.07	0.074	0.079	0.083
Final energy demand by sector - residential	0.155	0.145	0.139	0.135	0.132	0.13	0.128
Final energy demand by sector - transportation	0.228	0.214	0.197	0.187	0.187	0.193	0.2

Table 22: *RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

variable_name	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr	0	6992962195	7195912349	0	0	0	0
Sales of cooking units - Electric Resistance	0.369	0.39	0.386	0.385	0.383	0.385	0.384
Sales of cooking units - Gas	0.631	0.61	0.614	0.615	0.617	0.615	0.616
Sales of space heating units - Electric Heat Pump	0.048	0.13	0.412	0.642	0.679	0.683	0.684
Sales of space heating units - Electric Resistance	0.023	0.027	0.075	0.198	0.299	0.316	0.316
Sales of space heating units - Fossil	0.422	0.348	0.244	0.096	0.014	0.001	0
Sales of space heating units - Gas Furnace	0.507	0.495	0.269	0.064	0.008	0	0
Sales of water heating units - Electric Heat Pump	0.028	0.024	0.024	0.024	0.024	0.024	0.024
Sales of water heating units - Electric Resistance	0.138	0.115	0.112	0.114	0.114	0.112	0.113
Sales of water heating units - Gas Furnace	0.782	0.817	0.822	0.82	0.82	0.823	0.822
Sales of water heating units - Other	0.052	0.044	0.042	0.042	0.043	0.041	0.041

Table 23: *RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

variable_name	2025	2030	2035	2040	2045	2050
Electricity distribution peak load (capital invested) - Cumulative 5-yr	1.024	1.025	2.7	2.9	2.758	2.917

Table 24: *REF scenario - PILLAR 1: Efficiency/Electrification - Residential*

variable_name	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr	0	3.142	3.729	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.075	0.071	0.125	0.285	0.557	0.782	0.883
Sale of space heating units by type - Electric Resistance	0.049	0.065	0.062	0.058	0.046	0.03	0.021
Sale of space heating units by type - Fossil	0.531	0.663	0.619	0.485	0.276	0.131	0.076
Sale of space heating units by type - Gas	0.344	0.201	0.194	0.172	0.121	0.057	0.02
Sales of cooking units - Electric Resistance	0.717	0.725	0.751	0.819	0.914	0.972	0.993
Sales of cooking units - Gas	0.283	0.275	0.249	0.181	0.086	0.028	0.007
Sales of water heating units by type - Electric Heat Pump	0	0.005	0.018	0.061	0.152	0.255	0.312
Sales of water heating units by type - Electric Resistance	0.355	0.537	0.544	0.564	0.601	0.635	0.652
Sales of water heating units by type - Gas Furnace	0.468	0.339	0.328	0.292	0.205	0.096	0.031
Sales of water heating units by type - Other	0.176	0.119	0.11	0.083	0.041	0.014	0.005

Table 25: *REF scenario - PILLAR 1: Efficiency/Electrification - Transportation*

variable_name	2020	2025	2030	2035	2040	2045	2050
End-use technology sales by technology - HDV - diesel	0.974	0.96	0.913	0.798	0.582	0.321	0.137
End-use technology sales by technology - HDV - EV	0.005	0.015	0.041	0.108	0.236	0.394	0.51
End-use technology sales by technology - HDV - gasoline	0.002	0.002	0.002	0.002	0.002	0.001	0.001
End-use technology sales by technology - HDV - hybrid	0.001	0.001	0.001	0.001	0.001	0.001	0
End-use technology sales by technology - HDV - hydrogen FC	0.003	0.01	0.027	0.072	0.157	0.263	0.34
End-use technology sales by technology - HDV - other	0.015	0.013	0.015	0.019	0.022	0.02	0.011
End-use technology sales by technology - LDV - diesel	0.013	0.018	0.02	0.016	0.01	0.005	0.002
End-use technology sales by technology - LDV - EV	0.022	0.053	0.131	0.278	0.505	0.734	0.881
End-use technology sales by technology - LDV - gasoline	0.909	0.863	0.777	0.642	0.438	0.234	0.104
End-use technology sales by technology - LDV - hybrid	0.054	0.062	0.068	0.061	0.045	0.026	0.012
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	0.003	0.002	0.002	0.001	0
End-use technology sales by technology - LDV - other	0.001	0.001	0.001	0.001	0.001	0	0
End-use technology sales by technology - MDV - diesel	0.648	0.622	0.577	0.494	0.356	0.196	0.084
End-use technology sales by technology - MDV - EV	0.007	0.019	0.055	0.143	0.314	0.526	0.68
End-use technology sales by technology - MDV - gasoline	0.338	0.347	0.347	0.319	0.244	0.142	0.063
End-use technology sales by technology - MDV - hybrid	0.004	0.004	0.005	0.005	0.004	0.003	0.001
End-use technology sales by technology - MDV - hydrogen FC	0.002	0.005	0.014	0.036	0.079	0.132	0.17
End-use technology sales by technology - MDV - other	0.003	0.003	0.003	0.003	0.003	0.002	0.001
Light-duty vehicle capital costs - Cumulative 5-yr	0	0	90989298	186220890	633653801	1978919902	2888271527
Number of public EV charging plugs - DC Fast Charging	229	0	290.306	0	1394.5	0	3838.3
Number of public EV charging plugs - L2 Charging	794	0	6969.7	0	33479.6	0	92150.7

Table 26: *REF scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	95.611
Carbon sink enhancement potential - All (not counting overlap)	5015.9
Carbon sink enhancement potential - Avoid deforestation	1216.081
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-120.473
Carbon sink enhancement potential - Extend rotation length	1959.426
Carbon sink enhancement potential - Improve plantations	18.184
Carbon sink enhancement potential - Increase retention of HWP	600.219
Carbon sink enhancement potential - Increase trees outside forests	239.882
Carbon sink enhancement potential - permanent conservation cover	-4.717
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	344.612
Carbon sink enhancement potential - Restore productivity	541.848
Carbon sink enhancement potential - total	-125.19
Land impacted for carbon sink enhancement - Accelerate regeneration	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	326.441
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	83.13
Land impacted for carbon sink enhancement - Extend rotation length	1079.433
Land impacted for carbon sink enhancement - Improve plantations	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	67.669
Land impacted for carbon sink enhancement - permanent conservation cover	8.58
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	26.058
Land impacted for carbon sink enhancement - Restore productivity	305.77
Land impacted for carbon sink enhancement - total	91.71
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1071.962

Table 27: *REF scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 28: *REF scenario - PILLAR 1: Efficiency/Electrification - Overview*

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.12	0.114	0.111	0.108	0.105	0.101	0.096
Final energy demand by sector - industry	0.065	0.063	0.063	0.062	0.063	0.063	0.063
Final energy demand by sector - residential	0.155	0.144	0.135	0.128	0.118	0.105	0.091
Final energy demand by sector - transportation	0.228	0.214	0.195	0.179	0.167	0.152	0.134

Table 29: *REF scenario - PILLAR 1: Efficiency/Electrification - Commercial*

variable_name	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr	0	7079251696	7739585586	0	0	0	0
Sales of cooking units - Electric Resistance	0.369	0.407	0.447	0.565	0.727	0.829	0.864
Sales of cooking units - Gas	0.631	0.593	0.553	0.435	0.273	0.171	0.136
Sales of space heating units - Electric Heat Pump	0.048	0.077	0.11	0.209	0.409	0.618	0.73
Sales of space heating units - Electric Resistance	0.023	0.023	0.036	0.076	0.142	0.191	0.21
Sales of space heating units - Fossil	0.422	0.361	0.338	0.254	0.124	0.039	0.01
Sales of space heating units - Gas Furnace	0.507	0.539	0.517	0.46	0.325	0.152	0.049
Sales of water heating units - Electric Heat Pump	0.028	0.029	0.043	0.09	0.201	0.339	0.42
Sales of water heating units - Electric Resistance	0.138	0.12	0.13	0.177	0.282	0.412	0.488
Sales of water heating units - Gas Furnace	0.782	0.808	0.787	0.699	0.492	0.23	0.075
Sales of water heating units - Other	0.052	0.043	0.04	0.033	0.025	0.019	0.017

Table 30: *REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

variable_name	2025	2030	2035	2040	2045	2050
Electricity distribution peak load (capital invested) - Cumulative 5-yr	0.975	0.97	1.627	1.701	3.089	3.319

Table 31: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

variable_name	2025	2030	2035	2040	2045	2050
Power generation capital investment - Solar PV - Base	0	3.301	0.826	0.459	0	0
Power generation capital investment - Wind - Base	0	0.755	0.336	0.169	0	0.073

Table 32: *E+ scenario - PILLAR 2: Clean Electricity - Transmission*

variable_name	2020	2025	2030	2035	2040	2045	2050
HV transmission for wind and solar - base all	0	28.799	404.399	1515	1704.4	3062.6	7628.7
HV transmission for wind and solar - base other intra-state	0	1.823	25.255	25.255	25.255	25.255	25.255
HV transmission for wind and solar - base spur intra-state	0	3.345	259.569	436.681	553.381	553.381	556.666

Table 33: *E+ scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	95.611
Carbon sink enhancement potential - All (not counting overlap)	5015.9
Carbon sink enhancement potential - Avoid deforestation	1216.081
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-120.473
Carbon sink enhancement potential - Extend rotation length	1959.426
Carbon sink enhancement potential - Improve plantations	18.184
Carbon sink enhancement potential - Increase retention of HWP	600.219
Carbon sink enhancement potential - Increase trees outside forests	239.882
Carbon sink enhancement potential - permanent conservation cover	-4.717
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	344.612
Carbon sink enhancement potential - Restore productivity	541.848
Carbon sink enhancement potential - total	-125.19
Land impacted for carbon sink enhancement - Accelerate regeneration	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	326.441
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	83.13
Land impacted for carbon sink enhancement - Extend rotation length	1079.433
Land impacted for carbon sink enhancement - Improve plantations	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	67.669
Land impacted for carbon sink enhancement - permanent conservation cover	8.58
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	26.058
Land impacted for carbon sink enhancement - Restore productivity	305.77
Land impacted for carbon sink enhancement - total	91.71
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1071.962

Table 34: *E+ scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 35: *RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

variable_name	2020	2025	2030	2035	2040	2045	2050
Power generation capital investment - biomass power plant	0	0	0	0	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0	0	0	0
Power generation capital investment - biomass w/ccu power plant	0	0	0	0	0	0	0

Table 36: *RE+ scenario - PILLAR 2: Clean Electricity - Generation*

variable_name	2020	2025	2030	2035	2040	2045	2050
Power generation by technology - biomass power plant	0	0	0	0	0	0	0
Power generation by technology - biomass w/ccu allam power plant	0	0	0	0	0	0	0
Power generation by technology - biomass w/ccu power plant	0	0	0	0	0	0	0

Table 37: *RE+ scenario - PILLAR 3: Bioenergy and Hydrogen - Bioconversion*

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0	0	0	0.134
Capital investment	0	0	0	0	0	0	2.138
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	0	0	0	0
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	0	0	0	0
Number of facilities - power	0	0	0	0	0	0	0
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	0	0	0	2
Number of facilities - pyrolysis ccu	0	0	0	0	0	0	0
Number of facilities - sng	0	0	0	0	0	0	0
Number of facilities - sng ccu	0	0	0	0	0	0	0

Table 38: *RE+ scenario - PILLAR 4: CO2 capture, use, storage - CO2 capture*

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0	0	0	0	0.01
Annual - BECCS	0	0	0	0	0	0
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0.01
Cumulative - All	0	0	0	0	0	0.01
Cumulative - BECCS	0	0	0	0	0	0
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0	0	0	0.01

Table 39: *RE+ scenario - PILLAR 4: CO2 capture, use, storage - CO2 storage*

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	0	0	0	0	0
Injection wells	0	0	0	0	0	0
Resource characterization, appraisal and permitting costs cumulative	0	0	0	0	0	0
Wells and facilities construction costs cumulative	0	0	0	0	0	0

Table 40: *RE+ scenario - PILLAR 4: CO2 capture, use, storage - CO2 transportation*

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	262468.479	262468.479	262468.479	262468.479	262469.179
CO2 pipelines - Spur	0	703.22	703.211	703.248	703.21	703.956
CO2 pipelines - Trunk	0	261765.272	261765.272	261765.272	261765.272	261765.272

Table 41: *RE+ scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	95.611
Carbon sink enhancement potential - All (not counting overlap)	5015.9
Carbon sink enhancement potential - Avoid deforestation	1216.081
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-120.473
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	1959.426
Carbon sink enhancement potential - Improve plantations	18.184
Carbon sink enhancement potential - Increase retention of HWP	600.219
Carbon sink enhancement potential - Increase trees outside forests	239.882
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-4.717
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	344.612
Carbon sink enhancement potential - Restore productivity	541.848

Table 41: *RE+ scenario - PILLAR 6: Land carbon sinks - Agriculture (continued)*

variable_name	2050
Carbon sink enhancement potential - total	-125.19
Land impacted for carbon sink enhancement - Accelerate regeneration	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	326.441
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	163.149
Land impacted for carbon sink enhancement - Cropland to woody energy crops	0
Land impacted for carbon sink enhancement - Extend rotation length	1079.433
Land impacted for carbon sink enhancement - Improve plantations	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	67.669
Land impacted for carbon sink enhancement - pasture to energy crops	0.626
Land impacted for carbon sink enhancement - permanent conservation cover	8.58
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	26.058
Land impacted for carbon sink enhancement - Restore productivity	305.77
Land impacted for carbon sink enhancement - total	172.355
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1071.962

Table 42: *RE+ scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 43: *B+ scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	95.611
Carbon sink enhancement potential - All (not counting overlap)	5015.9
Carbon sink enhancement potential - Avoid deforestation	1216.081
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-120.473
Carbon sink enhancement potential - Extend rotation length	1959.426
Carbon sink enhancement potential - Improve plantations	18.184
Carbon sink enhancement potential - Increase retention of HWP	600.219
Carbon sink enhancement potential - Increase trees outside forests	239.882
Carbon sink enhancement potential - permanent conservation cover	-4.717
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	344.612
Carbon sink enhancement potential - Restore productivity	541.848
Carbon sink enhancement potential - total	-125.19
Land impacted for carbon sink enhancement - Accelerate regeneration	38.535
Land impacted for carbon sink enhancement - All (not counting overlap)	902.093
Land impacted for carbon sink enhancement - Avoid deforestation	326.441
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	83.13
Land impacted for carbon sink enhancement - Extend rotation length	1079.433
Land impacted for carbon sink enhancement - Improve plantations	10.106
Land impacted for carbon sink enhancement - Increase retention of HWP	120.044
Land impacted for carbon sink enhancement - Increase trees outside forests	67.669
Land impacted for carbon sink enhancement - permanent conservation cover	8.58

Table 43: *B+ scenario - PILLAR 6: Land carbon sinks - Agriculture (continued)*

variable_name	2050
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	26.058
Land impacted for carbon sink enhancement - Restore productivity	305.77
Land impacted for carbon sink enhancement - total	91.71
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1071.962

Table 44: *B+ scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	8.936
Business-as-usual carbon sink - Avoid deforestation	103.989
Business-as-usual carbon sink - Extend rotation length	590.525
Business-as-usual carbon sink - Improve plantations	3.838
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	13.605
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	6.366
Business-as-usual carbon sink - Restore productivity	107.64
Business-as-usual carbon sink - Total impacted (over 30 years)	0