Net-Zero America - florida 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	16.236	21.329	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.517	0.603	0.839	0.892	0.893	0.891	0.89
Sale of space heating units by type - Electric Resistance	0.4	0.355	0.15	0.104	0.103	0.105	0.106
Sale of space heating units by type - Fossil	0.008	0.007	0.001	0	0	0	0
Sale of space heating units by type - Gas	0.075	0.035	0.01	0.004	0.004	0.004	0.004
Sales of cooking units - Electric Resistance	0.96	0.969	0.995	1	1	1	1
Sales of cooking units - Gas	0.04	0.031	0.005	0	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.123	0.652	0.77	0.776	0.776	0.776
Sales of water heating units by type - Electric Resistance	0.884	0.818	0.316	0.204	0.199	0.199	0.199
Sales of water heating units by type - Gas Furnace	0.069	0.033	0.006	0	0	0	0
Sales of water heating units by type - Other	0.047	0.026	0.026	0.026	0.026	0.025	0.025

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	0.048	0.179	0.504	0.834	0.965	0.993	1
End-use technology sales by technology - LDV - gasoline	0.885	0.75	0.447	0.149	0.031	0.006	0
End-use technology sales by technology - LDV - hybrid	0.053	0.052	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	3332848266	8621272610	13842699416	21019707697	22821948900	21789350292
Number of public EV charging plugs - DC Fast Charging	717	0	5180.9	0	21919.5	0	35295.4
Number of public EV charging plugs - L2 Charging	3299	0	124424.1	0	526418.6	0	847655.2

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	0.003	0.163	0.013	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0.02	0.005	0.002	0.019
Power generation capital investment - biomass w/ccu power plant	0	0	0.043	0	0.006	2.061	0.012
Power generation capital investment - Offshore Wind - Base	0	0.266	0	0	1.435	0.916	9.445
Power generation capital investment - Solar PV - Base	0	12.208	26.315	41.118	26.29	22.011	0
Power generation capital investment - Solar PV - Constrained	0	13.816	28.125	31.225	32.418	20.267	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	5.923	325.748	350.842	350.842	350.842	350.842
Power generation by technology - biomass w/ccu allam power plant	0	0	0	20.154	24.918	26.875	45.762
Power generation by technology - biomass w/ccu power plant	0	0	48.478	48.478	55.494	2368.2	2381.9

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	1006.6	3268	7987.9	14827.4	22644.5	34534.7
HV transmission for wind and solar - base other intra-state	0	331.442	1220.5	2612.6	6129.4	10968.3	17302.4
HV transmission for wind and solar - base spur intra-state	0	640.358	1998.9	5179.6	8341.8	10654.1	15257.2
HV transmission for wind and solar - constrained all	0	861.856	3765.4	7758.3	15082	22443.1	36746.4
HV transmission for wind and solar - constrained other intra-state	0	431.114	1857.6	3460.2	7257.8	11014.5	19052.8
HV transmission for wind and solar - constrained spur intra-state	0	395.965	1819.8	4134.6	7474.3	9878.2	15067.3

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0.007	0.021	0.055	0.313	0.546	0.66
Capital investment	0	0	0.212	0	6.151	0	7.524
Number of facilities - allam power w ccu	0	0	0	1	2	3	4
Number of facilities - beccs hydrogen	0	0	0	1	7	9	12
Number of facilities - diesel	0	0	0	1	1	1	1
Number of facilities - diesel ccu	0	0	0	1	2	3	4
Number of facilities - power	0	1	1	1	1	1	1

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Number of facilities - power ccu	0	0	1	1	2	4	5
Number of facilities - pyrolysis	0	0	0	1	1	1	1
Number of facilities - pyrolysis ccu	0	0	0	1	2	3	4
Number of facilities - sng	0	1	1	1	1	1	1
Number of facilities - sng ccu	0	0	1	1	1	1	1

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

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0.08	3.73	14.53	24.57	31.36
Annual - BECCS	0	0.05	0.98	8.35	15.1	18.35
Annual - Cement	0	0	0	3.32	6.84	7.07
Annual - NGCC	0	0.03	2.75	2.87	2.62	5.94
Cumulative - All	0	0.08	3.81	18.34	42.91	74.27
Cumulative - BECCS	0	0.05	1.03	9.38	24.48	42.83
Cumulative - Cement	0	0	0	3.32	10.16	17.23
Cumulative - NGCC	0	0.03	2.78	5.65	8.27	14.21

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

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	4.39	10.57	19.87	30.99	42.87
Injection wells	0	8	32	56	92	116
Resource characterization, appraisal and permitting costs cumulative	158.95	551.75	785.01	785.01	785.01	785.01
Wells and facilities construction costs cumulative	0	245.05	955.01	1701.9	2845.7	3533

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

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	3103106.197	3326059.4	3601475.8	4159011.1	4758321.8
CO2 pipelines - Spur	0	55079.661	278033.477	553449.845	1110984.5	1710295.2
CO2 pipelines - Trunk	0	3048026.536	3048026.536	3048026.536	3048026.536	3048026.536

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	382.512	440.985	913.978	474.29	917.255	1126.6	1076.9
Jobs by economic sector - construction	17674.5	23021	35821.1	49346.9	48664.9	48605.5	43930
Jobs by economic sector - manufacturing	14085.8	24447.4	45256.5	46004.6	37098.3	42104.2	34014.3
Jobs by economic sector - mining	7181.3	5402.2	3986.8	2732.4	1719	1175.7	734.446
Jobs by economic sector - other	1512.6	2780.2	5563	9110.3	9284.3	9893.6	8443.4
Jobs by economic sector - pipeline	1370.2	1349.5	1447	947.735	737.167	543.881	480.986
Jobs by economic sector - professional	8726.2	10172	14469.2	19881.6	20821.3	21995.6	21480.8
Jobs by economic sector - trade	7004.2	7297.8	9869.5	13623.2	13902	14675.1	13914
Jobs by economic sector - utilities	21984.7	21345.2	26088.7	33400.9	37627.4	39598.4	39980.1
Jobs by resource sector - Biomass	1585.6	1892.7	2520.1	1350.8	2761.2	4108.9	4598.8
Jobs by resource sector - CO2	0	82.027	2816.1	891.898	1078.5	1646.3	2234
Jobs by resource sector - Coal	3478.4	1089.4	0	0	0	0	0
Jobs by resource sector - Grid	26752.4	25278	35441.5	55389.9	65497.1	70923	74894.6
Jobs by resource sector - Natural Gas	16153.6	16891.1	14612.5	12226.9	11291.7	9629	6184.6
Jobs by resource sector - Nuclear	1948	1916.6	1707.1	1058.1	519.871	301.903	0.792
Jobs by resource sector - Oil	13563	11673.4	9194	6499.7	4263	2686.4	1515.8
Jobs by resource sector - Solar	16428.9	37316	75397.7	96770.4	80831.9	79407.8	58456.1
Jobs by resource sector - Wind	11.977	117.167	1726.8	1334	4528.5	11015.3	16170.2
Median wages - All	54324.8	53710.9	53020.3	53537.8	54596	55319.4	56619.6
Required Level of Education - Associates degree or some college	25131.1	30511.5	45799	56566.6	55217.9	58114.3	53112.1
Required Level of Education - Bachelors degree	16784.3	19612.9	28143.4	33851.7	32816.3	34633.6	31824
Required Level of Education - Doctoral degree	521.887	600.983	833.942	1065.7	1065.2	1112.5	1047.2
Required Level of Education - High school diploma or less	33518.6	40999.8	62278.4	76174.6	73862.7	77627.7	70372
Required Level of Education - Masters or professional degree	3966	4531	6361	7863.3	7809.6	8230.6	7699.7
Wage income - All	4341997900	5170431491	7604729248	9398324812	9324783533	9943353581	9289990238

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	2325.025
Carbon sink enhancement potential - All (not counting overlap)	64024.6
Carbon sink enhancement potential - Avoid deforestation	6211.6
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-3142.997
Carbon sink enhancement potential - Extend rotation length	10482.3
Carbon sink enhancement potential - Improve plantations	6617.5
Carbon sink enhancement potential - Increase retention of HWP	15506.5
Carbon sink enhancement potential - Increase trees outside forests	1646.768
Carbon sink enhancement potential - permanent conservation cover	-44.365
Carbon sink enhancement potential - Reforest cropland	808.495
Carbon sink enhancement potential - Reforest pasture	12449.2

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

variable_name	2050
Carbon sink enhancement potential - Restore productivity	7977.1
Carbon sink enhancement potential - total	-3187.363
Land impacted for carbon sink enhancement - Accelerate regeneration	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	1667.431
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	1649.476
Land impacted for carbon sink enhancement - Extend rotation length	5774.6
Land impacted for carbon sink enhancement - Improve plantations	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	464.536
Land impacted for carbon sink enhancement - permanent conservation cover	80.692
Land impacted for carbon sink enhancement - Reforest cropland	269.181
Land impacted for carbon sink enhancement - Reforest pasture	941.356
Land impacted for carbon sink enhancement - Restore productivity	4501.567
Land impacted for carbon sink enhancement - total	1730.174
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	1126589	1143320	963754.4	772970.8	581880.9	366099.9	253917.3
Oil consumption	266955.2	250502.3	213378.1	160721.7	112574.7	74736.6	44455.9

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.434	0.437	0.427	0.413	0.402	0.4	0.406
Final energy demand by sector - industry	0.555	0.584	0.599	0.624	0.651	0.664	0.684
Final energy demand by sector - residential	0.511	0.493	0.475	0.45	0.43	0.422	0.425
Final energy demand by sector - transportation	1.917	1.804	1.617	1.384	1.172	1.037	0.974

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	66757723026	74509634801	0	0	0	0
Sales of cooking units - Electric Resistance	0.32	0.46	0.799	0.865	0.869	0.869	0.869
Sales of cooking units - Gas	0.68	0.54	0.201	0.135	0.131	0.131	0.131
Sales of space heating units - Electric Heat Pump	0.239	0.27	0.706	0.838	0.848	0.85	0.851
Sales of space heating units - Electric Resistance	0.227	0.085	0.103	0.124	0.132	0.13	0.128
Sales of space heating units - Fossil	0	0.038	0.007	0	0	0	0
Sales of space heating units - Gas Furnace	0.535	0.607	0.184	0.037	0.02	0.02	0.02
Sales of water heating units - Electric Heat Pump	0.008	0.105	0.543	0.64	0.644	0.645	0.645
Sales of water heating units - Electric Resistance	0.209	0.115	0.287	0.325	0.327	0.327	0.327
Sales of water heating units - Gas Furnace	0.695	0.739	0.14	0.006	0	0	0
Sales of water heating units - Other	0.087	0.041	0.031	0.029	0.029	0.028	0.028

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	7.896	7.559	13.522	13.934	16.318	16.965

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	15.82	16.213	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.511	0.666	0.669	0.678	0.688	0.705	0.736
Sale of space heating units by type - Electric Resistance	0.404	0.303	0.301	0.292	0.284	0.267	0.236
Sale of space heating units by type - Fossil	0.008	0.003	0.003	0.003	0.003	0.003	0.003
Sale of space heating units by type - Gas	0.076	0.028	0.027	0.026	0.025	0.025	0.025
Sales of cooking units - Electric Resistance	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Sales of cooking units - Gas	0.04	0.04	0.04	0.04	0.04	0.04	0.04
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	0.884	0.935	0.935	0.935	0.935	0.935	0.935
Sales of water heating units by type - Gas Furnace	0.069	0.039	0.039	0.039	0.039	0.039	0.039
Sales of water heating units by type - Other	0.047	0.026	0.026	0.026	0.026	0.025	0.025

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	0.017	0.021	0.02	0.018	0.017	0.016
End-use technology sales by technology - LDV - EV	0.044	0.067	0.076	0.093	0.113	0.128	0.141
End-use technology sales by technology - LDV - gasoline	0.888	0.85	0.825	0.804	0.781	0.763	0.748
End-use technology sales by technology - LDV - hybrid	0.053	0.061	0.074	0.079	0.084	0.089	0.092
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	2325.025
Carbon sink enhancement potential - All (not counting overlap)	0	0	64024.6
Carbon sink enhancement potential - Avoid deforestation	0	0	6211.6
Carbon sink enhancement potential - Extend rotation length	0	0	10482.3
Carbon sink enhancement potential - Improve plantations	0	0	6617.5
Carbon sink enhancement potential - Increase retention of HWP	0	0	15506.5
Carbon sink enhancement potential - Increase trees outside forests	0	0	1646.768
Carbon sink enhancement potential - Reforest cropland	0	0	808.495
Carbon sink enhancement potential - Reforest pasture	0	0	12449.2
Carbon sink enhancement potential - Restore productivity	0	0	7977.1
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	1667.431
Land impacted for carbon sink enhancement - Extend rotation length	0	0	5774.6
Land impacted for carbon sink enhancement - Improve plantations	0	0	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	464.536
Land impacted for carbon sink enhancement - Natural uptake	-24.57	-13.274	-10.758
Land impacted for carbon sink enhancement - Reforest cropland	0	0	269.181
Land impacted for carbon sink enhancement - Reforest pasture	0	0	941.356
Land impacted for carbon sink enhancement - Restore productivity	0	0	4501.567
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-2.531	-4.222	-4.444
Land impacted for carbon sink enhancement - Total	-27.101	-17.496	-15.202
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7

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	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.434	0.444	0.452	0.461	0.471	0.489	0.515
Final energy demand by sector - industry	0.555	0.597	0.628	0.656	0.683	0.707	0.739
Final energy demand by sector - residential	0.511	0.502	0.512	0.53	0.554	0.579	0.605
Final energy demand by sector - transportation	1.917	1.833	1.727	1.667	1.682	1.736	1.802

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	65778898046	68382057847	0	0	0	0
Sales of cooking units - Electric Resistance	0.32	0.343	0.343	0.343	0.344	0.343	0.343
Sales of cooking units - Gas	0.68	0.657	0.657	0.657	0.656	0.657	0.657
Sales of space heating units - Electric Heat Pump	0.239	0.293	0.652	0.721	0.721	0.723	0.724
Sales of space heating units - Electric Resistance	0.227	0.098	0.149	0.203	0.252	0.256	0.256
Sales of space heating units - Fossil	0	0.04	0.024	0.012	0.002	0	0
Sales of space heating units - Gas Furnace	0.535	0.568	0.175	0.065	0.026	0.021	0.02
Sales of water heating units - Electric Heat Pump	0.008	0.003	0.003	0.003	0.003	0.003	0.003
Sales of water heating units - Electric Resistance	0.209	0.075	0.073	0.073	0.073	0.072	0.072
Sales of water heating units - Gas Furnace	0.695	0.879	0.88	0.88	0.879	0.88	0.881
Sales of water heating units - Other	0.087	0.044	0.045	0.044	0.045	0.045	0.045

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	8.36	8.079	14.321	14.818	14.938	15.389

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	16.049	19.978	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.517	0.557	0.583	0.662	0.779	0.855	0.882
Sale of space heating units by type - Electric Resistance	0.4	0.395	0.372	0.304	0.202	0.136	0.113
Sale of space heating units by type - Fossil	0.008	0.008	0.007	0.006	0.003	0.001	0
Sale of space heating units by type - Gas	0.075	0.04	0.037	0.029	0.016	0.008	0.005
Sales of cooking units - Electric Resistance	0.96	0.961	0.965	0.974	0.988	0.996	0.999
Sales of cooking units - Gas	0.04	0.039	0.035	0.026	0.012	0.004	0.001
Sales of water heating units by type - Electric Heat Pump	0	0.021	0.081	0.255	0.521	0.694	0.755
Sales of water heating units by type - Electric Resistance	0.884	0.915	0.858	0.693	0.441	0.276	0.219
Sales of water heating units by type - Gas Furnace	0.069	0.038	0.035	0.026	0.013	0.004	0.001
Sales of water heating units by type - Other	0.047	0.026	0.026	0.026	0.026	0.025	0.025

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	0.054	0.132	0.28	0.507	0.735	0.882
End-use technology sales by technology - LDV - gasoline	0.908	0.862	0.775	0.639	0.436	0.233	0.103
End-use technology sales by technology - LDV - hybrid	0.055	0.062	0.069	0.062	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	552931392	1131237506	3849662597	12021360337	17545841302
Number of public EV charging plugs - DC Fast Charging	717	0	1712.2	0	8214.9	0	22606.7
Number of public EV charging plugs - L2 Charging	3299	0	41119.9	0	197290.4	0	542922.6

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	2325.025
Carbon sink enhancement potential - All (not counting overlap)	64024.6
Carbon sink enhancement potential - Avoid deforestation	6211.6
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-3142.997
Carbon sink enhancement potential - Extend rotation length	10482.3
Carbon sink enhancement potential - Improve plantations	6617.5
Carbon sink enhancement potential - Increase retention of HWP	15506.5
Carbon sink enhancement potential - Increase trees outside forests	1646.768
Carbon sink enhancement potential - permanent conservation cover	-44.365
Carbon sink enhancement potential - Reforest cropland	808.495
Carbon sink enhancement potential - Reforest pasture	12449.2
Carbon sink enhancement potential - Restore productivity	7977.1
Carbon sink enhancement potential - total	-3187.363
Land impacted for carbon sink enhancement - Accelerate regeneration	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	1667.431
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	1649.476
Land impacted for carbon sink enhancement - Extend rotation length	5774.6
Land impacted for carbon sink enhancement - Improve plantations	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	464.536
Land impacted for carbon sink enhancement - permanent conservation cover	80.692
Land impacted for carbon sink enhancement - Reforest cropland	269.181
Land impacted for carbon sink enhancement - Reforest pasture	941.356
Land impacted for carbon sink enhancement - Restore productivity	4501.567
Land impacted for carbon sink enhancement - total	1730.174
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.434	0.438	0.434	0.43	0.423	0.419	0.42
Final energy demand by sector - industry	0.555	0.584	0.6	0.63	0.661	0.675	0.696
Final energy demand by sector - residential	0.511	0.494	0.487	0.477	0.464	0.448	0.44
Final energy demand by sector - transportation	1.919	1.82	1.686	1.572	1.479	1.369	1.239

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	66741913624	74582531189	0	0	0	0
Sales of cooking units - Electric Resistance	0.32	0.362	0.409	0.534	0.71	0.817	0.855
Sales of cooking units - Gas	0.68	0.638	0.591	0.466	0.29	0.183	0.145
Sales of space heating units - Electric Heat Pump	0.239	0.187	0.238	0.38	0.604	0.766	0.828
Sales of space heating units - Electric Resistance	0.227	0.082	0.083	0.091	0.108	0.119	0.125
Sales of space heating units - Fossil	0	0.044	0.04	0.031	0.016	0.005	0.001
Sales of space heating units - Gas Furnace	0.535	0.686	0.638	0.498	0.273	0.11	0.045
Sales of water heating units - Electric Heat Pump	0.008	0.021	0.07	0.214	0.434	0.578	0.628
Sales of water heating units - Electric Resistance	0.209	0.082	0.099	0.156	0.244	0.3	0.32
Sales of water heating units - Gas Furnace	0.695	0.855	0.787	0.591	0.289	0.092	0.024
Sales of water heating units - Other	0.087	0.043	0.043	0.039	0.034	0.03	0.029

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	6.419	5.907	9.281	9.232	14.493	15.076

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

variable_name	2025	2030	2035	2040	2045	2050
Power generation capital investment - Offshore Wind - Base	0.266	0	1.446	8.163	5.677	5.239
Power generation capital investment - Solar PV - Base	5.093	34.108	59.515	23.56	0	136.013

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	618.285	3085.1	13399.4	24852.7	29617.6	57817.3
HV transmission for wind and solar - base other intra-state	0	246.432	994.427	5546.2	11854.9	14543.2	21643.7
HV transmission for wind and solar - base spur intra-state	0	331.025	2005.3	7489.3	11081.4	12400.9	22484.3

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	2325.025
Carbon sink enhancement potential - All (not counting overlap)	64024.6
Carbon sink enhancement potential - Avoid deforestation	6211.6
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-3142.997
Carbon sink enhancement potential - Extend rotation length	10482.3
Carbon sink enhancement potential - Improve plantations	6617.5
Carbon sink enhancement potential - Increase retention of HWP	15506.5
Carbon sink enhancement potential - Increase trees outside forests	1646.768
Carbon sink enhancement potential - permanent conservation cover	-44.365
Carbon sink enhancement potential - Reforest cropland	808.495
Carbon sink enhancement potential - Reforest pasture	12449.2
Carbon sink enhancement potential - Restore productivity	7977.1
Carbon sink enhancement potential - total	-3187.363
Land impacted for carbon sink enhancement - Accelerate regeneration	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	1667.431
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	1649.476
Land impacted for carbon sink enhancement - Extend rotation length	5774.6
Land impacted for carbon sink enhancement - Improve plantations	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	464.536
Land impacted for carbon sink enhancement - permanent conservation cover	80.692
Land impacted for carbon sink enhancement - Reforest cropland	269.181
Land impacted for carbon sink enhancement - Reforest pasture	941.356
Land impacted for carbon sink enhancement - Restore productivity	4501.567
Land impacted for carbon sink enhancement - total	1730.174
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545

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	0.004	0.523	0	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0.038	0.007	0.016	0.021
Power generation capital investment - biomass w/ccu power plant	0	0	0.049	11.463	2.177	5.847	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	7.521	1035.4	1035.4	1035.4	1035.4	1035.4
Power generation by technology - biomass w/ccu allam power plant	0	0	0	37.682	44.22	60.61	81.539
Power generation by technology - biomass w/ccu power plant	0	0	55.345	12921.4	15365.1	21927.8	21927.8

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0.001	0.076	1.004	1.435	2.322	2.709
Capital investment	0	0	0.597	0	17.181	0	15.311
Number of facilities - allam power w ccu	0	0	0	1	2	3	4
Number of facilities - beccs hydrogen	0	0	0	2	6	13	18
Number of facilities - diesel	0	0	0	1	1	1	1
Number of facilities - diesel ccu	0	0	0	1	2	3	3
Number of facilities - power	0	1	1	1	1	1	1
Number of facilities - power ccu	0	0	1	10	12	17	17
Number of facilities - pyrolysis	0	0	0	1	1	1	1
Number of facilities - pyrolysis ccu	0	0	0	1	2	4	5
Number of facilities - sng	0	1	1	1	1	1	1
Number of facilities - sng ccu	0	0	1	1	1	1	1

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

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0.07	17.26	27.82	45.3	53.05
Annual - BECCS	0	0.06	15.53	22.45	36.81	42.74
Annual - Cement	0	0	0	3.32	6.84	7.07
Annual - NGCC	0	0.02	1.74	2.06	1.65	3.24
Cumulative - All	0	0.07	17.33	45.15	90.45	143.5
Cumulative - BECCS	0	0.06	15.59	38.04	74.85	117.59
Cumulative - Cement	0	0	0	3.32	10.16	17.23
Cumulative - NGCC	0	0.02	1.76	3.82	5.47	8.71

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

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	3.69	14.98	33.27	45.3	48.49
Injection wells	0	8	34	62	102	128
Resource characterization, appraisal and permitting costs cumulative	158.95	624.72	905.95	905.95	905.95	905.95
Wells and facilities construction costs cumulative	0	270.21	1053.1	1876.7	3138	3895.8

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

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	3177624.401	3656631.9	4153662.6	4886702.4	5386474.3
CO2 pipelines - Spur	0	129598.065	608605.625	902560.668	1635600.9	2135372.8
CO2 pipelines - Trunk	0	3048026.536	3048026.536	3251101.536	3251101.536	3251101.536

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	2325.025
Carbon sink enhancement potential - All (not counting overlap)	64024.6
Carbon sink enhancement potential - Avoid deforestation	6211.6
Carbon sink enhancement potential - corn-ethanol to energy grasses	-25.094
Carbon sink enhancement potential - cropland measures	-3110.906
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	10482.3
Carbon sink enhancement potential - Improve plantations	6617.5
Carbon sink enhancement potential - Increase retention of HWP	15506.5
Carbon sink enhancement potential - Increase trees outside forests	1646.768
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-43.658
Carbon sink enhancement potential - Reforest cropland	808.495
Carbon sink enhancement potential - Reforest pasture	12449.2
Carbon sink enhancement potential - Restore productivity	7977.1

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

variable_name	2050
Carbon sink enhancement potential - total	-3179.659
Land impacted for carbon sink enhancement - Accelerate regeneration	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	1667.431
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	15.778
Land impacted for carbon sink enhancement - cropland measures	3228.603
Land impacted for carbon sink enhancement - Cropland to woody energy crops	10.616
Land impacted for carbon sink enhancement - Extend rotation length	5774.6
Land impacted for carbon sink enhancement - Improve plantations	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	464.536
Land impacted for carbon sink enhancement - pasture to energy crops	730.875
Land impacted for carbon sink enhancement - permanent conservation cover	79.406
Land impacted for carbon sink enhancement - Reforest cropland	269.181
Land impacted for carbon sink enhancement - Reforest pasture	941.356
Land impacted for carbon sink enhancement - Restore productivity	4501.567
Land impacted for carbon sink enhancement - total	4065.307
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	2325.025
Carbon sink enhancement potential - All (not counting overlap)	64024.6
Carbon sink enhancement potential - Avoid deforestation	6211.6
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-3142.997
Carbon sink enhancement potential - Extend rotation length	10482.3
Carbon sink enhancement potential - Improve plantations	6617.5
Carbon sink enhancement potential - Increase retention of HWP	15506.5
Carbon sink enhancement potential - Increase trees outside forests	1646.768
Carbon sink enhancement potential - permanent conservation cover	-44.365
Carbon sink enhancement potential - Reforest cropland	808.495
Carbon sink enhancement potential - Reforest pasture	12449.2
Carbon sink enhancement potential - Restore productivity	7977.1
Carbon sink enhancement potential - total	-3187.363
Land impacted for carbon sink enhancement - Accelerate regeneration	937.071
Land impacted for carbon sink enhancement - All (not counting overlap)	11528.8
Land impacted for carbon sink enhancement - Avoid deforestation	1667.431
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	1649.476
Land impacted for carbon sink enhancement - Extend rotation length	5774.6
Land impacted for carbon sink enhancement - Improve plantations	3677.829
Land impacted for carbon sink enhancement - Increase retention of HWP	3101.3
Land impacted for carbon sink enhancement - Increase trees outside forests	464.536
Land impacted for carbon sink enhancement - permanent conservation cover	80.692

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

variable_name	2050
Land impacted for carbon sink enhancement - Reforest cropland	269.181
Land impacted for carbon sink enhancement - Reforest pasture	941.356
Land impacted for carbon sink enhancement - Restore productivity	4501.567
Land impacted for carbon sink enhancement - total	1730.174
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	9806.1

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	217.292
Business-as-usual carbon sink - Avoid deforestation	531.166
Business-as-usual carbon sink - Extend rotation length	3159.1
Business-as-usual carbon sink - Improve plantations	1396.7
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	93.399
Business-as-usual carbon sink - Reforest cropland	30.545
Business-as-usual carbon sink - Reforest pasture	229.973
Business-as-usual carbon sink - Restore productivity	1584.7
Business-as-usual carbon sink - Total impacted (over 30 years)	30.545