Net-Zero America - new jersey 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	6.637	7.002	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.023	0.238	0.248	0.261	0.268	0.273	0.281
Sale of space heating units by type - Electric Resistance	0.071	0.09	0.088	0.086	0.085	0.079	0.071
Sale of space heating units by type - Fossil	0.099	0.136	0.074	0.038	0.035	0.035	0.036
Sale of space heating units by type - Gas	0.807	0.536	0.591	0.615	0.612	0.612	0.613
Sales of cooking units - Electric Resistance	0.328	0.328	0.328	0.328	0.328	0.328	0.328
Sales of cooking units - Gas	0.672	0.672	0.672	0.672	0.672	0.672	0.672
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	0.178	0.326	0.325	0.325	0.325	0.325	0.324
Sales of water heating units by type - Gas Furnace	0.791	0.652	0.652	0.653	0.653	0.653	0.653
Sales of water heating units by type - Other	0.031	0.022	0.022	0.022	0.022	0.022	0.022

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	0.981	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	0.094	0.113	0.129	0.141
End-use technology sales by technology - LDV - gasoline	0.888	0.849	0.825	0.803	0.781	0.762	0.747
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 3: *E- scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2020	2030	2050
Carbon sink enhancement potential - Accelerate regeneration	0	0	119.784
Carbon sink enhancement potential - All (not counting overlap)	0	0	5845.1
Carbon sink enhancement potential - Avoid deforestation	0	0	2066.427
Carbon sink enhancement potential - Extend rotation length	0	0	1639.51
Carbon sink enhancement potential - Improve plantations	0	0	11.762
Carbon sink enhancement potential - Increase retention of HWP	0	0	286.983
Carbon sink enhancement potential - Increase trees outside forests	0	0	450.223
Carbon sink enhancement potential - Reforest cropland	0	0	0
Carbon sink enhancement potential - Reforest pasture	0	0	473.089
Carbon sink enhancement potential - Restore productivity	0	0	797.28
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	554.713
Land impacted for carbon sink enhancement - Extend rotation length	0	0	903.174
Land impacted for carbon sink enhancement - Improve plantations	0	0	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	127.002
Land impacted for carbon sink enhancement - Natural uptake	0.55	-1.732	-1.549
Land impacted for carbon sink enhancement - Reforest cropland	0	0	0
Land impacted for carbon sink enhancement - Reforest pasture	0	0	35.773
Land impacted for carbon sink enhancement - Restore productivity	0	0	449.912
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-0.047	-0.084	-0.088
Land impacted for carbon sink enhancement - Total	0.503	-1.816	-1.636
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	1219.529

Table 4: *E- scenario - PILLAR 6: Land carbon sinks - Forests*

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482

Table 4: *E- 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	25.535
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 5: *E- scenario - PILLAR 1: Efficiency/Electrification - Overview*

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.306	0.305	0.307	0.309	0.314	0.329	0.352
Final energy demand by sector - industry	0.13	0.134	0.14	0.145	0.151	0.158	0.164
Final energy demand by sector - residential	0.376	0.35	0.336	0.325	0.318	0.315	0.313
Final energy demand by sector - transportation	0.684	0.651	0.614	0.593	0.597	0.615	0.636

Table 6: *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	41117085039	42333837379	0	0	0	0
Sales of cooking units - Electric Resistance	0.185	0.194	0.194	0.196	0.197	0.198	0.199
Sales of cooking units - Gas	0.815	0.806	0.806	0.804	0.803	0.802	0.801
Sales of space heating units - Electric Heat Pump	0.008	0.154	0.415	0.629	0.663	0.666	0.665
Sales of space heating units - Electric Resistance	0.026	0.041	0.089	0.209	0.307	0.323	0.326
Sales of space heating units - Fossil	0.081	0.132	0.103	0.046	0.007	0.001	0
Sales of space heating units - Gas Furnace	0.884	0.674	0.393	0.116	0.023	0.01	0.009
Sales of water heating units - Electric Heat Pump	0.002	0.003	0.003	0.003	0.003	0.003	0.003
Sales of water heating units - Electric Resistance	0.015	0.019	0.019	0.019	0.019	0.019	0.019
Sales of water heating units - Gas Furnace	0.976	0.964	0.963	0.963	0.963	0.963	0.963
Sales of water heating units - Other	0.006	0.013	0.014	0.014	0.014	0.015	0.015

Table 7: *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	2.767	2.776	8.272	8.935	8.037	8.513

Table 8: *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	7.133	8.05	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.041	0.178	0.671	0.909	0.939	0.941	0.94
Sale of space heating units by type - Electric Resistance	0.069	0.095	0.053	0.029	0.026	0.027	0.028
Sale of space heating units by type - Fossil	0.098	0.15	0.049	0.023	0.021	0.02	0.02
Sale of space heating units by type - Gas	0.793	0.577	0.227	0.039	0.014	0.012	0.012
Sales of cooking units - Electric Resistance	0.336	0.477	0.911	0.996	1	1	1
Sales of cooking units - Gas	0.664	0.523	0.089	0.004	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.07	0.396	0.539	0.556	0.557	0.557
Sales of water heating units by type - Electric Resistance	0.178	0.333	0.376	0.433	0.442	0.443	0.443
Sales of water heating units by type - Gas Furnace	0.791	0.578	0.224	0.028	0.001	0	0
Sales of water heating units by type - Other	0.031	0.019	0.004	0.001	0	0	0

Table 9: *RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

variable_name	2020	2025	2030	2035	2040	2045	2050
End-use technology sales by technology - HDV - diesel	0.972	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	0.505	0.834	0.965	0.993	1
End-use technology sales by technology - LDV - gasoline	0.884	0.749	0.446	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	1151435868	2985292798	4782390118	7266287106	7884550522	7530388340
Number of public EV charging plugs - DC Fast Charging	341	0	1733.3	0	7268.5	0	11691.7
Number of public EV charging plugs - L2 Charging	794	0	41620.2	0	174527.6	0	280734.8

Table 10: *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	0.008	0.35	0	0	0.019	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 - Offshore Wind - Base	0	0.236	0.183	0.208	0.284	41.213	14.532
Power generation capital investment - Offshore Wind - Constrained	0	0.236	0.231	0.226	0.132	34.233	20.633
Power generation capital investment - Solar PV - Base	0	1.389	1.173	0.71	0	0	0
Power generation capital investment - Solar PV - Constrained	0	3.679	0.736	0.911	0	0	0
Power generation capital investment - Wind - Constrained	0	0	0	0.075	0.536	0	0

Table 11: *RE- scenario - PILLAR 2: Clean Electricity - Generation*

variable_name	2020	2025	2030	2035	2040	2045	2050
Power generation by technology - biomass power plant	0	14.579	701.201	701.201	701.201	741.47	741.47
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 12: *RE- scenario - PILLAR 2: Clean Electricity - Transmission*

variable_name	2020	2025	2030	2035	2040	2045	2050
HV transmission for wind and solar - base all	0	236.641	652.388	1544	2475.7	45241	71061
HV transmission for wind and solar - base other intra-state	0	64.874	130.945	223.879	340.074	30514	47002.6
HV transmission for wind and solar - base spur intra-state	0	83.637	132.232	184.857	227.778	10965	16606.7
HV transmission for wind and solar - constrained all	0	295.783	634.342	1887.6	3686.6	42767.4	71372.3
HV transmission for wind and solar - constrained other intra-state	0	65.459	156.667	302.437	419.239	28156.7	46703.3
HV transmission for wind and solar - constrained spur intra-state	0	88.373	153.272	189.922	216.106	9001.9	16485

Table 13: *RE- scenario - PILLAR 3: Bioenergy and Hydrogen - Bioconversion*

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0.002	0.061	0.062	0.062	0.063	0.063
Capital investment	0	0	0.375	0	0.028	0	0.022
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	1	1	1	1
Number of facilities - diesel ccu	0	0	0	0	0	0	0
Number of facilities - power	0	1	1	1	1	1	1
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	1	1	1	1
Number of facilities - pyrolysis ccu	0	0	0	0	0	0	0
Number of facilities - sng	0	1	1	1	1	1	1
Number of facilities - sng ccu	0	0	0	0	0	0	0

Table 14: *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
Annual - BECCS	0	0	0	0	0	0
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	0	0	0
Cumulative - BECCS	0	0	0	0	0	0
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0	0	0	0

Table 15: *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 16: *RE- scenario - PILLAR 4: CO2 capture, use, storage - CO2 transportation*

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	230315.104	437688.475	437688.475	437688.475	437688.475
CO2 pipelines - Spur	0	0	0	0	0	0
CO2 pipelines - Trunk	0	230315.104	437688.475	437688.475	437688.475	437688.475

Table 17: *RE- scenario - IMPACTS - Jobs*

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	70.832	81.659	243.162	270.612	229.48	186.681	151.448
Jobs by economic sector - construction	13759.2	11359.5	11076.1	13093.5	13576.1	32022	34570.6
Jobs by economic sector - manufacturing	7132.2	13162	24228.6	24489.7	19329.7	24936.6	19631.2
Jobs by economic sector - mining	3809.8	3110.1	2210	1447.3	893.057	518.11	275.994
Jobs by economic sector - other	1841.7	1387.7	1462.2	1834.9	2076	3897.6	5731.3
Jobs by economic sector - pipeline	754.721	749.352	663.687	527.291	372.974	245.979	162.865
Jobs by economic sector - professional	5109.7	4624.4	4636.7	5486.1	5830.7	16753.7	20653
Jobs by economic sector - trade	4383.9	3825.8	3528.4	3815.1	3934.1	9786.4	12577.9
Jobs by economic sector - utilities	8143.2	9854.4	9935.6	12948.1	13999.5	35996.6	31142.3
Jobs by resource sector - Biomass	293.616	350.472	670.458	770.74	690.811	680.845	646.744
Jobs by resource sector - CO2	0	0	234.032	208.765	0	0	0
Jobs by resource sector - Coal	222.534	209.058	70.002	0	0	0	0
Jobs by resource sector - Grid	7219.5	10676.7	12029	19547.9	21830.7	69148.6	58759.1
Jobs by resource sector - Natural Gas	7664.5	7886.5	6335	5401.4	6078.8	4246.9	3787.6
Jobs by resource sector - Nuclear	1862.5	1832.5	1803.3	1539.9	952.844	360.396	0.169
Jobs by resource sector - Oil	8046.2	7097.1	5643.3	4064.1	2777.3	1868.2	1091.3
Jobs by resource sector - Solar	19684.4	20012.5	30166.5	31521.3	25479.6	25446.8	30595.7
Jobs by resource sector - Wind	11.909	90.076	1032.9	858.572	2431.6	22592	30015.8
Median wages - All	68895.8	68975.9	67710	69100.3	70943.7	74430.5	75715.8
Required Level of Education - Associates degree or some college	14031.3	15145.7	18317.1	20395.5	19406	40441.1	40573.3
Required Level of Education - Bachelors degree	9216.6	9887.8	11721.3	12677.5	11816.5	24556.9	25101.9
Required Level of Education - Doctoral degree	315.306	295.839	308.492	337.446	331.077	798.622	930.879
Required Level of Education - High school diploma or less	19269.5	20576.9	25102	27709.4	26008.8	52564.3	51966.1
Required Level of Education - Masters or professional degree	2172.5	2248.6	2535.5	2792.7	2679.1	5982.9	6324.3
Wage income - All	3101011027	3321790476	3926398047	4416723006	4274159181	9255810865	9457855101

Table 18: *RE- scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	119.784
Carbon sink enhancement potential - All (not counting overlap)	5845.1
Carbon sink enhancement potential - Avoid deforestation	2066.427
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-518.767
Carbon sink enhancement potential - Extend rotation length	1639.51
Carbon sink enhancement potential - Improve plantations	11.762
Carbon sink enhancement potential - Increase retention of HWP	286.983
Carbon sink enhancement potential - Increase trees outside forests	450.223
Carbon sink enhancement potential - permanent conservation cover	-12.564
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	473.089
Carbon sink enhancement potential - Restore productivity	797.28
Carbon sink enhancement potential - total	-531.331
Land impacted for carbon sink enhancement - Accelerate regeneration	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	554.713
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	262.212
Land impacted for carbon sink enhancement - Extend rotation length	903.174
Land impacted for carbon sink enhancement - Improve plantations	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	127.002
Land impacted for carbon sink enhancement - permanent conservation cover	22.852
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	35.773
Land impacted for carbon sink enhancement - Restore productivity	449.912
Land impacted for carbon sink enhancement - total	285.064
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1219.529

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	25.535
Business-as-usual carbon sink - Reforest cropland	0

Table 19: *RE- scenario - PILLAR 6: Land carbon sinks - Forests (continued)*

variable_name	2050
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
Business-as-usual carbon sink - Total impacted (over 30 years)	0

Table 20: *RE- scenario - IMPACTS - Fossil fuel industries*

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	587495.8	596220.9	502580.5	403090.3	303440.4	190914.5	132413.3
Oil consumption	165064	159639	138332.6	107905.2	79396.3	57170.9	35552.1

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.306	0.301	0.289	0.269	0.251	0.242	0.241
Final energy demand by sector - industry	0.13	0.131	0.133	0.133	0.134	0.135	0.137
Final energy demand by sector - residential	0.376	0.351	0.316	0.265	0.217	0.183	0.164
Final energy demand by sector - transportation	0.683	0.64	0.573	0.49	0.414	0.364	0.34

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	41627775752	45491316101	0	0	0	0
Sales of cooking units - Electric Resistance	0.185	0.337	0.753	0.835	0.839	0.84	0.84
Sales of cooking units - Gas	0.815	0.663	0.247	0.165	0.161	0.16	0.16
Sales of space heating units - Electric Heat Pump	0.008	0.168	0.538	0.783	0.818	0.82	0.819
Sales of space heating units - Electric Resistance	0.026	0.045	0.112	0.161	0.17	0.17	0.172
Sales of space heating units - Fossil	0.081	0.117	0.023	0.001	0	0	0
Sales of space heating units - Gas Furnace	0.884	0.671	0.327	0.055	0.011	0.009	0.009
Sales of water heating units - Electric Heat Pump	0.002	0.08	0.437	0.603	0.623	0.624	0.624
Sales of water heating units - Electric Resistance	0.015	0.054	0.23	0.355	0.373	0.374	0.374
Sales of water heating units - Gas Furnace	0.976	0.855	0.33	0.041	0.002	0	0
Sales of water heating units - Other	0.006	0.012	0.004	0.002	0.002	0.002	0.002

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	3.492	3.588	11.277	12.276	10.042	10.657

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	7.138	8.464	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.041	0.093	0.149	0.315	0.591	0.808	0.902
Sale of space heating units by type - Electric Resistance	0.069	0.102	0.097	0.083	0.058	0.038	0.03
Sale of space heating units by type - Fossil	0.098	0.169	0.158	0.124	0.073	0.038	0.025
Sale of space heating units by type - Gas	0.793	0.636	0.596	0.478	0.278	0.116	0.043
Sales of cooking units - Electric Resistance	0.333	0.351	0.412	0.573	0.796	0.934	0.982
Sales of cooking units - Gas	0.667	0.649	0.588	0.427	0.204	0.066	0.018
Sales of water heating units by type - Electric Heat Pump	0	0.013	0.05	0.159	0.338	0.475	0.533
Sales of water heating units by type - Electric Resistance	0.178	0.328	0.332	0.348	0.38	0.415	0.434
Sales of water heating units by type - Gas Furnace	0.791	0.637	0.597	0.478	0.274	0.107	0.032
Sales of water heating units by type - Other	0.031	0.022	0.02	0.015	0.008	0.003	0.001

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	0.281	0.508	0.736	0.882
End-use technology sales by technology - LDV - gasoline	0.908	0.861	0.774	0.639	0.435	0.232	0.103
End-use technology sales by technology - LDV - hybrid	0.055	0.063	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	192219946	390678061	1332054923	4151631923	6062313827
Number of public EV charging plugs - DC Fast Charging	341	0	581.597	0	2731.2	0	7488.5
Number of public EV charging plugs - L2 Charging	794	0	13965	0	65579.3	0	179810.5

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	119.784
Carbon sink enhancement potential - All (not counting overlap)	5845.1
Carbon sink enhancement potential - Avoid deforestation	2066.427
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-518.767
Carbon sink enhancement potential - Extend rotation length	1639.51
Carbon sink enhancement potential - Improve plantations	11.762
Carbon sink enhancement potential - Increase retention of HWP	286.983
Carbon sink enhancement potential - Increase trees outside forests	450.223
Carbon sink enhancement potential - permanent conservation cover	-12.564
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	473.089
Carbon sink enhancement potential - Restore productivity	797.28
Carbon sink enhancement potential - total	-531.331
Land impacted for carbon sink enhancement - Accelerate regeneration	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	554.713
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	262.212
Land impacted for carbon sink enhancement - Extend rotation length	903.174
Land impacted for carbon sink enhancement - Improve plantations	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	127.002
Land impacted for carbon sink enhancement - permanent conservation cover	22.852
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	35.773
Land impacted for carbon sink enhancement - Restore productivity	449.912
Land impacted for carbon sink enhancement - total	285.064
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1219.529

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	25.535
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
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	0.306	0.301	0.299	0.297	0.292	0.284	0.276
Final energy demand by sector - industry	0.13	0.131	0.133	0.135	0.136	0.137	0.139
Final energy demand by sector - residential	0.376	0.353	0.337	0.317	0.287	0.25	0.214
Final energy demand by sector - transportation	0.684	0.645	0.598	0.556	0.522	0.481	0.433

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	41603577037	45410907619	0	0	0	0
Sales of cooking units - Electric Resistance	0.185	0.216	0.275	0.43	0.645	0.777	0.823
Sales of cooking units - Gas	0.815	0.784	0.725	0.57	0.355	0.223	0.177
Sales of space heating units - Electric Heat Pump	0.008	0.108	0.15	0.277	0.498	0.69	0.778
Sales of space heating units - Electric Resistance	0.026	0.034	0.042	0.066	0.109	0.146	0.166
Sales of space heating units - Fossil	0.081	0.135	0.129	0.1	0.05	0.016	0.004
Sales of space heating units - Gas Furnace	0.884	0.723	0.679	0.558	0.344	0.149	0.052
Sales of water heating units - Electric Heat Pump	0.002	0.018	0.058	0.178	0.376	0.531	0.597
Sales of water heating units - Electric Resistance	0.015	0.027	0.046	0.107	0.214	0.309	0.354
Sales of water heating units - Gas Furnace	0.976	0.943	0.882	0.705	0.404	0.157	0.047
Sales of water heating units - Other	0.006	0.013	0.013	0.01	0.006	0.003	0.002

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	2.756	2.764	4.339	4.533	9.508	10.272

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	0.236	0.183	0.38	22.908	33.306	4.261
Power generation capital investment - Solar PV - Base	4.451	0.529	0	0	0	5.305
Power generation capital investment - Wind - Base	0	0	0	0	0.524	0.315

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	426.949	828.19	1827.1	21020.9	62392.5	71904.6
HV transmission for wind and solar - base other intra-state	0	66.858	124.614	237.894	13229.9	41532.3	47390.4
HV transmission for wind and solar - base spur intra-state	0	208.11	269.236	318.474	4927.5	14720.9	17090.3

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	119.784
Carbon sink enhancement potential - All (not counting overlap)	5845.1
Carbon sink enhancement potential - Avoid deforestation	2066.427
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-518.767
Carbon sink enhancement potential - Extend rotation length	1639.51
Carbon sink enhancement potential - Improve plantations	11.762
Carbon sink enhancement potential - Increase retention of HWP	286.983
Carbon sink enhancement potential - Increase trees outside forests	450.223
Carbon sink enhancement potential - permanent conservation cover	-12.564
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	473.089
Carbon sink enhancement potential - Restore productivity	797.28
Carbon sink enhancement potential - total	-531.331
Land impacted for carbon sink enhancement - Accelerate regeneration	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	554.713
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	262.212
Land impacted for carbon sink enhancement - Extend rotation length	903.174
Land impacted for carbon sink enhancement - Improve plantations	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	127.002
Land impacted for carbon sink enhancement - permanent conservation cover	22.852
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	35.773
Land impacted for carbon sink enhancement - Restore productivity	449.912
Land impacted for carbon sink enhancement - total	285.064
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1219.529

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	25.535
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
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	0.008	0.352	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	16.295	706.854	706.854	706.854	706.854	706.854
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	0.014	0.17	0.172	0.173	0.174	0.559
Capital investment	0	0	0.379	0	0.038	0	4.624
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	1	1	1	1
Number of facilities - diesel ccu	0	0	0	0	0	0	0
Number of facilities - power	0	1	1	1	1	1	1
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	1	1	1	7
Number of facilities - pyrolysis ccu	0	0	0	0	0	0	0
Number of facilities - sng	0	1	1	1	1	1	1
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
Annual - BECCS	0	0	0	0	0	0
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	0	0	0
Cumulative - BECCS	0	0	0	0	0	0
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0	0	0	0

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	230315.104	437688.475	437688.475	459859.475	459859.475
CO2 pipelines - Spur	0	0	0	0	0	0
CO2 pipelines - Trunk	0	230315.104	437688.475	437688.475	459859.475	459859.475

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	119.784
Carbon sink enhancement potential - All (not counting overlap)	5845.1
Carbon sink enhancement potential - Avoid deforestation	2066.427
Carbon sink enhancement potential - corn-ethanol to energy grasses	-37.692
Carbon sink enhancement potential - cropland measures	-492.668
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	1639.51
Carbon sink enhancement potential - Improve plantations	11.762
Carbon sink enhancement potential - Increase retention of HWP	286.983
Carbon sink enhancement potential - Increase trees outside forests	450.223
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-11.739
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	473.089
Carbon sink enhancement potential - Restore productivity	797.28

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

variable_name	2050
Carbon sink enhancement potential - total	-542.099
Land impacted for carbon sink enhancement - Accelerate regeneration	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	554.713
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	18.166
Land impacted for carbon sink enhancement - cropland measures	488.295
Land impacted for carbon sink enhancement - Cropland to woody energy crops	9.068
Land impacted for carbon sink enhancement - Extend rotation length	903.174
Land impacted for carbon sink enhancement - Improve plantations	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	127.002
Land impacted for carbon sink enhancement - pasture to energy crops	5.42
Land impacted for carbon sink enhancement - permanent conservation cover	21.35
Land impacted for carbon sink enhancement - Reforest cropland	0
Land impacted for carbon sink enhancement - Reforest pasture	35.773
Land impacted for carbon sink enhancement - Restore productivity	449.912
Land impacted for carbon sink enhancement - total	542.299
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1219.529

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	25.535
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
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	119.784
Carbon sink enhancement potential - All (not counting overlap)	5845.1
Carbon sink enhancement potential - Avoid deforestation	2066.427
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-518.767
Carbon sink enhancement potential - Extend rotation length	1639.51
Carbon sink enhancement potential - Improve plantations	11.762
Carbon sink enhancement potential - Increase retention of HWP	286.983
Carbon sink enhancement potential - Increase trees outside forests	450.223
Carbon sink enhancement potential - permanent conservation cover	-12.564
Carbon sink enhancement potential - Reforest cropland	0
Carbon sink enhancement potential - Reforest pasture	473.089
Carbon sink enhancement potential - Restore productivity	797.28
Carbon sink enhancement potential - total	-531.331
Land impacted for carbon sink enhancement - Accelerate regeneration	48.277
Land impacted for carbon sink enhancement - All (not counting overlap)	963.257
Land impacted for carbon sink enhancement - Avoid deforestation	554.713
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	262.212
Land impacted for carbon sink enhancement - Extend rotation length	903.174
Land impacted for carbon sink enhancement - Improve plantations	6.537
Land impacted for carbon sink enhancement - Increase retention of HWP	57.397
Land impacted for carbon sink enhancement - Increase trees outside forests	127.002
Land impacted for carbon sink enhancement - permanent conservation cover	22.852

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	35.773
Land impacted for carbon sink enhancement - Restore productivity	449.912
Land impacted for carbon sink enhancement - total	285.064
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1219.529

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	11.195
Business-as-usual carbon sink - Avoid deforestation	176.706
Business-as-usual carbon sink - Extend rotation length	494.099
Business-as-usual carbon sink - Improve plantations	2.482
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	25.535
Business-as-usual carbon sink - Reforest cropland	0
Business-as-usual carbon sink - Reforest pasture	8.739
Business-as-usual carbon sink - Restore productivity	158.382
Business-as-usual carbon sink - Total impacted (over 30 years)	0