Net-Zero America - louisiana state report v2

Larson et al. 2020

February 2021

Reading guide

IN DRAFT

List of Tables

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	3.782	4.861	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.15	0.305	0.754	0.854	0.859	0.857	0.857
Sale of space heating units by type - Electric Resistance	0.447	0.432	0.182	0.126	0.123	0.125	0.125
Sale of space heating units by type - Fossil	0.023	0.033	0.014	0.01	0.01	0.01	0.01
Sale of space heating units by type - Gas	0.38	0.23	0.05	0.01	0.008	0.008	0.008
Sales of cooking units - Electric Resistance	0.666	0.737	0.955	0.998	1	1	1
Sales of cooking units - Gas	0.334	0.263	0.045	0.002	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.12	0.636	0.751	0.756	0.756	0.756
Sales of water heating units by type - Electric Resistance	0.565	0.604	0.299	0.23	0.227	0.227	0.227
Sales of water heating units by type - Gas Furnace	0.413	0.258	0.048	0.002	0	0	0
Sales of water heating units by type - Other	0.022	0.017	0.017	0.017	0.017	0.017	0.017

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	0.017	0.019	0.013	0.004	0.001	0	0
End-use technology sales by technology - LDV - EV	0.034	0.136	0.44	0.808	0.962	0.993	1
End-use technology sales by technology - LDV - gasoline	0.908	0.798	0.513	0.175	0.034	0.006	0
End-use technology sales by technology - LDV - hybrid	0.039	0.042	0.03	0.011	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	747055848	1909498375	3102832391	4696794280	5115525531	4875364916
Number of public EV charging plugs - DC Fast Charging	67	0	1336.1	0	5933.5	0	9607.4
Number of public EV charging plugs - L2 Charging	204	0	32123.3	0	142658.9	0	230988.7

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	4.015	0	1.266	0	0
Power generation capital investment - Offshore Wind - Base	0	0	0	0	0	0	0
Power generation capital investment - Solar PV - Base	0	0	0	0	0	0	0
Power generation capital investment - Solar PV - Constrained	0	12.483	1.231	0.476	0	0	0
Power generation capital investment - Wind - Base	0	0	0	0	0	0	0
Power generation capital investment - Wind - Constrained	0	0	0	0	0	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	4506	4506	5927.5	5927.5	5927.5

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	915.844	1085.7	1672.1	2046.9	2390.8	3133.3
HV transmission for wind and solar - base other intra-state	0	90.572	90.572	321.964	467.245	685.36	928.915
HV transmission for wind and solar - base spur intra-state	0	768.233	855.169	950.771	997.354	1032.4	1126.1
HV transmission for wind and solar - constrained all	0	888.065	1094.3	1632.8	6395	6512.8	7791.5
HV transmission for wind and solar - constrained other intra-state	0	66.33	138.76	271.739	1870.2	1895.1	2556.2
HV transmission for wind and solar - constrained spur intra-state	0	780.031	843.847	883.467	1901.1	1901.1	2068

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0.168	0.319	0.992	0.992	0.992
Capital investment	0	0	3.47	0	14.931	0	0
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	3	16	16	16

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

variable_name	2020	2025	2030	2035	2040	2045	2050
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	4	4	5	5	5
Number of facilities - pyrolysis	0	0	0	0	0	0	0
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	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	4.5	8.25	24.65	24.68	25.13
Annual - BECCS	0	4.46	8.14	24.53	24.55	24.55
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0.03	0.11	0.12	0.13	0.58
Cumulative - All	0	4.5	12.75	37.4	62.08	87.21
Cumulative - BECCS	0	4.46	12.6	37.13	61.68	86.23
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0.03	0.14	0.26	0.39	0.97

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

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	12.07	41.4	74.98	121.36	163.08
Injection wells	0	10	41	72	122	150
Resource characterization, appraisal and permitting costs cumulative	47.32	1162	1837	1837	1837	1837
Wells and facilities construction costs cumulative	0	311.84	1215.3	2165.8	3621.4	4496

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

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	5320005.3	8748851.3	9322307.4	9424086	9752607
CO2 pipelines - Spur	0	211209.337	513258.951	1086715.1	1188493.7	1517014.7
CO2 pipelines - Trunk	0	5108796.154	8235592.4	8235592.4	8235592.4	8235592.4

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	150.278	173.25	481.639	787.236	1871.2	1526.3	1256.7
Jobs by economic sector - construction	12626.1	18630.9	15167.8	15055.2	13368.8	11175.2	10661.8
Jobs by economic sector - manufacturing	16193	26861.2	30394.7	37234.5	35030.9	27835.9	32792.2
Jobs by economic sector - mining	29707.1	25600.6	19924.4	14818.4	9644.7	6202.9	3458.2
Jobs by economic sector - other	653.954	1833.1	949.688	1134.3	1222.1	1186.3	1381.1
Jobs by economic sector - pipeline	2154.9	2176.8	2516.6	1991.6	1289.1	925.953	708.01
Jobs by economic sector - professional	9217.6	11016.5	8779.9	8764.7	9077.4	7721.9	6909.3
Jobs by economic sector - trade	9036.4	9893.8	7912	7265	6335.7	5171.9	4354.6
Jobs by economic sector - utilities	14040.1	14952.4	15133.6	15450	14243.8	11051.5	10131.8
Jobs by resource sector - Biomass	622.94	743.567	1328	2242.2	5632.8	5566.6	5366.6
Jobs by resource sector - CO2	0	47.412	5826.4	4377.6	1433.2	1842	2234.9
Jobs by resource sector - Coal	1395.7	640.547	105.252	8.246	7.082	6.296	5.516
Jobs by resource sector - Grid	9332.4	11975.8	11411.3	16175.5	17207.7	14745.8	15190.5
Jobs by resource sector - Natural Gas	44770.3	41897.3	32991.4	25333.2	20463.7	13078.2	7449.5
Jobs by resource sector - Nuclear	1146.9	1128.4	1110.4	1092.8	633.983	0	0
Jobs by resource sector - Oil	28989.8	27519.6	24380.7	21255.9	15487.9	11574.9	7349.1
Jobs by resource sector - Solar	6023.5	19783	13691.4	18105.5	18416.8	16666.6	22252.8
Jobs by resource sector - Wind	1497.8	7402.9	10415.4	13910	12800.6	9317.6	11804.7
Median wages - All	59825.2	59060.6	59661.9	59502.3	59589.8	59989.9	59445.7
Required Level of Education - Associates degree or some college	27756.8	33558.4	30800.3	31406.2	28148.9	22291.6	22232.8
Required Level of Education - Bachelors degree	22810.9	25587.3	22892.4	22506.5	19789.6	15479.8	14799.1
Required Level of Education - Doctoral degree	769.859	838.868	694.089	649.358	584.511	464.93	410.552
Required Level of Education - High school diploma or less	36947	45132.7	41625.4	42885.1	39097.7	31064.1	30971.6
Required Level of Education - Masters or professional degree	5494.8	6021.4	5248	5053.7	4463	3497.4	3239.5
Wage income - All	5610535039	6564247233	6041581092	6099266117	5487492886	4367364355	4259747171

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	679.913
Carbon sink enhancement potential - All (not counting overlap)	62449.8
Carbon sink enhancement potential - Avoid deforestation	2197.653
Carbon sink enhancement potential - corn-ethanol to energy grasses	-362.63
Carbon sink enhancement potential - cropland measures	-8229.772
Carbon sink enhancement potential - Extend rotation length	11905.1
Carbon sink enhancement potential - Improve plantations	6732.9
Carbon sink enhancement potential - Increase retention of HWP	22302.2
Carbon sink enhancement potential - Increase trees outside forests	1417.865
Carbon sink enhancement potential - permanent conservation cover	-101.769

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

variable_name	2050
Carbon sink enhancement potential - Reforest cropland	2340.4
Carbon sink enhancement potential - Reforest pasture	8567.8
Carbon sink enhancement potential - Restore productivity	6306.1
Carbon sink enhancement potential - total	-8694.171
Land impacted for carbon sink enhancement - Accelerate regeneration	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	589.924
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	146.694
Land impacted for carbon sink enhancement - cropland measures	2375.81
Land impacted for carbon sink enhancement - Extend rotation length	6558.3
Land impacted for carbon sink enhancement - Improve plantations	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	399.964
Land impacted for carbon sink enhancement - permanent conservation cover	185.098
Land impacted for carbon sink enhancement - Reforest cropland	779.205
Land impacted for carbon sink enhancement - Reforest pasture	647.861
Land impacted for carbon sink enhancement - Restore productivity	3558.603
Land impacted for carbon sink enhancement - total	2707.656
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	1322280	1341918	1131161	907237.8	682955.1	429692.4	298023.4
Oil consumption	180664.8	175930.3	157590.5	129487.8	101745	79968	58756.4

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.127	0.128	0.123	0.117	0.112	0.111	0.112
Final energy demand by sector - industry	1.932	2.153	2.273	2.317	2.383	2.435	2.505
Final energy demand by sector - residential	0.142	0.136	0.128	0.117	0.108	0.103	0.102
Final energy demand by sector - transportation	0.598	0.567	0.515	0.454	0.397	0.363	0.35

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	16472409395	19202581161	0	0	0	0
Sales of cooking units - Electric Resistance	0.301	0.444	0.792	0.861	0.865	0.865	0.865
Sales of cooking units - Gas	0.699	0.556	0.208	0.139	0.135	0.136	0.135
Sales of space heating units - Electric Heat Pump	0.061	0.261	0.769	0.911	0.922	0.922	0.922
Sales of space heating units - Electric Resistance	0.05	0.045	0.048	0.061	0.064	0.064	0.064
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.889	0.694	0.183	0.028	0.014	0.013	0.013
Sales of water heating units - Electric Heat Pump	0.001	0.107	0.563	0.665	0.669	0.669	0.669
Sales of water heating units - Electric Resistance	0.042	0.081	0.269	0.311	0.313	0.313	0.313
Sales of water heating units - Gas Furnace	0.937	0.793	0.15	0.006	0	0	0
Sales of water heating units - Other	0.02	0.018	0.018	0.018	0.018	0.018	0.018

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	5.939	6.216	10.363	11.1	8.067	8.355

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	3.655	3.765	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.123	0.408	0.42	0.44	0.459	0.484	0.521
Sale of space heating units by type - Electric Resistance	0.463	0.372	0.366	0.356	0.343	0.32	0.282
Sale of space heating units by type - Fossil	0.023	0.021	0.022	0.021	0.021	0.021	0.021
Sale of space heating units by type - Gas	0.391	0.199	0.192	0.182	0.177	0.175	0.176
Sales of cooking units - Electric Resistance	0.662	0.662	0.662	0.662	0.662	0.662	0.662
Sales of cooking units - Gas	0.338	0.338	0.338	0.338	0.338	0.338	0.338
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	0.565	0.676	0.677	0.677	0.675	0.675	0.675
Sales of water heating units by type - Gas Furnace	0.413	0.307	0.305	0.306	0.308	0.307	0.308
Sales of water heating units by type - Other	0.022	0.017	0.017	0.017	0.018	0.018	0.018

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	0.017	0.021	0.022	0.021	0.019	0.017	0.016
End-use technology sales by technology - LDV - EV	0.031	0.049	0.057	0.069	0.085	0.099	0.111
End-use technology sales by technology - LDV - gasoline	0.911	0.877	0.858	0.841	0.822	0.802	0.786
End-use technology sales by technology - LDV - hybrid	0.039	0.048	0.059	0.065	0.071	0.077	0.083
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	0.004	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	679.913
Carbon sink enhancement potential - All (not counting overlap)	0	0	62449.8
Carbon sink enhancement potential - Avoid deforestation	0	0	2197.653
Carbon sink enhancement potential - Extend rotation length	0	0	11905.1
Carbon sink enhancement potential - Improve plantations	0	0	6732.9
Carbon sink enhancement potential - Increase retention of HWP	0	0	22302.2
Carbon sink enhancement potential - Increase trees outside forests	0	0	1417.865
Carbon sink enhancement potential - Reforest cropland	0	0	2340.4
Carbon sink enhancement potential - Reforest pasture	0	0	8567.8
Carbon sink enhancement potential - Restore productivity	0	0	6306.1
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	589.924
Land impacted for carbon sink enhancement - Extend rotation length	0	0	6558.3
Land impacted for carbon sink enhancement - Improve plantations	0	0	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	399.964
Land impacted for carbon sink enhancement - Natural uptake	-31.75	-11.528	-9.343
Land impacted for carbon sink enhancement - Reforest cropland	0	0	779.205
Land impacted for carbon sink enhancement - Reforest pasture	0	0	647.861
Land impacted for carbon sink enhancement - Restore productivity	0	0	3558.603
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-3.641	-6.073	-6.392
Land impacted for carbon sink enhancement - Total	-35.391	-17.601	-15.735
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421

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	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.127	0.13	0.131	0.133	0.135	0.141	0.15
Final energy demand by sector - industry	1.933	2.162	2.297	2.357	2.441	2.51	2.595
Final energy demand by sector - residential	0.142	0.137	0.138	0.141	0.145	0.151	0.156
Final energy demand by sector - transportation	0.599	0.57	0.535	0.514	0.514	0.526	0.543

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	16112000420	16910335816	0	0	0	0
Sales of cooking units - Electric Resistance	0.301	0.323	0.323	0.323	0.323	0.323	0.323
Sales of cooking units - Gas	0.699	0.677	0.677	0.677	0.677	0.677	0.677
Sales of space heating units - Electric Heat Pump	0.061	0.289	0.709	0.791	0.795	0.795	0.795
Sales of space heating units - Electric Resistance	0.05	0.064	0.122	0.159	0.187	0.191	0.191
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.889	0.647	0.17	0.05	0.018	0.014	0.013
Sales of water heating units - Electric Heat Pump	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Sales of water heating units - Electric Resistance	0.042	0.037	0.037	0.037	0.037	0.037	0.037
Sales of water heating units - Gas Furnace	0.937	0.943	0.943	0.943	0.943	0.943	0.943
Sales of water heating units - Other	0.02	0.018	0.018	0.018	0.018	0.018	0.018

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	6.335	6.66	9.855	10.521	8.167	8.473

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	3.733	4.579	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.15	0.219	0.27	0.418	0.643	0.789	0.84
Sale of space heating units by type - Electric Resistance	0.447	0.48	0.451	0.367	0.242	0.162	0.134
Sale of space heating units by type - Fossil	0.023	0.036	0.035	0.028	0.019	0.013	0.011
Sale of space heating units by type - Gas	0.38	0.265	0.245	0.187	0.096	0.036	0.015
Sales of cooking units - Electric Resistance	0.665	0.674	0.704	0.785	0.898	0.967	0.991
Sales of cooking units - Gas	0.335	0.326	0.296	0.215	0.102	0.033	0.009
Sales of water heating units by type - Electric Heat Pump	0	0.021	0.079	0.248	0.507	0.676	0.735
Sales of water heating units by type - Electric Resistance	0.565	0.663	0.63	0.529	0.375	0.274	0.239
Sales of water heating units by type - Gas Furnace	0.413	0.299	0.273	0.205	0.101	0.032	0.008
Sales of water heating units by type - Other	0.022	0.017	0.017	0.017	0.017	0.017	0.017

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	0.017	0.021	0.021	0.017	0.011	0.006	0.002
End-use technology sales by technology - LDV - EV	0.017	0.043	0.11	0.245	0.469	0.711	0.872
End-use technology sales by technology - LDV - gasoline	0.923	0.882	0.809	0.683	0.478	0.259	0.114
End-use technology sales by technology - LDV - hybrid	0.041	0.049	0.055	0.051	0.039	0.024	0.012
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	0.003	0.003	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	119917205	254048574	855920304	2699706680	3931006129
Number of public EV charging plugs - DC Fast Charging	67	0	403.719	0	2193.2	0	6153.5
Number of public EV charging plugs - L2 Charging	204	0	9706.6	0	52730	0	147948.1

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	679.913
Carbon sink enhancement potential - All (not counting overlap)	62449.8
Carbon sink enhancement potential - Avoid deforestation	2197.653
Carbon sink enhancement potential - corn-ethanol to energy grasses	-362.63
Carbon sink enhancement potential - cropland measures	-8229.772
Carbon sink enhancement potential - Extend rotation length	11905.1
Carbon sink enhancement potential - Improve plantations	6732.9
Carbon sink enhancement potential - Increase retention of HWP	22302.2
Carbon sink enhancement potential - Increase trees outside forests	1417.865
Carbon sink enhancement potential - permanent conservation cover	-101.769
Carbon sink enhancement potential - Reforest cropland	2340.4
Carbon sink enhancement potential - Reforest pasture	8567.8
Carbon sink enhancement potential - Restore productivity	6306.1
Carbon sink enhancement potential - total	-8694.171
Land impacted for carbon sink enhancement - Accelerate regeneration	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	589.924
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	146.694
Land impacted for carbon sink enhancement - cropland measures	2375.81
Land impacted for carbon sink enhancement - Extend rotation length	6558.3
Land impacted for carbon sink enhancement - Improve plantations	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	399.964
Land impacted for carbon sink enhancement - permanent conservation cover	185.098
Land impacted for carbon sink enhancement - Reforest cropland	779.205
Land impacted for carbon sink enhancement - Reforest pasture	647.861
Land impacted for carbon sink enhancement - Restore productivity	3558.603
Land impacted for carbon sink enhancement - total	2707.656
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.127	0.128	0.127	0.126	0.123	0.121	0.119
Final energy demand by sector - industry	1.932	2.153	2.275	2.325	2.395	2.445	2.512
Final energy demand by sector - residential	0.142	0.137	0.134	0.131	0.124	0.116	0.11
Final energy demand by sector - transportation	0.599	0.57	0.531	0.5	0.477	0.451	0.421

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	16461319887	19126132514	0	0	0	0
Sales of cooking units - Electric Resistance	0.301	0.342	0.39	0.52	0.701	0.812	0.85
Sales of cooking units - Gas	0.699	0.658	0.61	0.48	0.299	0.188	0.15
Sales of space heating units - Electric Heat Pump	0.061	0.164	0.223	0.39	0.651	0.831	0.898
Sales of space heating units - Electric Resistance	0.05	0.045	0.045	0.047	0.051	0.058	0.062
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.889	0.791	0.732	0.563	0.298	0.111	0.04
Sales of water heating units - Electric Heat Pump	0.001	0.02	0.071	0.221	0.449	0.599	0.651
Sales of water heating units - Electric Resistance	0.042	0.045	0.066	0.128	0.222	0.284	0.305
Sales of water heating units - Gas Furnace	0.937	0.917	0.844	0.633	0.31	0.099	0.026
Sales of water heating units - Other	0.02	0.018	0.018	0.018	0.018	0.018	0.018

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	4.714	4.845	6.219	6.498	9.045	9.594

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	0.255	0.217	0	0.31	0	3.133
Power generation capital investment - Solar PV - Base	5	0.207	0.17	0.14	0.476	0
Power generation capital investment - Wind - Base	0	0	0	0.397	0.388	26.132

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	721.864	907.411	1103.6	2161.7	3710.4	21343.1
HV transmission for wind and solar - base other intra-state	0	112.233	190.421	217.388	570.581	881.088	8271.6
HV transmission for wind and solar - base spur intra-state	0	494.432	540.022	560.184	654.256	741.136	4865

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	679.913
Carbon sink enhancement potential - All (not counting overlap)	62449.8
Carbon sink enhancement potential - Avoid deforestation	2197.653
Carbon sink enhancement potential - corn-ethanol to energy grasses	-362.63
Carbon sink enhancement potential - cropland measures	-8229.772
Carbon sink enhancement potential - Extend rotation length	11905.1
Carbon sink enhancement potential - Improve plantations	6732.9
Carbon sink enhancement potential - Increase retention of HWP	22302.2
Carbon sink enhancement potential - Increase trees outside forests	1417.865
Carbon sink enhancement potential - permanent conservation cover	-101.769
Carbon sink enhancement potential - Reforest cropland	2340.4
Carbon sink enhancement potential - Reforest pasture	8567.8
Carbon sink enhancement potential - Restore productivity	6306.1
Carbon sink enhancement potential - total	-8694.171
Land impacted for carbon sink enhancement - Accelerate regeneration	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	589.924
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	146.694
Land impacted for carbon sink enhancement - cropland measures	2375.81
Land impacted for carbon sink enhancement - Extend rotation length	6558.3
Land impacted for carbon sink enhancement - Improve plantations	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	399.964
Land impacted for carbon sink enhancement - permanent conservation cover	185.098
Land impacted for carbon sink enhancement - Reforest cropland	779.205
Land impacted for carbon sink enhancement - Reforest pasture	647.861
Land impacted for carbon sink enhancement - Restore productivity	3558.603
Land impacted for carbon sink enhancement - total	2707.656
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42

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	10.491	12.53	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	11774.4	25837.8	25837.8	25837.8

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0.753	2.585	2.585	2.585
Capital investment	0	0	0	0	33.706	0	0
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	1	16	16	16
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	9	20	20	20
Number of facilities - pyrolysis	0	0	0	0	0	0	0
Number of facilities - pyrolysis ccu	0	0	0	1	1	1	1
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	13.39	44.49	44.47	44.46
Annual - BECCS	0	0	13.26	44.38	44.38	44.28
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0.14	0.11	0.09	0.17
Cumulative - All	0	0	13.39	57.88	102.35	146.81
Cumulative - BECCS	0	0	13.26	57.64	102.02	146.3
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0.14	0.25	0.34	0.51

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

variable_name	2025	2030	2035	2040	2045	2050
Annual	0	19.39	87.76	173.47	240.29	252.47
Injection wells	0	16	65	116	194	240
Resource characterization, appraisal and permitting costs cumulative	47.32	1957.7	3114.8	3114.8	3114.8	3114.8
Wells and facilities construction costs cumulative	0	499.31	1946	3467.8	5798.5	7199

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

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	5578526.089	10343213.5	14947986	14947743	15243820
CO2 pipelines - Spur	0	12757.035	715413.713	1787934.7	1787692.7	2083769.7
CO2 pipelines - Trunk	0	5565769.154	9627799.3	13160050.3	13160050.3	13160050.3

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	679.913
Carbon sink enhancement potential - All (not counting overlap)	62449.8
Carbon sink enhancement potential - Avoid deforestation	2197.653
Carbon sink enhancement potential - corn-ethanol to energy grasses	-1053.294
Carbon sink enhancement potential - cropland measures	-7530.482
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	11905.1
Carbon sink enhancement potential - Improve plantations	6732.9
Carbon sink enhancement potential - Increase retention of HWP	22302.2
Carbon sink enhancement potential - Increase trees outside forests	1417.865
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-89.823
Carbon sink enhancement potential - Reforest cropland	2340.4
Carbon sink enhancement potential - Reforest pasture	8567.8
Carbon sink enhancement potential - Restore productivity	6306.1

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

variable_name	2050
Carbon sink enhancement potential - total	-8673.599
Land impacted for carbon sink enhancement - Accelerate regeneration	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	589.924
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	434.296
Land impacted for carbon sink enhancement - cropland measures	4281.906
Land impacted for carbon sink enhancement - Cropland to woody energy crops	113.056
Land impacted for carbon sink enhancement - Extend rotation length	6558.3
Land impacted for carbon sink enhancement - Improve plantations	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	399.964
Land impacted for carbon sink enhancement - pasture to energy crops	480.742
Land impacted for carbon sink enhancement - permanent conservation cover	163.371
Land impacted for carbon sink enhancement - Reforest cropland	779.205
Land impacted for carbon sink enhancement - Reforest pasture	647.861
Land impacted for carbon sink enhancement - Restore productivity	3558.603
Land impacted for carbon sink enhancement - total	5473.3
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	679.913
Carbon sink enhancement potential - All (not counting overlap)	62449.8
Carbon sink enhancement potential - Avoid deforestation	2197.653
Carbon sink enhancement potential - corn-ethanol to energy grasses	-362.63
Carbon sink enhancement potential - cropland measures	-8229.772
Carbon sink enhancement potential - Extend rotation length	11905.1
Carbon sink enhancement potential - Improve plantations	6732.9
Carbon sink enhancement potential - Increase retention of HWP	22302.2
Carbon sink enhancement potential - Increase trees outside forests	1417.865
Carbon sink enhancement potential - permanent conservation cover	-101.769
Carbon sink enhancement potential - Reforest cropland	2340.4
Carbon sink enhancement potential - Reforest pasture	8567.8
Carbon sink enhancement potential - Restore productivity	6306.1
Carbon sink enhancement potential - total	-8694.171
Land impacted for carbon sink enhancement - Accelerate regeneration	274.03
Land impacted for carbon sink enhancement - All (not counting overlap)	12212.2
Land impacted for carbon sink enhancement - Avoid deforestation	589.924
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	146.694
Land impacted for carbon sink enhancement - cropland measures	2375.81
Land impacted for carbon sink enhancement - Extend rotation length	6558.3
Land impacted for carbon sink enhancement - Improve plantations	3741.906
Land impacted for carbon sink enhancement - Increase retention of HWP	4460.4
Land impacted for carbon sink enhancement - Increase trees outside forests	399.964
Land impacted for carbon sink enhancement - permanent conservation cover	185.098

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

variable_name	2050
Land impacted for carbon sink enhancement - Reforest cropland	779.205
Land impacted for carbon sink enhancement - Reforest pasture	647.861
Land impacted for carbon sink enhancement - Restore productivity	3558.603
Land impacted for carbon sink enhancement - total	2707.656
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8798

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	63.543
Business-as-usual carbon sink - Avoid deforestation	187.922
Business-as-usual carbon sink - Extend rotation length	3587.8
Business-as-usual carbon sink - Improve plantations	1421
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	80.416
Business-as-usual carbon sink - Reforest cropland	88.42
Business-as-usual carbon sink - Reforest pasture	158.272
Business-as-usual carbon sink - Restore productivity	1252.7
Business-as-usual carbon sink - Total impacted (over 30 years)	88.42