Net-Zero America - nebraska 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	1.712	1.807	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.056	0.141	0.145	0.151	0.157	0.164	0.174
Sale of space heating units by type - Electric Resistance	0.167	0.214	0.212	0.209	0.205	0.198	0.189
Sale of space heating units by type - Fossil	0.06	0.094	0.095	0.095	0.093	0.092	0.093
Sale of space heating units by type - Gas	0.717	0.55	0.548	0.545	0.545	0.546	0.544
Sales of cooking units - Electric Resistance	0.739	0.739	0.739	0.739	0.739	0.739	0.739
Sales of cooking units - Gas	0.261	0.261	0.261	0.261	0.261	0.261	0.261
Sales of water heating units by type - Electric Heat Pump	0	0	0	0	0	0	0
Sales of water heating units by type - Electric Resistance	0.355	0.512	0.512	0.511	0.511	0.51	0.51
Sales of water heating units by type - Gas Furnace	0.645	0.487	0.488	0.489	0.489	0.489	0.49
Sales of water heating units by type - Other	0	0	0	0	0	0	0

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	0.017	0.021	0.022	0.02	0.019	0.017	0.016
End-use technology sales by technology - LDV - EV	0.032	0.051	0.058	0.072	0.087	0.102	0.114
End-use technology sales by technology - LDV - gasoline	0.909	0.874	0.854	0.837	0.818	0.798	0.782
End-use technology sales by technology - LDV - hybrid	0.041	0.049	0.06	0.066	0.072	0.079	0.084
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 3: *E- scenario - PILLAR 6: Land carbon sinks - Agriculture*

variable_name	2020	2030	2050
Carbon sink enhancement potential - Accelerate regeneration	0	0	433.279
Carbon sink enhancement potential - All (not counting overlap)	0	0	28671.7
Carbon sink enhancement potential - Avoid deforestation	0	0	1499.879
Carbon sink enhancement potential - Extend rotation length	0	0	722.742
Carbon sink enhancement potential - Improve plantations	0	0	81.782
Carbon sink enhancement potential - Increase retention of HWP	0	0	474.935
Carbon sink enhancement potential - Increase trees outside forests	0	0	4551
Carbon sink enhancement potential - Reforest cropland	0	0	13746.8
Carbon sink enhancement potential - Reforest pasture	0	0	6442.9
Carbon sink enhancement potential - Restore productivity	0	0	718.503
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	402.622
Land impacted for carbon sink enhancement - Extend rotation length	0	0	398.144
Land impacted for carbon sink enhancement - Improve plantations	0	0	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	1283.777
Land impacted for carbon sink enhancement - Natural uptake	-0.18	0.307	0.088
Land impacted for carbon sink enhancement - Reforest cropland	0	0	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	0	0	487.186
Land impacted for carbon sink enhancement - Restore productivity	0	0	405.459
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-0.078	-0.161	-0.17
Land impacted for carbon sink enhancement - Total	-0.258	0.146	-0.081
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261

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	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.071	0.071	0.071	0.07	0.069	0.07	0.072
Final energy demand by sector - industry	0.281	0.297	0.305	0.312	0.321	0.329	0.34
Final energy demand by sector - residential	0.086	0.082	0.081	0.079	0.079	0.08	0.08
Final energy demand by sector - transportation	0.182	0.171	0.157	0.149	0.149	0.153	0.158

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	5475929028	5633379041	0	0	0	0
Sales of cooking units - Electric Resistance	0.448	0.478	0.479	0.478	0.479	0.479	0.48
Sales of cooking units - Gas	0.552	0.522	0.521	0.522	0.521	0.521	0.52
Sales of space heating units - Electric Heat Pump	0.039	0.13	0.446	0.705	0.748	0.752	0.752
Sales of space heating units - Electric Resistance	0.063	0.064	0.108	0.184	0.234	0.242	0.243
Sales of space heating units - Fossil	0	0.021	0.016	0.007	0.001	0	0
Sales of space heating units - Gas Furnace	0.898	0.785	0.43	0.104	0.017	0.005	0.005
Sales of water heating units - Electric Heat Pump	0.009	0.008	0.008	0.008	0.008	0.008	0.008
Sales of water heating units - Electric Resistance	0.08	0.07	0.07	0.07	0.07	0.07	0.07
Sales of water heating units - Gas Furnace	0.902	0.912	0.912	0.912	0.912	0.912	0.912
Sales of water heating units - Other	0.008	0.01	0.01	0.01	0.01	0.01	0.01

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	1.355	1.391	1.459	1.499	1.634	1.685

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	1.787	2.299	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.064	0.122	0.352	0.819	0.903	0.909	0.906
Sale of space heating units by type - Electric Resistance	0.165	0.22	0.174	0.075	0.057	0.056	0.059
Sale of space heating units by type - Fossil	0.058	0.099	0.077	0.032	0.023	0.022	0.022
Sale of space heating units by type - Gas	0.713	0.559	0.397	0.074	0.016	0.013	0.012
Sales of cooking units - Electric Resistance	0.742	0.797	0.965	0.998	1	1	1
Sales of cooking units - Gas	0.258	0.203	0.035	0.002	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.007	0.101	0.307	0.344	0.346	0.346
Sales of water heating units by type - Electric Resistance	0.355	0.515	0.553	0.637	0.653	0.654	0.653
Sales of water heating units by type - Gas Furnace	0.645	0.477	0.345	0.055	0.003	0	0
Sales of water heating units by type - Other	0	0	0	0	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	0.017	0.019	0.013	0.004	0.001	0	0
End-use technology sales by technology - LDV - EV	0.035	0.14	0.446	0.811	0.962	0.993	1
End-use technology sales by technology - LDV - gasoline	0.905	0.794	0.507	0.173	0.034	0.006	0
End-use technology sales by technology - LDV - hybrid	0.04	0.043	0.031	0.012	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	376819268	964185722	1565086508	2369748343	2580300506	2459550317
Number of public EV charging plugs - DC Fast Charging	61	0	695.362	0	3074.4	0	4975.5
Number of public EV charging plugs - L2 Charging	164	0	16747.3	0	74044.6	0	119831.4

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	0	0	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0.013	0.004	0	0
Power generation capital investment - biomass w/ccu power plant	0	0	0	0	0.005	0	0.597
Power generation capital investment - Solar PV - Base	0	2.033	10.951	9.432	6.821	5.939	15.337
Power generation capital investment - Solar PV - Constrained	0	3.437	13.355	6.07	7.001	7.796	11.1
Power generation capital investment - Wind - Base	0	0.55	11.476	23.722	25.885	28.606	36.99
Power generation capital investment - Wind - Constrained	0	17.01	13.886	23.425	20.333	25.694	27.647

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	0	0	0	0	0	0
Power generation by technology - biomass w/ccu allam power plant	0	0	0	13.102	17.113	17.113	17.113
Power generation by technology - biomass w/ccu power plant	0	0	0	0	5.709	5.709	676.07

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	818.023	4410.6	11779.8	19615.6	28903.4	47709.6
HV transmission for wind and solar - base other intra-state	0	116.595	1081.7	3773.3	6294.6	9405.6	16174.3
HV transmission for wind and solar - base spur intra-state	0	186.612	1605.4	4130.3	6873.6	9946.7	16403.3
HV transmission for wind and solar - constrained all	0	2367.8	6842.1	15574.6	26262.2	45142.5	76171.6
HV transmission for wind and solar - constrained other intra-state	0	690.165	2132.7	5471.8	8882.5	15521	26663
HV transmission for wind and solar - constrained spur intra-state	0	766.954	2356.5	5634	9823.5	16604.2	24719.9

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0.045	0.115	0.658	3.594
Capital investment	0	0	0	0	1.642	0	67.013
Number of facilities - allam power w ccu	0	0	0	1	1	1	1
Number of facilities - beccs hydrogen	0	0	0	1	2	11	29
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	1	1	1	1
Number of facilities - power	0	0	0	0	0	0	0
Number of facilities - power ccu	0	0	0	0	1	1	2
Number of facilities - pyrolysis	0	0	0	0	0	0	0
Number of facilities - pyrolysis ccu	0	0	0	1	1	1	33
Number of facilities - sng	0	0	0	0	0	0	0
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	0.86	2.21	12.72	56.84
Annual - BECCS	0	0	0.86	2.21	12.72	56.84
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0.86	3.07	15.79	72.63
Cumulative - BECCS	0	0	0.86	3.07	15.79	72.63
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	1459769.883	2992581.239	2939134.239	3695452.8	6656024.8
CO2 pipelines - Spur	0	0	73041.774	19594.574	775913.378	3736486
CO2 pipelines - Trunk	0	1459769.883	2919539.766	2919539.766	2919539.766	2919539.766

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	3678.8	3679.4	3685.3	3623	2083.1	1053.6	3462.3
Jobs by economic sector - construction	3806	5601.9	16136.2	23789	28510.3	34963.3	55610.5
Jobs by economic sector - manufacturing	4243.2	6179.8	7502.2	9749.8	9261.8	8468.9	13621.4

Table 17: *RE- scenario - IMPACTS - Jobs (continued)*

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - mining	1411.2	1054.2	702.208	481.085	303.255	184.097	104.83
Jobs by economic sector - other	272.334	585.737	2338.6	3233.7	3947.8	4846	8589.6
Jobs by economic sector - pipeline	200.753	198.84	349.232	315.059	105.053	99.829	425.08
Jobs by economic sector - professional	2926.6	3529.4	8228.5	13832.8	18366.5	24471.8	40728.3
Jobs by economic sector - trade	3188.7	3205.9	5632.1	8310.7	10370.6	13344.8	21991.3
Jobs by economic sector - utilities	4787	5242.7	10307.7	17535	21910	28841	47110.5
Jobs by resource sector - Biomass	8883.5	8620.8	8390.4	8104.5	4971.6	4014.1	15387.6
Jobs by resource sector - CO2	0	0	1452.7	1457.2	14.145	246.768	3161.7
Jobs by resource sector - Coal	1639	1025	257.24	0	0	0	0
Jobs by resource sector - Grid	6413.6	7620.8	16427.8	30894.1	41013.3	53981.8	87724.8
Jobs by resource sector - Natural Gas	1685.2	1577.3	1419.8	1280.2	1070.2	1313	1250.7
Jobs by resource sector - Nuclear	410.913	404.288	397.835	230.765	0.007	0.015	0.026
Jobs by resource sector - Oil	2595.9	2295.1	1889	1433.1	1005.2	703.129	450.018
Jobs by resource sector - Solar	682.52	3759.7	14626.9	15669.8	15381.8	15001.3	29215
Jobs by resource sector - Wind	2203.9	3974.8	10020.4	21800.6	31402.2	41013.1	54454
Median wages - All	53266.1	53897.7	55468.6	57288.9	58995.2	60631.6	61479
Required Level of Education - Associates degree or some college	6528.7	8126.8	16530.3	25050.6	30079	37368	61009.4
Required Level of Education - Bachelors degree	4634.7	5487.6	10348.1	15756.9	19124.4	24036	39535.2
Required Level of Education - Doctoral degree	158.751	187.795	396.883	627.157	797.331	1035.1	1715.4
Required Level of Education - High school diploma or less	12057.6	14141.9	25004.9	35391.7	39857.3	47456.6	78860.2
Required Level of Education - Masters or professional degree	1134.8	1333.8	2601.9	4043.9	5000.4	6377.6	10523.7
Wage income - All	1305853921	1578109726	3044593489	4633502838	5596878485	7050712084	11783646335

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	433.279
Carbon sink enhancement potential - All (not counting overlap)	28671.7
Carbon sink enhancement potential - Avoid deforestation	1499.879
Carbon sink enhancement potential - corn-ethanol to energy grasses	-5187.696
Carbon sink enhancement potential - cropland measures	-11779.293
Carbon sink enhancement potential - Extend rotation length	722.742
Carbon sink enhancement potential - Improve plantations	81.782
Carbon sink enhancement potential - Increase retention of HWP	474.935
Carbon sink enhancement potential - Increase trees outside forests	4551
Carbon sink enhancement potential - permanent conservation cover	-428.955
Carbon sink enhancement potential - Reforest cropland	13746.8
Carbon sink enhancement potential - Reforest pasture	6442.9
Carbon sink enhancement potential - Restore productivity	718.503
Carbon sink enhancement potential - total	-17395.944
Land impacted for carbon sink enhancement - Accelerate regeneration	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	402.622
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	2911.8
Land impacted for carbon sink enhancement - cropland measures	10717.8
Land impacted for carbon sink enhancement - Extend rotation length	398.144
Land impacted for carbon sink enhancement - Improve plantations	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	1283.777
Land impacted for carbon sink enhancement - permanent conservation cover	732.895
Land impacted for carbon sink enhancement - Reforest cropland	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	487.186
Land impacted for carbon sink enhancement - Restore productivity	405.459
Land impacted for carbon sink enhancement - total	14362.5
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	141818.6	143924.8	121320.4	97304	73249	46085.8	31963.9
Oil consumption	48100.7	46085.1	40777.3	32561.4	24411.9	18022.7	12347.2

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.071	0.069	0.067	0.062	0.058	0.054	0.052
Final energy demand by sector - industry	0.281	0.293	0.298	0.298	0.301	0.304	0.307
Final energy demand by sector - residential	0.086	0.082	0.078	0.07	0.06	0.053	0.049
Final energy demand by sector - transportation	0.182	0.17	0.15	0.125	0.103	0.089	0.083

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	5540650607	6031484033	0	0	0	0
Sales of cooking units - Electric Resistance	0.448	0.571	0.84	0.893	0.896	0.896	0.896
Sales of cooking units - Gas	0.552	0.429	0.16	0.107	0.104	0.104	0.104
Sales of space heating units - Electric Heat Pump	0.039	0.076	0.301	0.78	0.866	0.871	0.871
Sales of space heating units - Electric Resistance	0.063	0.058	0.082	0.118	0.124	0.124	0.124
Sales of space heating units - Fossil	0	0.018	0.004	0	0	0	0
Sales of space heating units - Gas Furnace	0.898	0.848	0.613	0.102	0.01	0.005	0.005
Sales of water heating units - Electric Heat Pump	0.009	0.018	0.145	0.42	0.47	0.473	0.473
Sales of water heating units - Electric Resistance	0.08	0.08	0.203	0.47	0.518	0.521	0.521
Sales of water heating units - Gas Furnace	0.902	0.892	0.645	0.103	0.006	0	0
Sales of water heating units - Other	0.008	0.009	0.007	0.007	0.007	0.007	0.007

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

variable_name	2025	2030	2035	2040	2045	2050
Electricity distribution peak load (capital invested) - Cumulative 5-yr	1.617	1.684	2.877	3.078	2.814	2.96

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	1.782	2.268	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.064	0.11	0.137	0.225	0.432	0.689	0.836
Sale of space heating units by type - Electric Resistance	0.165	0.222	0.215	0.198	0.155	0.102	0.072
Sale of space heating units by type - Fossil	0.058	0.1	0.098	0.089	0.068	0.043	0.03
Sale of space heating units by type - Gas	0.713	0.568	0.549	0.488	0.345	0.167	0.062
Sales of cooking units - Electric Resistance	0.741	0.748	0.772	0.834	0.921	0.974	0.993
Sales of cooking units - Gas	0.259	0.252	0.228	0.166	0.079	0.026	0.007
Sales of water heating units by type - Electric Heat Pump	0	0.004	0.015	0.051	0.139	0.249	0.315
Sales of water heating units by type - Electric Resistance	0.355	0.514	0.518	0.532	0.568	0.613	0.64
Sales of water heating units by type - Gas Furnace	0.645	0.482	0.467	0.417	0.293	0.137	0.045
Sales of water heating units by type - Other	0	0	0	0	0	0	0

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	0.018	0.044	0.112	0.249	0.473	0.713	0.873
End-use technology sales by technology - LDV - gasoline	0.922	0.88	0.806	0.679	0.474	0.256	0.113
End-use technology sales by technology - LDV - hybrid	0.042	0.05	0.057	0.052	0.04	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	60666308	128122048	432042392	1361518950	1982906095
Number of public EV charging plugs - DC Fast Charging	61	0	211.959	0	1137.8	0	3186.8
Number of public EV charging plugs - L2 Charging	164	0	5104.9	0	27402.8	0	76751.9

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	433.279
Carbon sink enhancement potential - All (not counting overlap)	28671.7
Carbon sink enhancement potential - Avoid deforestation	1499.879
Carbon sink enhancement potential - corn-ethanol to energy grasses	-5187.696

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

variable_name	2050
Carbon sink enhancement potential - cropland measures	-11779.293
Carbon sink enhancement potential - Extend rotation length	722.742
Carbon sink enhancement potential - Improve plantations	81.782
Carbon sink enhancement potential - Increase retention of HWP	474.935
Carbon sink enhancement potential - Increase trees outside forests	4551
Carbon sink enhancement potential - permanent conservation cover	-428.955
Carbon sink enhancement potential - Reforest cropland	13746.8
Carbon sink enhancement potential - Reforest pasture	6442.9
Carbon sink enhancement potential - Restore productivity	718.503
Carbon sink enhancement potential - total	-17395.944
Land impacted for carbon sink enhancement - Accelerate regeneration	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	402.622
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	2911.8
Land impacted for carbon sink enhancement - cropland measures	10717.8
Land impacted for carbon sink enhancement - Extend rotation length	398.144
Land impacted for carbon sink enhancement - Improve plantations	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	1283.777
Land impacted for carbon sink enhancement - permanent conservation cover	732.895
Land impacted for carbon sink enhancement - Reforest cropland	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	487.186
Land impacted for carbon sink enhancement - Restore productivity	405.459
Land impacted for carbon sink enhancement - total	14362.5
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.071	0.069	0.068	0.066	0.063	0.061	0.058
Final energy demand by sector - industry	0.281	0.293	0.3	0.302	0.307	0.311	0.314
Final energy demand by sector - residential	0.086	0.082	0.079	0.075	0.071	0.066	0.059
Final energy demand by sector - transportation	0.182	0.171	0.156	0.144	0.135	0.124	0.111

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	5540498950	6038684091	0	0	0	0
Sales of cooking units - Electric Resistance	0.448	0.493	0.531	0.63	0.769	0.855	0.885
Sales of cooking units - Gas	0.552	0.507	0.469	0.37	0.231	0.145	0.115
Sales of space heating units - Electric Heat Pump	0.039	0.067	0.093	0.179	0.386	0.645	0.797
Sales of space heating units - Electric Resistance	0.063	0.056	0.058	0.067	0.086	0.107	0.119
Sales of space heating units - Fossil	0	0.021	0.02	0.015	0.007	0.002	0.001
Sales of space heating units - Gas Furnace	0.898	0.856	0.829	0.739	0.521	0.245	0.083
Sales of water heating units - Electric Heat Pump	0.009	0.014	0.028	0.077	0.194	0.343	0.43
Sales of water heating units - Electric Resistance	0.08	0.075	0.09	0.137	0.251	0.395	0.48
Sales of water heating units - Gas Furnace	0.902	0.901	0.873	0.778	0.547	0.255	0.083
Sales of water heating units - Other	0.008	0.01	0.01	0.009	0.008	0.007	0.007

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	1.326	1.358	1.767	1.844	2.53	2.68

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

variable_name	2025	2030	2035	2040	2045	2050
Power generation capital investment - Solar PV - Base	0	15.592	12.035	14.641	12.205	52.798
Power generation capital investment - Wind - Base	2.405	13.814	28.708	46.818	55.793	72.787

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	920.617	5400.7	14487.2	31050.5	55048.5	120038.9
HV transmission for wind and solar - base other intra-state	0	200.708	1847	5761.9	13773.7	24230.2	55918.2
HV transmission for wind and solar - base spur intra-state	0	244.209	2064.9	5271.3	10611.2	19244.2	41197.8

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	433.279
Carbon sink enhancement potential - All (not counting overlap)	28671.7
Carbon sink enhancement potential - Avoid deforestation	1499.879
Carbon sink enhancement potential - corn-ethanol to energy grasses	-5187.696
Carbon sink enhancement potential - cropland measures	-11779.293
Carbon sink enhancement potential - Extend rotation length	722.742
Carbon sink enhancement potential - Improve plantations	81.782
Carbon sink enhancement potential - Increase retention of HWP	474.935
Carbon sink enhancement potential - Increase trees outside forests	4551
Carbon sink enhancement potential - permanent conservation cover	-428.955
Carbon sink enhancement potential - Reforest cropland	13746.8
Carbon sink enhancement potential - Reforest pasture	6442.9
Carbon sink enhancement potential - Restore productivity	718.503
Carbon sink enhancement potential - total	-17395.944
Land impacted for carbon sink enhancement - Accelerate regeneration	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	402.622
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	2911.8
Land impacted for carbon sink enhancement - cropland measures	10717.8
Land impacted for carbon sink enhancement - Extend rotation length	398.144
Land impacted for carbon sink enhancement - Improve plantations	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	1283.777
Land impacted for carbon sink enhancement - permanent conservation cover	732.895
Land impacted for carbon sink enhancement - Reforest cropland	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	487.186
Land impacted for carbon sink enhancement - Restore productivity	405.459
Land impacted for carbon sink enhancement - total	14362.5
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359

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	0.003	0.032	0	0	0	0
Power generation capital investment - biomass w/ccu allam power plant	0	0	0	0.024	0.006	0.01	0
Power generation capital investment - biomass w/ccu power plant	0	0	0	0.061	0.002	0.208	0.095

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	5.4	67.751	67.751	67.751	67.751	67.751
Power generation by technology - biomass w/ccu allam power plant	0	0	0	24.144	30.159	40.111	40.111
Power generation by technology - biomass w/ccu power plant	0	0	0	68.003	69.869	302.761	409.534

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0.004	0.111	1.03	2.429	5.656
Capital investment	0	0	0.036	0	12.928	0	67.876
Number of facilities - allam power w ccu	0	0	0	1	2	3	3
Number of facilities - beccs hydrogen	0	0	0	1	15	35	41
Number of facilities - diesel	0	0	0	1	1	2	3
Number of facilities - diesel ccu	0	0	0	1	2	3	4
Number of facilities - power	0	1	1	1	1	1	1
Number of facilities - power ccu	0	0	0	1	2	3	3
Number of facilities - pyrolysis	0	0	0	1	1	2	32
Number of facilities - pyrolysis ccu	0	0	0	1	2	3	17
Number of facilities - sng	0	1	1	1	1	2	2
Number of facilities - sng ccu	0	0	0	0	0	1	2

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

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0	1.79	17.52	41.49	57.61
Annual - BECCS	0	0	1.79	17.52	41.49	57.61
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	1.79	19.31	60.8	118.41
Cumulative - BECCS	0	0	1.79	19.31	60.8	118.41
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	1627721.883	3273341.239	5869634.7	6877618	7935952.4
CO2 pipelines - Spur	0	0	17897.974	986469.478	1994453.3	3052787.8
CO2 pipelines - Trunk	0	1627721.883	3255443.766	4883164.649	4883164.649	4883164.649

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	433.279
Carbon sink enhancement potential - All (not counting overlap)	28671.7
Carbon sink enhancement potential - Avoid deforestation	1499.879
Carbon sink enhancement potential - corn-ethanol to energy grasses	-5761.736
Carbon sink enhancement potential - cropland measures	-11517.731
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	722.742
Carbon sink enhancement potential - Improve plantations	81.782
Carbon sink enhancement potential - Increase retention of HWP	474.935
Carbon sink enhancement potential - Increase trees outside forests	4551
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-409.062
Carbon sink enhancement potential - Reforest cropland	13746.8
Carbon sink enhancement potential - Reforest pasture	6442.9
Carbon sink enhancement potential - Restore productivity	718.503
Carbon sink enhancement potential - total	-17688.53
Land impacted for carbon sink enhancement - Accelerate regeneration	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	402.622
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	3357.8
Land impacted for carbon sink enhancement - cropland measures	20485.9

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

variable_name	2050
Land impacted for carbon sink enhancement - Cropland to woody energy crops	31.352
Land impacted for carbon sink enhancement - Extend rotation length	398.144
Land impacted for carbon sink enhancement - Improve plantations	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	1283.777
Land impacted for carbon sink enhancement - pasture to energy crops	576.204
Land impacted for carbon sink enhancement - permanent conservation cover	698.992
Land impacted for carbon sink enhancement - Reforest cropland	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	487.186
Land impacted for carbon sink enhancement - Restore productivity	405.459
Land impacted for carbon sink enhancement - total	25150.1
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	433.279
Carbon sink enhancement potential - All (not counting overlap)	28671.7
Carbon sink enhancement potential - Avoid deforestation	1499.879
Carbon sink enhancement potential - corn-ethanol to energy grasses	-5187.696
Carbon sink enhancement potential - cropland measures	-11779.293
Carbon sink enhancement potential - Extend rotation length	722.742
Carbon sink enhancement potential - Improve plantations	81.782
Carbon sink enhancement potential - Increase retention of HWP	474.935
Carbon sink enhancement potential - Increase trees outside forests	4551
Carbon sink enhancement potential - permanent conservation cover	-428.955
Carbon sink enhancement potential - Reforest cropland	13746.8
Carbon sink enhancement potential - Reforest pasture	6442.9
Carbon sink enhancement potential - Restore productivity	718.503
Carbon sink enhancement potential - total	-17395.944
Land impacted for carbon sink enhancement - Accelerate regeneration	174.628
Land impacted for carbon sink enhancement - All (not counting overlap)	5905.9
Land impacted for carbon sink enhancement - Avoid deforestation	402.622
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	2911.8
Land impacted for carbon sink enhancement - cropland measures	10717.8
Land impacted for carbon sink enhancement - Extend rotation length	398.144
Land impacted for carbon sink enhancement - Improve plantations	45.453
Land impacted for carbon sink enhancement - Increase retention of HWP	94.987
Land impacted for carbon sink enhancement - Increase trees outside forests	1283.777
Land impacted for carbon sink enhancement - permanent conservation cover	732.895
Land impacted for carbon sink enhancement - Reforest cropland	4576.898
Land impacted for carbon sink enhancement - Reforest pasture	487.186
Land impacted for carbon sink enhancement - Restore productivity	405.459
Land impacted for carbon sink enhancement - total	14362.5
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	1963.156

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	40.493
Business-as-usual carbon sink - Avoid deforestation	128.257
Business-as-usual carbon sink - Extend rotation length	217.812
Business-as-usual carbon sink - Improve plantations	17.261
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	258.114
Business-as-usual carbon sink - Reforest cropland	519.359
Business-as-usual carbon sink - Reforest pasture	119.019
Business-as-usual carbon sink - Restore productivity	142.733
Business-as-usual carbon sink - Total impacted (over 30 years)	519.359