Net-Zero America - oregon 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	2.536	2.435	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.106	0.292	0.3	0.313	0.328	0.349	0.378
Sale of space heating units by type - Electric Resistance	0.317	0.33	0.326	0.319	0.308	0.289	0.257
Sale of space heating units by type - Fossil	0.085	0.13	0.118	0.11	0.108	0.107	0.108
Sale of space heating units by type - Gas	0.492	0.247	0.256	0.258	0.256	0.256	0.256
Sales of cooking units - Electric Resistance	0.652	0.652	0.652	0.652	0.652	0.652	0.652
Sales of cooking units - Gas	0.348	0.348	0.348	0.348	0.348	0.348	0.348
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	0.402	0.571	0.57	0.57	0.569	0.569	0.569
Sales of water heating units by type - Gas Furnace	0.534	0.375	0.376	0.376	0.376	0.377	0.377
Sales of water heating units by type - Other	0.064	0.054	0.054	0.054	0.054	0.054	0.054

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	0.016	0.02	0.022	0.02	0.018	0.017	0.016
End-use technology sales by technology - LDV - EV	0.033	0.053	0.06	0.074	0.09	0.105	0.117
End-use technology sales by technology - LDV - gasoline	0.906	0.871	0.851	0.834	0.813	0.794	0.778
End-use technology sales by technology - LDV - hybrid	0.042	0.051	0.062	0.068	0.074	0.08	0.085
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	5374.4
Carbon sink enhancement potential - All (not counting overlap)	0	0	101354.3
Carbon sink enhancement potential - Avoid deforestation	0	0	2005.908
Carbon sink enhancement potential - Extend rotation length	0	0	18655.6
Carbon sink enhancement potential - Improve plantations	0	0	10030.1
Carbon sink enhancement potential - Increase retention of HWP	0	0	33494.5
Carbon sink enhancement potential - Increase trees outside forests	0	0	1105.944
Carbon sink enhancement potential - Reforest cropland	0	0	11486.8
Carbon sink enhancement potential - Reforest pasture	0	0	5811.9
Carbon sink enhancement potential - Restore productivity	0	0	13389.2
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	538.45
Land impacted for carbon sink enhancement - Extend rotation length	0	0	10277
Land impacted for carbon sink enhancement - Improve plantations	0	0	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	311.975
Land impacted for carbon sink enhancement - Natural uptake	-34.27	-7.178	-5.978
Land impacted for carbon sink enhancement - Reforest cropland	0	0	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	0	0	439.472
Land impacted for carbon sink enhancement - Restore productivity	0	0	7555.7
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-5.468	-9.176	-9.659
Land impacted for carbon sink enhancement - Total	-39.738	-16.354	-15.637
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9

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	62.725
Business-as-usual carbon sink - Reforest cropland	433.975
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.094	0.096	0.099	0.101	0.104	0.11	0.118
Final energy demand by sector - industry	0.209	0.222	0.23	0.24	0.253	0.268	0.285
Final energy demand by sector - residential	0.151	0.14	0.129	0.121	0.115	0.111	0.107
Final energy demand by sector - transportation	0.334	0.316	0.295	0.284	0.286	0.295	0.308

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	13236088793	13602496719	0	0	0	0
Sales of cooking units - Electric Resistance	0.275	0.29	0.29	0.29	0.29	0.289	0.289
Sales of cooking units - Gas	0.725	0.71	0.71	0.71	0.71	0.711	0.711
Sales of space heating units - Electric Heat Pump	0.025	0.224	0.55	0.639	0.646	0.647	0.647
Sales of space heating units - Electric Resistance	0.167	0.163	0.26	0.31	0.341	0.346	0.346
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.808	0.613	0.19	0.052	0.013	0.007	0.007
Sales of water heating units - Electric Heat Pump	0.01	0.008	0.008	0.008	0.008	0.008	0.008
Sales of water heating units - Electric Resistance	0.031	0.024	0.024	0.024	0.024	0.024	0.024
Sales of water heating units - Gas Furnace	0.951	0.961	0.961	0.961	0.961	0.961	0.961
Sales of water heating units - Other	0.008	0.006	0.006	0.006	0.006	0.006	0.006

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	2.311	2.402	2.043	2.081	2.229	2.279

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	2.542	2.658	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.124	0.245	0.483	0.576	0.588	0.588	0.587
Sale of space heating units by type - Electric Resistance	0.31	0.374	0.341	0.314	0.31	0.312	0.313
Sale of space heating units by type - Fossil	0.083	0.135	0.105	0.096	0.094	0.092	0.092
Sale of space heating units by type - Gas	0.483	0.247	0.072	0.014	0.008	0.008	0.008
Sales of cooking units - Electric Resistance	0.656	0.73	0.954	0.998	1	1	1
Sales of cooking units - Gas	0.344	0.27	0.046	0.002	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.077	0.414	0.51	0.518	0.518	0.518
Sales of water heating units by type - Electric Resistance	0.402	0.548	0.448	0.431	0.431	0.431	0.431
Sales of water heating units by type - Gas Furnace	0.534	0.323	0.087	0.008	0	0	0
Sales of water heating units by type - Other	0.064	0.053	0.051	0.051	0.051	0.051	0.051

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	0.016	0.019	0.013	0.004	0.001	0	0
End-use technology sales by technology - LDV - EV	0.037	0.144	0.453	0.813	0.963	0.993	1
End-use technology sales by technology - LDV - gasoline	0.903	0.789	0.5	0.17	0.034	0.006	0
End-use technology sales by technology - LDV - hybrid	0.042	0.044	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	737198045	1952678928	3061888852	4678785095	5048023425	4836960420
Number of public EV charging plugs - DC Fast Charging	347	0	1506.8	0	5841.4	0	9305.1
Number of public EV charging plugs - L2 Charging	1296	0	36304.9	0	140740.1	0	224195

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	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	0.417	0	0	0.179	0	12.294
Power generation capital investment - Offshore Wind - Constrained	0	0.46	0	0	0	0.231	14.149
Power generation capital investment - Solar PV - Base	0	0	0	0	0	0	0
Power generation capital investment - Solar PV - Constrained	0	1.675	0	0	0	0	0
Power generation capital investment - Wind - Base	0	0	2.51	1.272	1.201	0.855	0.175
Power generation capital investment - Wind - Constrained	0	0	2.325	2.855	7.4	6.279	0.499

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	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	509.002	971.425	1246.9	1610.9	1760.3	15143.3
HV transmission for wind and solar - base other intra-state	0	135.77	357.471	478.555	652.022	689.443	11291
HV transmission for wind and solar - base spur intra-state	0	182.673	389.183	502.504	632.193	692.412	3469.4
HV transmission for wind and solar - constrained all	0	484.094	916.207	1263.1	2352.8	3457.5	19805.1
HV transmission for wind and solar - constrained other intra-state	0	145.152	321.081	401.36	833.682	1395.3	12242.1
HV transmission for wind and solar - constrained spur intra-state	0	152.883	328.179	462.695	944.733	1373.9	4256.7

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	0	0.117	0.375
Capital investment	0	0	0	0	0	0	6.869
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	0	0	4	11
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	0	0	0	0
Number of facilities - power	0	0	0	0	0	0	0
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	0	0	0	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	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	2.92	9.37
Annual - BECCS	0	0	0	0	2.92	9.37
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	0	2.92	12.29
Cumulative - BECCS	0	0	0	0	2.92	12.29
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	0	1560998.407	1560998.407	1794887.826	2144512.9
CO2 pipelines - Spur	0	0	0	0	233889.519	583515.12
CO2 pipelines - Trunk	0	0	1560998.407	1560998.407	1560998.407	1560998.407

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	168.422	183.221	298.234	155.738	104.586	229.486	500.53
Jobs by economic sector - construction	14601.4	9860.2	9551.7	11033.4	10875	11128.4	23154.3
Jobs by economic sector - manufacturing	2618.5	2689	4017.9	4949.3	4552	4061.4	5967.2
Jobs by economic sector - mining	1443.5	1109.5	787.97	503.254	297.18	160.124	80.176
Jobs by economic sector - other	2323.2	1507.7	1564.8	1881.9	2198.4	2513.1	5236.9
Jobs by economic sector - pipeline	264.649	258.679	218.307	358.32	123.875	108.663	129.111
Jobs by economic sector - professional	5378.6	4290	4526.8	4973.4	5413.1	5975.9	13282.1
Jobs by economic sector - trade	3717.8	2854	2895.9	3218.1	3531.8	3889.9	8533.5
Jobs by economic sector - utilities	3618.2	4144.8	4454.9	6315.1	6083.5	6269	15629.3
Jobs by resource sector - Biomass	574.088	646.61	787.793	400.409	289.517	840.306	2149.2
Jobs by resource sector - CO2	0	0	0	1543.6	0	250.058	658.801
Jobs by resource sector - Coal	271.025	86.886	0	0	0	0	0
Jobs by resource sector - Grid	4190	6144	7092.6	9280.8	10433.6	10900.4	29557.9
Jobs by resource sector - Natural Gas	2637.4	2131.1	1792	1839.5	1653.8	1258.7	1035
Jobs by resource sector - Nuclear	0	0	0	0	0	0	0
Jobs by resource sector - Oil	3085.5	2618.6	2054.1	1431.4	921.96	562.006	300.13
Jobs by resource sector - Solar	20556.8	11449.5	11082.9	13181.4	14423.6	15631.4	27983
Jobs by resource sector - Wind	2819.5	3820.4	5507.1	5711.4	5456.8	4893.1	10829.2
Median wages - All	60760.6	62291.4	62797.9	63769.8	64648.2	65678.1	67495.9
Required Level of Education - Associates degree or some college	10774.9	8494.2	8962.5	10764.9	10703.3	11061.7	23425.3
Required Level of Education - Bachelors degree	6520.4	5306.9	5591.6	6495.9	6510.2	6766.4	14372.9
Required Level of Education - Doctoral degree	271.002	211.883	218.679	241.733	253.087	272.473	589.29
Required Level of Education - High school diploma or less	14955.8	11565.6	12160.4	14289.8	14083.1	14514.1	30391.9
Required Level of Education - Masters or professional degree	1612.1	1318.5	1383.3	1596.2	1629.7	1721.4	3733.9
Wage income - All	2074391470	1675708057	1778484331	2129503153	2145361944	2255557741	4895286132

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	5374.4
Carbon sink enhancement potential - All (not counting overlap)	101354.3
Carbon sink enhancement potential - Avoid deforestation	2005.908
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-1642.51
Carbon sink enhancement potential - Extend rotation length	18655.6
Carbon sink enhancement potential - Improve plantations	10030.1
Carbon sink enhancement potential - Increase retention of HWP	33494.5
Carbon sink enhancement potential - Increase trees outside forests	1105.944
Carbon sink enhancement potential - permanent conservation cover	-111.144
Carbon sink enhancement potential - Reforest cropland	11486.8
Carbon sink enhancement potential - Reforest pasture	5811.9
Carbon sink enhancement potential - Restore productivity	13389.2
Carbon sink enhancement potential - total	-1753.654
Land impacted for carbon sink enhancement - Accelerate regeneration	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	538.45
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	2714.023
Land impacted for carbon sink enhancement - Extend rotation length	10277
Land impacted for carbon sink enhancement - Improve plantations	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	311.975
Land impacted for carbon sink enhancement - permanent conservation cover	188.486
Land impacted for carbon sink enhancement - Reforest cropland	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	439.472
Land impacted for carbon sink enhancement - Restore productivity	7555.7
Land impacted for carbon sink enhancement - total	2902.551
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	62.725
Business-as-usual carbon sink - Reforest cropland	433.975

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

variable_name	2050
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	195033.1	197929.6	166843.5	133815.4	100734.2	63378.6	43957.7
Oil consumption	63297	58902.3	50350.8	38005.9	26356.6	17198.7	9777.4

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.094	0.095	0.093	0.089	0.086	0.085	0.086
Final energy demand by sector - industry	0.209	0.215	0.214	0.219	0.226	0.23	0.236
Final energy demand by sector - residential	0.151	0.14	0.123	0.104	0.088	0.078	0.072
Final energy demand by sector - transportation	0.334	0.313	0.278	0.236	0.197	0.173	0.163

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	13357787988	14518438209	0	0	0	0
Sales of cooking units - Electric Resistance	0.275	0.417	0.782	0.854	0.858	0.858	0.858
Sales of cooking units - Gas	0.725	0.583	0.218	0.146	0.142	0.142	0.142
Sales of space heating units - Electric Heat Pump	0.025	0.167	0.412	0.548	0.566	0.567	0.567
Sales of space heating units - Electric Resistance	0.167	0.175	0.363	0.42	0.426	0.426	0.426
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.808	0.658	0.225	0.032	0.008	0.007	0.007
Sales of water heating units - Electric Heat Pump	0.01	0.103	0.522	0.649	0.66	0.66	0.66
Sales of water heating units - Electric Resistance	0.031	0.065	0.25	0.325	0.333	0.333	0.333
Sales of water heating units - Gas Furnace	0.951	0.826	0.222	0.02	0.001	0	0
Sales of water heating units - Other	0.008	0.006	0.006	0.006	0.006	0.006	0.006

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	2.383	2.482	3.935	4.195	3.617	3.778

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	2.528	2.653	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.124	0.202	0.229	0.309	0.438	0.534	0.572
Sale of space heating units by type - Electric Resistance	0.31	0.379	0.375	0.363	0.342	0.324	0.315
Sale of space heating units by type - Fossil	0.083	0.14	0.137	0.127	0.11	0.099	0.095
Sale of space heating units by type - Gas	0.483	0.279	0.259	0.201	0.109	0.044	0.018
Sales of cooking units - Electric Resistance	0.655	0.664	0.696	0.779	0.895	0.966	0.991
Sales of cooking units - Gas	0.345	0.336	0.304	0.221	0.105	0.034	0.009
Sales of water heating units by type - Electric Heat Pump	0	0.014	0.052	0.163	0.337	0.457	0.501
Sales of water heating units by type - Electric Resistance	0.402	0.567	0.555	0.522	0.474	0.444	0.434
Sales of water heating units by type - Gas Furnace	0.534	0.366	0.34	0.262	0.137	0.048	0.013
Sales of water heating units by type - Other	0.064	0.053	0.053	0.053	0.052	0.051	0.051

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	0.016	0.02	0.021	0.017	0.011	0.005	0.002
End-use technology sales by technology - LDV - EV	0.018	0.045	0.115	0.252	0.477	0.716	0.874
End-use technology sales by technology - LDV - gasoline	0.92	0.878	0.802	0.674	0.47	0.253	0.112
End-use technology sales by technology - LDV - hybrid	0.043	0.052	0.058	0.053	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	130315736	249259291	865415665	2648812236	3884744100
Number of public EV charging plugs - DC Fast Charging	347	0	569.898	0	2247.4	0	5959.9
Number of public EV charging plugs - L2 Charging	1296	0	13731	0	54147.6	0	143596.7

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	5374.4
Carbon sink enhancement potential - All (not counting overlap)	101354.3
Carbon sink enhancement potential - Avoid deforestation	2005.908
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-1642.51
Carbon sink enhancement potential - Extend rotation length	18655.6
Carbon sink enhancement potential - Improve plantations	10030.1
Carbon sink enhancement potential - Increase retention of HWP	33494.5
Carbon sink enhancement potential - Increase trees outside forests	1105.944
Carbon sink enhancement potential - permanent conservation cover	-111.144
Carbon sink enhancement potential - Reforest cropland	11486.8
Carbon sink enhancement potential - Reforest pasture	5811.9
Carbon sink enhancement potential - Restore productivity	13389.2
Carbon sink enhancement potential - total	-1753.654
Land impacted for carbon sink enhancement - Accelerate regeneration	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	538.45
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	2714.023
Land impacted for carbon sink enhancement - Extend rotation length	10277
Land impacted for carbon sink enhancement - Improve plantations	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	311.975
Land impacted for carbon sink enhancement - permanent conservation cover	188.486
Land impacted for carbon sink enhancement - Reforest cropland	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	439.472
Land impacted for carbon sink enhancement - Restore productivity	7555.7
Land impacted for carbon sink enhancement - total	2902.551
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	62.725
Business-as-usual carbon sink - Reforest cropland	433.975
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.094	0.095	0.097	0.097	0.096	0.094	0.093
Final energy demand by sector - industry	0.209	0.215	0.215	0.222	0.23	0.234	0.24
Final energy demand by sector - residential	0.151	0.14	0.128	0.117	0.105	0.093	0.082
Final energy demand by sector - transportation	0.334	0.315	0.29	0.27	0.254	0.235	0.213

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	13323539502	14288257399	0	0	0	0
Sales of cooking units - Electric Resistance	0.275	0.31	0.361	0.497	0.686	0.802	0.843
Sales of cooking units - Gas	0.725	0.69	0.639	0.503	0.314	0.198	0.157
Sales of space heating units - Electric Heat Pump	0.025	0.125	0.153	0.236	0.377	0.493	0.545
Sales of space heating units - Electric Resistance	0.167	0.139	0.161	0.224	0.322	0.39	0.416
Sales of space heating units - Fossil	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.808	0.736	0.686	0.54	0.301	0.117	0.039
Sales of water heating units - Electric Heat Pump	0.01	0.025	0.073	0.211	0.429	0.581	0.638
Sales of water heating units - Electric Resistance	0.031	0.032	0.053	0.114	0.215	0.29	0.321
Sales of water heating units - Gas Furnace	0.951	0.937	0.868	0.668	0.35	0.123	0.034
Sales of water heating units - Other	0.008	0.006	0.006	0.006	0.006	0.006	0.006

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	1.881	1.922	2.215	2.286	3.562	3.776

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	0.417	0	0	0.179	0.218	26.588
Power generation capital investment - Solar PV - Base	0	0	0	0	0	16.886
Power generation capital investment - Wind - Base	0	2.578	2.215	4.058	5.444	5.952

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	463.319	945.268	1393.8	2116.9	3170.8	43267.9
HV transmission for wind and solar - base other intra-state	0	137.672	371.776	545.54	768.451	1013.1	22590
HV transmission for wind and solar - base spur intra-state	0	154.401	368.035	556.929	808.845	1154.9	8316.5

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	5374.4
Carbon sink enhancement potential - All (not counting overlap)	101354.3
Carbon sink enhancement potential - Avoid deforestation	2005.908
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-1642.51
Carbon sink enhancement potential - Extend rotation length	18655.6
Carbon sink enhancement potential - Improve plantations	10030.1
Carbon sink enhancement potential - Increase retention of HWP	33494.5
Carbon sink enhancement potential - Increase trees outside forests	1105.944
Carbon sink enhancement potential - permanent conservation cover	-111.144
Carbon sink enhancement potential - Reforest cropland	11486.8
Carbon sink enhancement potential - Reforest pasture	5811.9
Carbon sink enhancement potential - Restore productivity	13389.2
Carbon sink enhancement potential - total	-1753.654
Land impacted for carbon sink enhancement - Accelerate regeneration	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	538.45
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	2714.023
Land impacted for carbon sink enhancement - Extend rotation length	10277
Land impacted for carbon sink enhancement - Improve plantations	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	311.975
Land impacted for carbon sink enhancement - permanent conservation cover	188.486
Land impacted for carbon sink enhancement - Reforest cropland	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	439.472
Land impacted for carbon sink enhancement - Restore productivity	7555.7
Land impacted for carbon sink enhancement - total	2902.551
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	62.725
Business-as-usual carbon sink - Reforest cropland	433.975
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975

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

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

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

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

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0	0.22	0.569	0.612
Capital investment	0	0	0	0	2.94	0	5.224
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	0	4	9	10
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	0	0	0	0
Number of facilities - power	0	0	0	0	0	0	0
Number of facilities - power ccu	0	0	0	0	0	0	0
Number of facilities - pyrolysis	0	0	0	0	0	0	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	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	4.01	10.36	11.14
Annual - BECCS	0	0	0	4.01	10.36	11.14
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	4.01	14.37	25.51
Cumulative - BECCS	0	0	0	4.01	14.37	25.51
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	0	1560998.407	1809444.826	2021523.3	2068935.2
CO2 pipelines - Spur	0	0	0	248446.619	460525.484	507936.856
CO2 pipelines - Trunk	0	0	1560998.407	1560998.407	1560998.407	1560998.407

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	5374.4
Carbon sink enhancement potential - All (not counting overlap)	101354.3
Carbon sink enhancement potential - Avoid deforestation	2005.908
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-1642.505
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	18655.6
Carbon sink enhancement potential - Improve plantations	10030.1
Carbon sink enhancement potential - Increase retention of HWP	33494.5
Carbon sink enhancement potential - Increase trees outside forests	1105.944
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-111.144
Carbon sink enhancement potential - Reforest cropland	11486.8
Carbon sink enhancement potential - Reforest pasture	5811.9
Carbon sink enhancement potential - Restore productivity	13389.2

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

variable_name	2050
Carbon sink enhancement potential - total	-1753.649
Land impacted for carbon sink enhancement - Accelerate regeneration	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	538.45
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	5341.42
Land impacted for carbon sink enhancement - Cropland to woody energy crops	0.012
Land impacted for carbon sink enhancement - Extend rotation length	10277
Land impacted for carbon sink enhancement - Improve plantations	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	311.975
Land impacted for carbon sink enhancement - pasture to energy crops	8.116
Land impacted for carbon sink enhancement - permanent conservation cover	188.485
Land impacted for carbon sink enhancement - Reforest cropland	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	439.472
Land impacted for carbon sink enhancement - Restore productivity	7555.7
Land impacted for carbon sink enhancement - total	5538.112
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	62.725
Business-as-usual carbon sink - Reforest cropland	433.975
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	5374.4
Carbon sink enhancement potential - All (not counting overlap)	101354.3
Carbon sink enhancement potential - Avoid deforestation	2005.908
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-1642.51
Carbon sink enhancement potential - Extend rotation length	18655.6
Carbon sink enhancement potential - Improve plantations	10030.1
Carbon sink enhancement potential - Increase retention of HWP	33494.5
Carbon sink enhancement potential - Increase trees outside forests	1105.944
Carbon sink enhancement potential - permanent conservation cover	-111.144
Carbon sink enhancement potential - Reforest cropland	11486.8
Carbon sink enhancement potential - Reforest pasture	5811.9
Carbon sink enhancement potential - Restore productivity	13389.2
Carbon sink enhancement potential - total	-1753.654
Land impacted for carbon sink enhancement - Accelerate regeneration	2166.052
Land impacted for carbon sink enhancement - All (not counting overlap)	22110.8
Land impacted for carbon sink enhancement - Avoid deforestation	538.45
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	2714.023
Land impacted for carbon sink enhancement - Extend rotation length	10277
Land impacted for carbon sink enhancement - Improve plantations	5574.6
Land impacted for carbon sink enhancement - Increase retention of HWP	6698.9
Land impacted for carbon sink enhancement - Increase trees outside forests	311.975
Land impacted for carbon sink enhancement - permanent conservation cover	188.486

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

variable_name	2050
Land impacted for carbon sink enhancement - Reforest cropland	3824.368
Land impacted for carbon sink enhancement - Reforest pasture	439.472
Land impacted for carbon sink enhancement - Restore productivity	7555.7
Land impacted for carbon sink enhancement - total	2902.551
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	15275.7

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	502.282
Business-as-usual carbon sink - Avoid deforestation	171.525
Business-as-usual carbon sink - Extend rotation length	5622.2
Business-as-usual carbon sink - Improve plantations	2116.9
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	62.725
Business-as-usual carbon sink - Reforest cropland	433.975
Business-as-usual carbon sink - Reforest pasture	107.363
Business-as-usual carbon sink - Restore productivity	2659.8
Business-as-usual carbon sink - Total impacted (over 30 years)	433.975