Net-Zero America - idaho state report v2

Larson et al. 2020

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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	1.252	1.37	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.095	0.204	0.403	0.807	0.883	0.89	0.888
Sale of space heating units by type - Electric Resistance	0.107	0.17	0.135	0.058	0.045	0.044	0.045
Sale of space heating units by type - Fossil	0.064	0.106	0.093	0.062	0.052	0.049	0.051
Sale of space heating units by type - Gas	0.734	0.521	0.37	0.072	0.02	0.016	0.016
Sales of cooking units - Electric Resistance	0.617	0.699	0.948	0.997	1	1	1
Sales of cooking units - Gas	0.383	0.301	0.052	0.003	0	0	0
Sales of water heating units by type - Electric Heat Pump	0	0.008	0.111	0.337	0.377	0.38	0.38
Sales of water heating units by type - Electric Resistance	0.213	0.367	0.432	0.572	0.598	0.599	0.599
Sales of water heating units by type - Gas Furnace	0.767	0.604	0.436	0.07	0.004	0	0
Sales of water heating units by type - Other	0.02	0.021	0.021	0.021	0.021	0.021	0.021

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	0.019	0.021	0.014	0.005	0.001	0	0
End-use technology sales by technology - LDV - EV	0.027	0.115	0.407	0.795	0.96	0.993	1
End-use technology sales by technology - LDV - gasoline	0.919	0.822	0.548	0.189	0.036	0.006	0
End-use technology sales by technology - LDV - hybrid	0.032	0.037	0.028	0.011	0.003	0.001	0
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	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	360628353	924409030	1497838934	2268988724	2469431906	2354496382
Number of public EV charging plugs - DC Fast Charging	66	0	688.104	0	3019.8	0	4883.1
Number of public EV charging plugs - L2 Charging	128	0	16572.2	0	72729	0	117604.4

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	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	0.002	0	0	0	0	0
Power generation capital investment - Wind - Base	0	0	17.087	6.283	5.04	5.166	0.609
Power generation capital investment - Wind - Constrained	0	0	14.77	7.009	7.448	5.782	0.297

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	0	0	0	0	0

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	0.578	2905.9	4292.3	5409.2	6741	6896.6
HV transmission for wind and solar - base other intra-state	0	0	0	0	0	0	0
HV transmission for wind and solar - base spur intra-state	0	0.207	1190.9	1822.5	2227.5	2692.6	2750.8
HV transmission for wind and solar - constrained all	0	14.828	2675.2	4147.6	5895	7628.4	7700.2
HV transmission for wind and solar - constrained other intra-state	0	0	0	0	0	0	0
HV transmission for wind and solar - constrained spur intra-state	0	5	1084.3	1721.7	2367.1	2914.5	2917.9

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Biomass purchases	0	0	0	0	0	0	0.052
Capital investment	0	0	0	0	0	0	0.82
Number of facilities - allam power w ccu	0	0	0	0	0	0	0
Number of facilities - beccs hydrogen	0	0	0	0	0	0	3
Number of facilities - diesel	0	0	0	0	0	0	0
Number of facilities - diesel ccu	0	0	0	0	0	0	0

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

variable_name	2020	2025	2030	2035	2040	2045	2050
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 7: *E- scenario - PILLAR 4: CO2 capture, use, storage - CO2 capture*

variable_name	2025	2030	2035	2040	2045	2050
Annual - All	0	0	0	0	0	1.08
Annual - BECCS	0	0	0	0	0	1.08
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	0	0	1.08
Cumulative - BECCS	0	0	0	0	0	1.08
Cumulative - Cement	0	0	0	0	0	0
Cumulative - NGCC	0	0	0	0	0	0

Table 8: *E- 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 9: *E- scenario - PILLAR 4: CO2 capture, use, storage - CO2 transportation*

variable_name	2025	2030	2035	2040	2045	2050
CO2 pipelines - All	0	0	423286.276	423286.276	423286.276	606954.687
CO2 pipelines - Spur	0	0	0	0	0	183668.411
CO2 pipelines - Trunk	0	0	423286.276	423286.276	423286.276	423286.276

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Jobs by economic sector - agriculture	137.452	142.814	184.506	130.2	77.809	26.005	66.929
Jobs by economic sector - construction	2854.2	2220.9	7427.3	8395.8	8720.2	9256.3	9386.7
Jobs by economic sector - manufacturing	1287.6	1309	2450.8	2880.9	2696.5	2466.8	2658.5
Jobs by economic sector - mining	731.483	580.921	414.295	265.17	155.441	83.333	39.36
Jobs by economic sector - other	383.14	266.562	741.212	904.583	1047.1	1207.5	1521
Jobs by economic sector - pipeline	126.369	123.444	104.557	132.608	58.914	37.338	51.348
Jobs by economic sector - professional	1196.3	1076.8	4833.1	5675.4	6291.3	7025.8	7209.3
Jobs by economic sector - trade	972.53	827.813	2548.1	3001	3365.6	3831.3	4121.8
Jobs by economic sector - utilities	1313.9	1550.4	5647	6258.2	6470.9	7088.2	6824.2
Jobs by resource sector - Biomass	392.418	413.16	459.392	309.139	198.03	99.625	302.588
Jobs by resource sector - CO2	0	0	0	419.413	0	0	236.259
Jobs by resource sector - Coal	3.168	2.458	0.823	0	0	0	0
Jobs by resource sector - Grid	1302.2	1909.7	9465.3	10246.9	11504.1	12808.3	12126.7
Jobs by resource sector - Natural Gas	1003.6	922.236	774.732	779.987	568.788	462.279	473.444
Jobs by resource sector - Nuclear	307.8	302.838	298.001	172.853	0	0	0
Jobs by resource sector - Oil	1661.2	1419	1118.3	782.549	500.454	302.131	150.536
Jobs by resource sector - Solar	3602.9	2066.1	2101.7	2734.1	2942.8	3154.8	5306.2
Jobs by resource sector - Wind	729.829	1063.2	10132.6	12199	13169.6	14195.4	13283.3
Median wages - All	53347.1	54810.2	56191.9	56868.3	57798.9	58888.3	59480.3
Required Level of Education - Associates degree or some college	2748.6	2479.5	7748.3	8866.2	9294.6	10016.2	10293.8
Required Level of Education - Bachelors degree	1845.4	1682.2	5080.9	5776.5	6080.4	6583.1	6749
Required Level of Education - Doctoral degree	68.255	60.106	213.883	246.285	266.181	293.325	301.505
Required Level of Education - High school diploma or less	3897.6	3471.3	9989.6	11249.3	11637.3	12373.8	12734.5
Required Level of Education - Masters or professional degree	443.362	405.63	1318.2	1505.6	1605.2	1756.1	1800.2
Wage income - All	480346081	443933631	1368455532	1572229226	1669637501	1827086717	1896444610

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	7743.4
Carbon sink enhancement potential - All (not counting overlap)	52284.4
Carbon sink enhancement potential - Avoid deforestation	1256.082
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-2885.595
Carbon sink enhancement potential - Extend rotation length	7883.6
Carbon sink enhancement potential - Improve plantations	506.886
Carbon sink enhancement potential - Increase retention of HWP	7098
Carbon sink enhancement potential - Increase trees outside forests	1360.564
Carbon sink enhancement potential - permanent conservation cover	-94.212
Carbon sink enhancement potential - Reforest cropland	10418.3
Carbon sink enhancement potential - Reforest pasture	4735.9

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

variable_name	2050
Carbon sink enhancement potential - Restore productivity	11281.8
Carbon sink enhancement potential - total	-2979.808
Land impacted for carbon sink enhancement - Accelerate regeneration	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	337.178
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	3451.5
Land impacted for carbon sink enhancement - Extend rotation length	4342.943
Land impacted for carbon sink enhancement - Improve plantations	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	383.801
Land impacted for carbon sink enhancement - permanent conservation cover	155.487
Land impacted for carbon sink enhancement - Reforest cropland	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	358.109
Land impacted for carbon sink enhancement - Restore productivity	6366.5
Land impacted for carbon sink enhancement - total	3606.9
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption	85193.2	86458.4	72879.6	58452.4	44002.1	27684.6	19201.3
Oil consumption	33858.6	31682.4	27176.8	20542.6	14121.7	9096.4	4805

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.049	0.049	0.048	0.046	0.043	0.041	0.041
Final energy demand by sector - industry	0.165	0.175	0.179	0.179	0.18	0.185	0.191
Final energy demand by sector - residential	0.071	0.068	0.065	0.059	0.051	0.045	0.041
Final energy demand by sector - transportation	0.15	0.141	0.124	0.104	0.086	0.075	0.07

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	4239196864	4715691521	0	0	0	0
Sales of cooking units - Electric Resistance	0.419	0.546	0.83	0.886	0.889	0.889	0.889
Sales of cooking units - Gas	0.581	0.454	0.17	0.114	0.111	0.111	0.111
Sales of space heating units - Electric Heat Pump	0.035	0.083	0.313	0.813	0.902	0.907	0.908
Sales of space heating units - Electric Resistance	0.033	0.035	0.05	0.081	0.087	0.087	0.087
Sales of space heating units - Fossil	0.011	0.002	0	0	0	0	0
Sales of space heating units - Gas Furnace	0.921	0.879	0.637	0.106	0.011	0.005	0.005
Sales of water heating units - Electric Heat Pump	0	0.011	0.144	0.437	0.489	0.492	0.492
Sales of water heating units - Electric Resistance	0.015	0.025	0.158	0.449	0.501	0.504	0.504
Sales of water heating units - Gas Furnace	0.981	0.96	0.694	0.111	0.007	0	0
Sales of water heating units - Other	0.004	0.004	0.004	0.004	0.004	0.004	0.004

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	1.282	1.345	2.219	2.378	2.184	2.301

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	1.223	1.236	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.089	0.22	0.222	0.228	0.235	0.242	0.248
Sale of space heating units by type - Electric Resistance	0.109	0.166	0.164	0.163	0.161	0.156	0.148
Sale of space heating units by type - Fossil	0.064	0.103	0.104	0.102	0.093	0.088	0.093
Sale of space heating units by type - Gas	0.738	0.512	0.509	0.507	0.511	0.514	0.51
Sales of cooking units - Electric Resistance	0.612	0.612	0.612	0.612	0.612	0.612	0.612
Sales of cooking units - Gas	0.388	0.388	0.388	0.388	0.388	0.388	0.388
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	0.213	0.362	0.363	0.363	0.364	0.364	0.365
Sales of water heating units by type - Gas Furnace	0.767	0.617	0.616	0.616	0.615	0.614	0.614
Sales of water heating units by type - Other	0.02	0.021	0.021	0.021	0.021	0.021	0.021

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	0.019	0.023	0.022	0.021	0.019	0.018	0.017
End-use technology sales by technology - LDV - EV	0.024	0.041	0.047	0.056	0.069	0.082	0.094
End-use technology sales by technology - LDV - gasoline	0.922	0.89	0.875	0.861	0.844	0.824	0.807
End-use technology sales by technology - LDV - hybrid	0.033	0.042	0.051	0.057	0.064	0.071	0.078
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	7743.4
Carbon sink enhancement potential - All (not counting overlap)	0	0	52284.4
Carbon sink enhancement potential - Avoid deforestation	0	0	1256.082
Carbon sink enhancement potential - Extend rotation length	0	0	7883.6
Carbon sink enhancement potential - Improve plantations	0	0	506.886
Carbon sink enhancement potential - Increase retention of HWP	0	0	7098
Carbon sink enhancement potential - Increase trees outside forests	0	0	1360.564
Carbon sink enhancement potential - Reforest cropland	0	0	10418.3
Carbon sink enhancement potential - Reforest pasture	0	0	4735.9
Carbon sink enhancement potential - Restore productivity	0	0	11281.8
Land impacted for carbon sink enhancement - Accelerate regeneration	0	0	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	0	0	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	0	0	337.178
Land impacted for carbon sink enhancement - Extend rotation length	0	0	4342.943
Land impacted for carbon sink enhancement - Improve plantations	0	0	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	0	0	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	0	0	383.801
Land impacted for carbon sink enhancement - Natural uptake	-21.95	4.289	1.229
Land impacted for carbon sink enhancement - Reforest cropland	0	0	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	0	0	358.109
Land impacted for carbon sink enhancement - Restore productivity	0	0	6366.5
Land impacted for carbon sink enhancement - Retained in Hardwood Products	-1.159	-2.407	-2.534
Land impacted for carbon sink enhancement - Total	-23.109	1.882	-1.304
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	0	0	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981

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	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.049	0.05	0.051	0.051	0.052	0.053	0.056
Final energy demand by sector - industry	0.165	0.182	0.194	0.206	0.22	0.239	0.257
Final energy demand by sector - residential	0.071	0.069	0.068	0.068	0.068	0.069	0.07
Final energy demand by sector - transportation	0.15	0.142	0.131	0.124	0.124	0.127	0.132

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	4185434468	4377299278	0	0	0	0
Sales of cooking units - Electric Resistance	0.419	0.447	0.447	0.446	0.444	0.445	0.446
Sales of cooking units - Gas	0.581	0.553	0.553	0.554	0.556	0.555	0.554
Sales of space heating units - Electric Heat Pump	0.035	0.141	0.47	0.739	0.783	0.788	0.788
Sales of space heating units - Electric Resistance	0.033	0.043	0.088	0.156	0.2	0.206	0.207
Sales of space heating units - Fossil	0.011	0.002	0.001	0	0	0	0
Sales of space heating units - Gas Furnace	0.921	0.813	0.441	0.104	0.017	0.006	0.005
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Sales of water heating units - Gas Furnace	0.981	0.981	0.981	0.981	0.981	0.981	0.981
Sales of water heating units - Other	0.004	0.004	0.004	0.004	0.004	0.004	0.004

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	1.175	1.226	1.358	1.418	1.516	1.58

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	1.249	1.369	0	0	0	0
Sale of space heating units by type - Electric Heat Pump	0.095	0.192	0.211	0.277	0.433	0.626	0.734
Sale of space heating units by type - Electric Resistance	0.107	0.172	0.168	0.157	0.129	0.094	0.073
Sale of space heating units by type - Fossil	0.064	0.107	0.108	0.1	0.081	0.065	0.062
Sale of space heating units by type - Gas	0.734	0.53	0.513	0.466	0.356	0.215	0.131
Sales of cooking units - Electric Resistance	0.616	0.626	0.661	0.754	0.883	0.962	0.99
Sales of cooking units - Gas	0.384	0.374	0.339	0.246	0.117	0.038	0.01
Sales of water heating units by type - Electric Heat Pump	0	0.004	0.014	0.048	0.13	0.234	0.295
Sales of water heating units by type - Electric Resistance	0.213	0.364	0.371	0.393	0.444	0.509	0.547
Sales of water heating units by type - Gas Furnace	0.767	0.611	0.594	0.538	0.404	0.236	0.136
Sales of water heating units by type - Other	0.02	0.021	0.021	0.021	0.021	0.021	0.021

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	0.019	0.023	0.021	0.017	0.011	0.006	0.002
End-use technology sales by technology - LDV - EV	0.015	0.038	0.099	0.227	0.448	0.697	0.866
End-use technology sales by technology - LDV - gasoline	0.93	0.892	0.827	0.707	0.502	0.274	0.12
End-use technology sales by technology - LDV - hybrid	0.033	0.042	0.048	0.046	0.036	0.022	0.011
End-use technology sales by technology - LDV - hydrogen FC	0.001	0.004	0.003	0.003	0.002	0.001	0.001
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	58349060	122582274	413980902	1302649244	1897841445
Number of public EV charging plugs - DC Fast Charging	66	0	212.776	0	1119.9	0	3127.6
Number of public EV charging plugs - L2 Charging	128	0	5124.5	0	26972.4	0	75325.5

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	7743.4
Carbon sink enhancement potential - All (not counting overlap)	52284.4
Carbon sink enhancement potential - Avoid deforestation	1256.082
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-2885.595
Carbon sink enhancement potential - Extend rotation length	7883.6
Carbon sink enhancement potential - Improve plantations	506.886
Carbon sink enhancement potential - Increase retention of HWP	7098
Carbon sink enhancement potential - Increase trees outside forests	1360.564
Carbon sink enhancement potential - permanent conservation cover	-94.212
Carbon sink enhancement potential - Reforest cropland	10418.3
Carbon sink enhancement potential - Reforest pasture	4735.9
Carbon sink enhancement potential - Restore productivity	11281.8
Carbon sink enhancement potential - total	-2979.808
Land impacted for carbon sink enhancement - Accelerate regeneration	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	337.178
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	3451.5
Land impacted for carbon sink enhancement - Extend rotation length	4342.943
Land impacted for carbon sink enhancement - Improve plantations	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	383.801
Land impacted for carbon sink enhancement - permanent conservation cover	155.487
Land impacted for carbon sink enhancement - Reforest cropland	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	358.109
Land impacted for carbon sink enhancement - Restore productivity	6366.5
Land impacted for carbon sink enhancement - total	3606.9
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605

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

variable_name	2020	2025	2030	2035	2040	2045	2050
Final energy demand by sector - commercial	0.049	0.049	0.049	0.049	0.048	0.047	0.046
Final energy demand by sector - industry	0.165	0.176	0.181	0.184	0.188	0.193	0.197
Final energy demand by sector - residential	0.071	0.068	0.066	0.064	0.062	0.058	0.053
Final energy demand by sector - transportation	0.15	0.142	0.13	0.12	0.112	0.103	0.093

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	4238853950	4714259670	0	0	0	0
Sales of cooking units - Electric Resistance	0.419	0.462	0.502	0.608	0.754	0.846	0.878
Sales of cooking units - Gas	0.581	0.538	0.498	0.392	0.246	0.154	0.122
Sales of space heating units - Electric Heat Pump	0.035	0.073	0.096	0.171	0.352	0.582	0.716
Sales of space heating units - Electric Resistance	0.033	0.034	0.036	0.041	0.052	0.067	0.075
Sales of space heating units - Fossil	0.011	0.003	0.002	0.002	0.001	0.001	0
Sales of space heating units - Gas Furnace	0.921	0.89	0.866	0.787	0.595	0.351	0.208
Sales of water heating units - Electric Heat Pump	0	0.005	0.018	0.062	0.169	0.304	0.383
Sales of water heating units - Electric Resistance	0.015	0.02	0.033	0.076	0.182	0.316	0.395
Sales of water heating units - Gas Furnace	0.981	0.972	0.945	0.857	0.645	0.376	0.218
Sales of water heating units - Other	0.004	0.004	0.004	0.004	0.004	0.004	0.004

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	1.089	1.129	1.387	1.453	2.085	2.218

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

variable_name	2025	2030	2035	2040	2045	2050
Power generation capital investment - Wind - Base	0	17.762	9.951	14.339	8.471	14.09

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	0.578	3034.4	5275.5	9118.3	11952.5	16893.6
HV transmission for wind and solar - base other intra-state	0	0	0	0	0	0	0
HV transmission for wind and solar - base spur intra-state	0	0.207	1240.8	2167.1	3482.7	4425.3	6014.4

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	7743.4
Carbon sink enhancement potential - All (not counting overlap)	52284.4
Carbon sink enhancement potential - Avoid deforestation	1256.082
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-2885.595
Carbon sink enhancement potential - Extend rotation length	7883.6
Carbon sink enhancement potential - Improve plantations	506.886
Carbon sink enhancement potential - Increase retention of HWP	7098
Carbon sink enhancement potential - Increase trees outside forests	1360.564
Carbon sink enhancement potential - permanent conservation cover	-94.212
Carbon sink enhancement potential - Reforest cropland	10418.3
Carbon sink enhancement potential - Reforest pasture	4735.9
Carbon sink enhancement potential - Restore productivity	11281.8
Carbon sink enhancement potential - total	-2979.808
Land impacted for carbon sink enhancement - Accelerate regeneration	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	337.178
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	3451.5
Land impacted for carbon sink enhancement - Extend rotation length	4342.943
Land impacted for carbon sink enhancement - Improve plantations	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	383.801
Land impacted for carbon sink enhancement - permanent conservation cover	155.487
Land impacted for carbon sink enhancement - Reforest cropland	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	358.109
Land impacted for carbon sink enhancement - Restore productivity	6366.5
Land impacted for carbon sink enhancement - total	3606.9
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605

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	0.041
Power generation capital investment - biomass w/ccu power plant	0	0	0	0	0	0	0.096

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	40.496
Power generation by technology - biomass w/ccu power plant	0	0	0	0	0	0	107.186

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	0	0.074
Capital investment	0	0	0	0	0	0	1.021
Number of facilities - allam power w ccu	0	0	0	0	0	0	1
Number of facilities - beccs hydrogen	0	0	0	0	0	0	2
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	1
Number of facilities - pyrolysis	0	0	0	0	0	0	0
Number of facilities - pyrolysis ccu	0	0	0	0	0	0	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	0	0	0	1.16
Annual - BECCS	0	0	0	0	0	1.16
Annual - Cement	0	0	0	0	0	0
Annual - NGCC	0	0	0	0	0	0
Cumulative - All	0	0	0	0	0	1.16
Cumulative - BECCS	0	0	0	0	0	1.16
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	423286.276	423286.276	423286.276	573585.193
CO2 pipelines - Spur	0	0	0	0	0	150298.917
CO2 pipelines - Trunk	0	0	423286.276	423286.276	423286.276	423286.276

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	7743.4
Carbon sink enhancement potential - All (not counting overlap)	52284.4
Carbon sink enhancement potential - Avoid deforestation	1256.082
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-2885.371
Carbon sink enhancement potential - Cropland to woody energy crops	0
Carbon sink enhancement potential - Extend rotation length	7883.6
Carbon sink enhancement potential - Improve plantations	506.886
Carbon sink enhancement potential - Increase retention of HWP	7098
Carbon sink enhancement potential - Increase trees outside forests	1360.564
Carbon sink enhancement potential - pasture to energy crops	0
Carbon sink enhancement potential - permanent conservation cover	-94.188
Carbon sink enhancement potential - Reforest cropland	10418.3
Carbon sink enhancement potential - Reforest pasture	4735.9
Carbon sink enhancement potential - Restore productivity	11281.8

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

variable_name	2050
Carbon sink enhancement potential - total	-2979.559
Land impacted for carbon sink enhancement - Accelerate regeneration	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	337.178
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	6805.8
Land impacted for carbon sink enhancement - Cropland to woody energy crops	0.5
Land impacted for carbon sink enhancement - Extend rotation length	4342.943
Land impacted for carbon sink enhancement - Improve plantations	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	383.801
Land impacted for carbon sink enhancement - pasture to energy crops	8.742
Land impacted for carbon sink enhancement - permanent conservation cover	155.45
Land impacted for carbon sink enhancement - Reforest cropland	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	358.109
Land impacted for carbon sink enhancement - Restore productivity	6366.5
Land impacted for carbon sink enhancement - total	6970.5
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605

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

variable_name	2050
Carbon sink enhancement potential - Accelerate regeneration	7743.4
Carbon sink enhancement potential - All (not counting overlap)	52284.4
Carbon sink enhancement potential - Avoid deforestation	1256.082
Carbon sink enhancement potential - corn-ethanol to energy grasses	0
Carbon sink enhancement potential - cropland measures	-2885.595
Carbon sink enhancement potential - Extend rotation length	7883.6
Carbon sink enhancement potential - Improve plantations	506.886
Carbon sink enhancement potential - Increase retention of HWP	7098
Carbon sink enhancement potential - Increase trees outside forests	1360.564
Carbon sink enhancement potential - permanent conservation cover	-94.212
Carbon sink enhancement potential - Reforest cropland	10418.3
Carbon sink enhancement potential - Reforest pasture	4735.9
Carbon sink enhancement potential - Restore productivity	11281.8
Carbon sink enhancement potential - total	-2979.808
Land impacted for carbon sink enhancement - Accelerate regeneration	3120.893
Land impacted for carbon sink enhancement - All (not counting overlap)	11478.8
Land impacted for carbon sink enhancement - Avoid deforestation	337.178
Land impacted for carbon sink enhancement - corn-ethanol to energy grasses	0
Land impacted for carbon sink enhancement - cropland measures	3451.5
Land impacted for carbon sink enhancement - Extend rotation length	4342.943
Land impacted for carbon sink enhancement - Improve plantations	281.718
Land impacted for carbon sink enhancement - Increase retention of HWP	1419.6
Land impacted for carbon sink enhancement - Increase trees outside forests	383.801
Land impacted for carbon sink enhancement - permanent conservation cover	155.487

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

variable_name	2050
Land impacted for carbon sink enhancement - Reforest cropland	3468.607
Land impacted for carbon sink enhancement - Reforest pasture	358.109
Land impacted for carbon sink enhancement - Restore productivity	6366.5
Land impacted for carbon sink enhancement - total	3606.9
Land impacted for carbon sink enhancement - Total impacted (over 30 years)	8600.5

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

variable_name	2050
Business-as-usual carbon sink - Accelerate regeneration	723.675
Business-as-usual carbon sink - Avoid deforestation	107.409
Business-as-usual carbon sink - Extend rotation length	2375.9
Business-as-usual carbon sink - Improve plantations	106.981
Business-as-usual carbon sink - Increase retention of HWP	0
Business-as-usual carbon sink - Increase trees outside forests	77.166
Business-as-usual carbon sink - Reforest cropland	393.605
Business-as-usual carbon sink - Reforest pasture	87.486
Business-as-usual carbon sink - Restore productivity	2241.2
Business-as-usual carbon sink - Total impacted (over 30 years)	393.605