Net-Zero America - oklahoma state report

Larson et al. 2020

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These data underlie graphs and tables presented in the Princeton Net-Zero America study (E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, interim report, Princeton University, Princeton, NJ, December 15, 2020. Report available at https://netzeroamerica.princeton.edu.)

Notes

- These data are a subset of all data from the study available at https://netzeroamerica.princeton.edu.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one "no new policies" reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not state-level results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- Some results are not model outputs, but rather they are limits that apply across all scenarios (e.g., maximum carbon storage potential in agricultural soils).

List of Tables

Table 1: *E+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.2	3.89	0	0	0	0
Sales of cooking units - Electric Resistance (%)	40.4	53.1	92	99.6	100	100	100
Sales of cooking units - Gas (%)	59.6	46.9	8.02	0.404	0	0	0
Sales of space heating units - Electric Heat Pump (%)	8.53	25.2	76.9	88.5	89	88.9	88.8
Sales of space heating units - Electric Resistance (%)	24.8	26.1	10.9	7.55	7.39	7.53	7.57
Sales of space heating units - Fossil (%)	5.91	8.95	3.48	2.25	2.19	2.17	2.16
Sales of space heating units - Gas (%)	60.7	39.8	8.68	1.75	1.46	1.44	1.43
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.7	72.9	73.4	73.4	73.4
Sales of water heating units - Electric Resistance (%)	30.5	39.9	28.2	25.5	25.4	25.4	25.4
Sales of water heating units - Gas Furnace (%)	68.2	47.2	8.93	0.373	0	0	0
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.2	1.19	1.2	1.2

Table 2: *E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	710	1,819	2,948	4,465	4,860	4,634
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.4	0	6.16	0	9.97
Public EV charging plugs - L2 (1000 units)	0.301	0	33.8	0	148	0	240
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.67	1.92	1.31	0.419	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.51	13.9	44.5	81	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.6	79.4	50.8	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.02	4.25	3.08	1.16	0.279	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.347	0.213	0.067	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.069	0.024	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 3: *E+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	122	117	109	103	101	103
Final energy use - Industry (PJ)	310	318	324	323	325	323	330
Final energy use - Residential (PJ)	177	168	153	133	115	105	99.9
Final energy use - Transportation (PJ)	431	405	359	302	250	219	207

Table 4: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	14,173	16,554	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	1.94	26.9	77	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2	4.42	4.72	6.04	6.33	6.36	6.38
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0

Table 4: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	96.1	68.7	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.059	10.7	56.4	66.5	67	67	66.9
Sales of water heating units - Electric Resistance (%)	1.74	8.05	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	97.4	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 5: *E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.97	3.05	4.83	5.11	4.99	5.22

Table 6: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.019	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	1.09	4.46	0.979
Capital invested - Solar PV - Constrained (billion $2018)	0	1.7	4.96	6.17	5.53	5.51	2.59
Capital invested - Wind - Base (billion $2018)	0	0	8.18	17.2	16.7	12	1.18
Capital invested - Wind - Constrained (billion $2018)	0	6.51	7.43	13.6	12.3	8.59	0.321

Table 7: *E+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	19	19	19	19
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	551	0	0	0	2,214	9,796	2,294
Solar - Constrained land use assumptions (GWh)	531	969	7,735	14,369	14,918	12,670	6,406
Wind - Base land use assumptions (GWh)	48,113	0	23,097	51,053	50,955	38,097	3,746
Wind - Constrained land use assumptions (GWh)	48,113	1,108	20,586	40,117	41,698	26,915	1,040

Table 8: *E+ scenario - PILLAR 3: Clean fuels - Bioenergy*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	192	266	412	531
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	3,342	1,276	2,536	2,177
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	4	7	9	12
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

Table 9: *E+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	11	12.5	16	18.8
Annual - BECCS (MMT)	0	0	0	4.26	5.9	9.16	11.8
Annual - Cement and lime (MMT)	0	0	0	6.71	6.64	6.84	7.07
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	11	23.5	39.5	58.3
Cumulative - BECCS (MMT)	0	0	0	4.26	10.2	19.3	31.1
Cumulative - Cement and lime (MMT)	0	0	0	6.71	13.3	20.2	27.3
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

Table 10: *E+ scenario - PILLAR 4: CCUS - CO2 storage*

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	1.1	1.76	3.61	6.02	7.46
Injection wells (wells)	0	0	1	4	8	13	16
Resource characterization, appraisal, permitting costs (million $2020)	0	103	251	295	295	295	295
Wells and facilities construction costs (million $2020)	0	0	35.6	139	247	413	513

Table 11: *E+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	774	1,805	2,123	2,851	3,186
Cumulative investment - All (million $2018)	0	0	4,032	6,502	6,684	7,204	7,407
Cumulative investment - Spur (million $2018)	0	0	0	557	740	1,259	1,462
Cumulative investment - Trunk (million $2018)	0	0	4,032	5,944	5,944	5,944	5,944
Spur (km)	0	0	0	670	988	1,715	2,050
Trunk (km)	0	0	774	1,136	1,136	1,136	1,136

Table 12: *E+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,525
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-262
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,806
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,381
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-131
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,530
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	4,283
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	450
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,745
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7

Table 12: *E+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,254
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	225
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,491

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	329
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	591
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	27,327
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,182

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	156
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	68.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	99.9

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,761

Table 14: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	267	0.239	0.23	0.185	0.12	0.002
Monetary damages from air pollution - Natural Gas (million 2019$)	0	238	124	55.4	41.2	23.9	12.8
Monetary damages from air pollution - Transportation (million 2019$)	0	674	634	485	281	129	50.9
Premature deaths from air pollution - Coal (deaths)	0	30	0.027	0.026	0.021	0.013	0
Premature deaths from air pollution - Natural Gas (deaths)	0	26.9	14	6.25	4.66	2.7	1.44
Premature deaths from air pollution - Transportation (deaths)	0	75.8	71.3	54.5	31.6	14.5	5.72

Table 15: *E+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	23.8	27.4	55.6	379	447	560	593
By economic sector - Construction (jobs)	14,474	14,781	16,934	21,027	22,801	25,208	21,719
By economic sector - Manufacturing (jobs)	20,485	28,891	31,436	36,802	33,310	27,008	28,975
By economic sector - Mining (jobs)	40,144	35,058	27,735	21,464	14,038	9,029	4,915
By economic sector - Other (jobs)	762	778	931	1,480	2,080	2,978	2,723
By economic sector - Pipeline (jobs)	1,754	1,798	2,040	1,681	1,137	881	643
By economic sector - Professional (jobs)	13,126	13,331	13,581	16,852	18,326	19,829	17,485
By economic sector - Trade (jobs)	12,747	12,358	11,762	12,564	12,277	12,543	10,597
By economic sector - Utilities (jobs)	12,099	11,521	12,676	16,002	17,481	18,831	17,098
By education level - All sectors - Associates degree or some college (jobs)	33,252	34,439	34,580	38,498	37,227	36,154	32,760
By education level - All sectors - Bachelors degree (jobs)	29,413	29,546	28,272	29,906	27,655	25,933	22,760
By education level - All sectors - Doctoral degree (jobs)	1,032	1,008	953	1,026	991	982	839
By education level - All sectors - High school diploma or less (jobs)	44,779	46,511	46,674	51,743	49,377	47,418	42,852
By education level - All sectors - Masters or professional degree (jobs)	7,139	7,039	6,672	7,078	6,647	6,380	5,537
By resource sector - Biomass (jobs)	98.5	118	153	1,079	1,345	2,042	2,533
By resource sector - CO2 (jobs)	0	53.6	3,571	2,476	756	1,295	1,714
By resource sector - Coal (jobs)	1,918	679	47.7	0.976	0.751	0.607	0.518
By resource sector - Grid (jobs)	11,224	10,694	12,550	21,365	26,557	30,550	28,842
By resource sector - Natural Gas (jobs)	36,708	34,455	26,923	20,616	15,610	10,051	5,609
By resource sector - Nuclear (jobs)	0	0	0.003	0.006	0	0	0
By resource sector - Oil (jobs)	54,160	52,247	47,100	42,254	30,570	22,744	13,938
By resource sector - Solar (jobs)	3,460	6,432	7,479	10,834	12,680	15,428	17,569
By resource sector - Wind (jobs)	8,045	13,865	19,325	29,626	34,379	34,756	34,543
Median wages - Annual - All ($2019 per job)	59,844	59,948	59,892	59,534	59,523	59,782	59,634
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	18,083	18,548	18,481	20,312	19,425	18,746	16,770
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	6,944	6,931	6,948	7,660	7,491	7,491	6,518
On-Site or In-Plant Training - Total jobs - None (jobs)	18,784	19,267	18,984	20,837	19,870	19,094	17,214

Table 15: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	806	844	870	991	980	972	878
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	70,998	72,954	71,867	78,450	74,131	70,565	63,369
On-the-Job Training - All sectors - 1 to 4 years (jobs)	23,112	23,643	23,561	25,912	24,855	24,067	21,520
On-the-Job Training - All sectors - 4 to 10 years (jobs)	6,205	6,185	6,278	7,041	7,018	7,145	6,251
On-the-Job Training - All sectors - None (jobs)	6,596	6,640	6,434	6,939	6,553	6,296	5,605
On-the-Job Training - All sectors - Over 10 years (jobs)	1,128	1,192	1,191	1,305	1,227	1,151	1,052
On-the-Job Training - All sectors - Up to 1 year (jobs)	78,573	80,884	79,686	87,054	82,244	78,208	70,320
Related work experience - All sectors - 1 to 4 years (jobs)	43,469	44,333	43,558	47,306	44,685	42,664	37,935
Related work experience - All sectors - 4 to 10 years (jobs)	27,566	28,132	27,733	30,215	28,703	27,526	24,533
Related work experience - All sectors - None (jobs)	15,692	16,125	16,057	17,699	16,947	16,394	14,724
Related work experience - All sectors - Over 10 years (jobs)	7,903	8,142	7,971	8,607	8,049	7,545	6,787
Related work experience - All sectors - Up to 1 year (jobs)	20,984	21,812	21,831	24,423	23,514	22,739	20,769
Wage income - All (million $2019)	6,919	7,107	7,017	7,636	7,256	6,987	6,247

Table 16: *E+ scenario - IMPACTS - Fossil fuel industries*

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	617	626	528	423	319	200	139
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	12,746
Natural gas production - Annual (tcf)	2,969	3,291	3,111	2,709	2,291	1,817	1,411
Oil consumption - Annual (million bbls)	109	102	87.7	66.7	45.9	29.6	14.7
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	2,028
Oil production - Annual (million bbls)	240	260	261	261	206	168	112

Table 17: *E- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.16	3.73	0	0	0	0
Sales of cooking units - Electric Resistance (%)	40.2	41.8	47.2	61.7	81.7	94.1	98.4
Sales of cooking units - Gas (%)	59.8	58.2	52.8	38.3	18.3	5.9	1.59
Sales of space heating units - Electric Heat Pump (%)	8.53	15.3	21.1	38.1	64.1	81	86.8
Sales of space heating units - Electric Resistance (%)	24.8	29	27.1	22.1	14.5	9.75	8.07
Sales of space heating units - Fossil (%)	5.91	10	9.47	7.6	4.79	3.01	2.4
Sales of space heating units - Gas (%)	60.7	45.8	42.3	32.2	16.6	6.26	2.7
Sales of water heating units - Electric Heat Pump (%)	0	2	7.69	24.1	49.2	65.6	71.4
Sales of water heating units - Electric Resistance (%)	30.5	42.2	40.8	37	31.1	27.3	25.9
Sales of water heating units - Gas Furnace (%)	68.2	54.6	50.3	37.7	18.4	5.87	1.53
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.21	1.21	1.21	1.2

Table 18: *E- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	0	115	241	815	2,564	3,735
Public EV charging plugs - DC Fast (1000 units)	0.326	0	0.434	0	2.29	0	6.38
Public EV charging plugs - L2 (1000 units)	0.301	0	10.4	0	55	0	154
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7

Table 18: *E- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.68	2.07	2.08	1.66	1.07	0.553	0.236
Vehicle sales - Light-duty - EV (%)	1.74	4.37	11.2	24.8	47.2	71.3	87.3
Vehicle sales - Light-duty - gasoline (%)	92.2	88.1	80.6	68	47.5	25.7	11.3
Vehicle sales - Light-duty - hybrid (%)	4.16	5	5.65	5.2	3.96	2.37	1.16
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.384	0.333	0.257	0.184	0.103	0.048
Vehicle sales - Light-duty - other (%)	0.108	0.112	0.102	0.09	0.065	0.036	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 19: *E- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	122	121	120	117	113	111
Final energy use - Industry (PJ)	310	319	325	326	330	327	334
Final energy use - Residential (PJ)	177	169	164	158	146	131	118
Final energy use - Transportation (PJ)	431	408	374	347	327	302	274

Table 20: *E- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	14,157	16,435	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	1.94	17.4	23.1	39.7	65.5	83.2	89.8
Sales of space heating units - Electric Resistance (%)	2	4.42	4.46	4.63	5.06	5.73	6.18
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	96.1	78.2	72.4	55.7	29.4	11	3.98
Sales of water heating units - Electric Heat Pump (%)	0.059	1.96	7.15	22.1	45	59.9	65.1
Sales of water heating units - Electric Resistance (%)	1.74	4.42	6.55	12.7	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	97.4	91.9	84.5	63.4	31	9.91	2.58
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 21: *E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.54	2.56	3.09	3.17	4.7	4.96

Table 22: *E- scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,525
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-262
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,806

Table 22: *E- scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,381
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-131
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,530
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	4,283
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	450
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,745
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,254
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	225
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,491

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	329

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	591
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	27,327
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,182
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	156
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	68.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	99.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,761

Table 24: *E- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	267	0.239	0.23	0.185	0.12	0.002
Monetary damages from air pollution - Natural Gas (million 2019$)	0	237	105	51.4	27	9.67	7.79
Monetary damages from air pollution - Transportation (million 2019$)	0	685	696	682	619	496	343
Premature deaths from air pollution - Coal (deaths)	0	30	0.027	0.026	0.021	0.013	0
Premature deaths from air pollution - Natural Gas (deaths)	0	26.7	11.9	5.81	3.05	1.09	0.88
Premature deaths from air pollution - Transportation (deaths)	0	77	78.2	76.7	69.6	55.8	38.5

Table 25: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.2	3.89	0	0	0	0
Sales of cooking units - Electric Resistance (%)	40.4	53.1	92	99.6	100	100	100
Sales of cooking units - Gas (%)	59.6	46.9	8.02	0.404	0	0	0
Sales of space heating units - Electric Heat Pump (%)	8.53	25.2	76.9	88.5	89	88.9	88.8
Sales of space heating units - Electric Resistance (%)	24.8	26.1	10.9	7.55	7.39	7.53	7.57
Sales of space heating units - Fossil (%)	5.91	8.95	3.48	2.25	2.19	2.17	2.16
Sales of space heating units - Gas (%)	60.7	39.8	8.68	1.75	1.46	1.44	1.43
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.7	72.9	73.4	73.4	73.4

Table 25: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	30.5	39.9	28.2	25.5	25.4	25.4	25.4
Sales of water heating units - Gas Furnace (%)	68.2	47.2	8.93	0.373	0	0	0
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.2	1.19	1.2	1.2

Table 26: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	710	1,819	2,948	4,465	4,860	4,634
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.4	0	6.16	0	9.97
Public EV charging plugs - L2 (1000 units)	0.301	0	33.8	0	148	0	240
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.67	1.92	1.31	0.419	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.51	13.9	44.5	81	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.6	79.4	50.8	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.02	4.25	3.08	1.16	0.279	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.347	0.213	0.067	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.069	0.024	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 27: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	122	117	109	103	101	103
Final energy use - Industry (PJ)	310	318	324	323	325	323	330
Final energy use - Residential (PJ)	177	168	153	133	115	105	99.9
Final energy use - Transportation (PJ)	431	405	359	302	250	219	207

Table 28: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	14,173	16,554	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	1.94	26.9	77	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2	4.42	4.72	6.04	6.33	6.36	6.38
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	96.1	68.7	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.059	10.7	56.4	66.5	67	67	66.9
Sales of water heating units - Electric Resistance (%)	1.74	8.05	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	97.4	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 29: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.97	3.05	4.83	5.11	4.99	5.22

Table 30: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0.381	4.53	11.1	7.93
Capital invested - Wind - Base (billion $2018)	0	3.94	9.8	31.2	29.9	33.3	33.7

Table 31: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	551	0	0	738	9,386	24,320	18,528
Solar - Constrained land use assumptions (GWh)	551	6,047	17,930	12,073	26,393	51,843	29,323
Wind - Base land use assumptions (GWh)	48,113	10,147	27,387	91,178	89,523	103,363	108,283
Wind - Constrained land use assumptions (GWh)	48,113	10,150	24,700	71,339	67,955	77,819	46,763

Table 32: *E+RE+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,525
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-262
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,806
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,381
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-131
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,530
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	4,283
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	450
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,745
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,254
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	225
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,491

Table 33: *E+RE+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	329
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	591
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	27,327
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,182
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	156

Table 33: *E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	68.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	99.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,761

Table 34: *E+RE+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	267	0.239	0.23	0.185	0.12	0.002
Monetary damages from air pollution - Natural Gas (million 2019$)	0	225	120	35	23.8	10.3	6.75
Monetary damages from air pollution - Transportation (million 2019$)	0	674	634	485	281	129	50.9
Premature deaths from air pollution - Coal (deaths)	0	30	0.027	0.026	0.021	0.013	0
Premature deaths from air pollution - Natural Gas (deaths)	0	25.4	13.6	3.96	2.69	1.16	0.763
Premature deaths from air pollution - Transportation (deaths)	0	75.8	71.3	54.5	31.6	14.5	5.72

Table 35: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.2	3.89	0	0	0	0
Sales of cooking units - Electric Resistance (%)	40.4	53.1	92	99.6	100	100	100
Sales of cooking units - Gas (%)	59.6	46.9	8.02	0.404	0	0	0
Sales of space heating units - Electric Heat Pump (%)	8.53	25.2	76.9	88.5	89	88.9	88.8
Sales of space heating units - Electric Resistance (%)	24.8	26.1	10.9	7.55	7.39	7.53	7.57
Sales of space heating units - Fossil (%)	5.91	8.95	3.48	2.25	2.19	2.17	2.16
Sales of space heating units - Gas (%)	60.7	39.8	8.68	1.75	1.46	1.44	1.43
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.7	72.9	73.4	73.4	73.4
Sales of water heating units - Electric Resistance (%)	30.5	39.9	28.2	25.5	25.4	25.4	25.4
Sales of water heating units - Gas Furnace (%)	68.2	47.2	8.93	0.373	0	0	0
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.2	1.19	1.2	1.2

Table 36: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	710	1,819	2,948	4,465	4,860	4,634
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.4	0	6.16	0	9.97
Public EV charging plugs - L2 (1000 units)	0.301	0	33.8	0	148	0	240
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.67	1.92	1.31	0.419	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.51	13.9	44.5	81	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.6	79.4	50.8	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.02	4.25	3.08	1.16	0.279	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.347	0.213	0.067	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.069	0.024	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 37: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	122	117	109	103	101	103
Final energy use - Industry (PJ)	310	318	324	323	325	323	330
Final energy use - Residential (PJ)	177	168	153	133	115	105	99.9
Final energy use - Transportation (PJ)	431	405	359	302	250	219	207

Table 38: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	14,173	16,554	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	1.94	26.9	77	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2	4.42	4.72	6.04	6.33	6.36	6.38
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	96.1	68.7	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.059	10.7	56.4	66.5	67	67	66.9
Sales of water heating units - Electric Resistance (%)	1.74	8.05	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	97.4	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 39: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.97	3.05	4.83	5.11	4.99	5.22

Table 40: *E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	0.659	2.65	1.08
Capital invested - Solar PV - Constrained (billion $2018)	0	4.95	7.13	4.83	5.6	7.78	5.84
Capital invested - Wind - Base (billion $2018)	0	0	0	7.96	10.5	4.98	0
Capital invested - Wind - Constrained (billion $2018)	0	0	0.453	7.19	8.53	3.71	0.089

Table 41: *E+RE- scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	551	0	0	0	1,334	5,863	2,547
Solar - Constrained land use assumptions (GWh)	551	8,009	13,077	9,569	11,726	16,901	13,632
Wind - Base land use assumptions (GWh)	48,113	0	0	24,106	32,827	16,209	0
Wind - Constrained land use assumptions (GWh)	48,113	0	1,108	21,471	26,094	11,907	287

Table 42: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,525
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-262
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,806
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.2

Table 42: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,381
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-131
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,530
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	4,283
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	450
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,745
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,254
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	225
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,491

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	329
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	591

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	27,327
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,182
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	156
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	68.9

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	99.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,761

Table 44: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	267	0.239	0.23	0.185	0.12	0.002
Monetary damages from air pollution - Natural Gas (million 2019$)	0	251	114	114	78.9	32.4	14.3
Monetary damages from air pollution - Transportation (million 2019$)	0	674	634	485	281	129	50.9
Premature deaths from air pollution - Coal (deaths)	0	30	0.027	0.026	0.021	0.013	0
Premature deaths from air pollution - Natural Gas (deaths)	0	28.4	12.9	12.8	8.91	3.66	1.62
Premature deaths from air pollution - Transportation (deaths)	0	75.8	71.3	54.5	31.6	14.5	5.72

Table 45: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.16	3.73	0	0	0	0
Sales of cooking units - Electric Resistance (%)	40.2	41.8	47.2	61.7	81.7	94.1	98.4
Sales of cooking units - Gas (%)	59.8	58.2	52.8	38.3	18.3	5.9	1.59
Sales of space heating units - Electric Heat Pump (%)	8.53	15.3	21.1	38.1	64.1	81	86.8
Sales of space heating units - Electric Resistance (%)	24.8	29	27.1	22.1	14.5	9.75	8.07
Sales of space heating units - Fossil (%)	5.91	10	9.47	7.6	4.79	3.01	2.4
Sales of space heating units - Gas (%)	60.7	45.8	42.3	32.2	16.6	6.26	2.7
Sales of water heating units - Electric Heat Pump (%)	0	2	7.69	24.1	49.2	65.6	71.4
Sales of water heating units - Electric Resistance (%)	30.5	42.2	40.8	37	31.1	27.3	25.9

Table 45: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	68.2	54.6	50.3	37.7	18.4	5.87	1.53
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.21	1.21	1.21	1.2

Table 46: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	0	115	241	815	2,564	3,735
Public EV charging plugs - DC Fast (1000 units)	0.326	0	0.434	0	2.29	0	6.38
Public EV charging plugs - L2 (1000 units)	0.301	0	10.4	0	55	0	154
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.68	2.07	2.08	1.66	1.07	0.553	0.236
Vehicle sales - Light-duty - EV (%)	1.74	4.37	11.2	24.8	47.2	71.3	87.3
Vehicle sales - Light-duty - gasoline (%)	92.2	88.1	80.6	68	47.5	25.7	11.3
Vehicle sales - Light-duty - hybrid (%)	4.16	5	5.65	5.2	3.96	2.37	1.16
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.384	0.333	0.257	0.184	0.103	0.048
Vehicle sales - Light-duty - other (%)	0.108	0.112	0.102	0.09	0.065	0.036	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 47: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	122	121	120	117	113	111
Final energy use - Industry (PJ)	310	319	325	326	330	327	334
Final energy use - Residential (PJ)	177	169	164	158	146	131	118
Final energy use - Transportation (PJ)	431	408	374	347	327	302	274

Table 48: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	14,157	16,435	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	1.94	17.4	23.1	39.7	65.5	83.2	89.8
Sales of space heating units - Electric Resistance (%)	2	4.42	4.46	4.63	5.06	5.73	6.18
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	96.1	78.2	72.4	55.7	29.4	11	3.98
Sales of water heating units - Electric Heat Pump (%)	0.059	1.96	7.15	22.1	45	59.9	65.1
Sales of water heating units - Electric Resistance (%)	1.74	4.42	6.55	12.7	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	97.4	91.9	84.5	63.4	31	9.91	2.58
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 49: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.54	2.56	3.09	3.17	4.7	4.96

Table 50: *E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.034	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	2.6	1.6	12.5	21.2	5.44

Table 51: *E-B+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	34.2	34.2	34.2	34.2
Biomass w/ccu power plant (GWh)	0	0	2,913	4,709	18,789	42,612	48,723

Table 52: *E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	188	2,532	4,349	6,838	7,232
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	2,381	25,955	21,506	29,942	4,994
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	27	39	51	51
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	2	3	14	34	39
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	2	2	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

Table 53: *E-B+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	2.89	42.8	69.5	107	113
Annual - BECCS (MMT)	0	0	2.89	36.1	62.8	99.9	106
Annual - Cement and lime (MMT)	0	0	0	6.71	6.64	6.84	7.07
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	2.89	45.7	115	222	335
Cumulative - BECCS (MMT)	0	0	2.89	39	102	202	307
Cumulative - Cement and lime (MMT)	0	0	0	6.71	13.3	20.2	27.3
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

Table 54: *E-B+ scenario - PILLAR 4: CCUS - CO2 storage*

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0.92	4.28	9.51	12.8	13.4
Injection wells (wells)	0	0	2	9	16	26	33
Resource characterization, appraisal, permitting costs (million $2020)	0	103	294	380	380	380	380
Wells and facilities construction costs (million $2020)	0	0	70.4	274	489	817	1,014

Table 55: *E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	865	2,722	4,312	5,904	6,156
Cumulative investment - All (million $2018)	0	0	4,390	8,116	11,940	14,166	14,563
Cumulative investment - Spur (million $2018)	0	0	69.1	1,512	2,637	4,863	5,259
Cumulative investment - Trunk (million $2018)	0	0	4,321	6,605	9,304	9,304	9,304
Spur (km)	0	0	90.7	1,586	2,740	4,332	4,584
Trunk (km)	0	0	774	1,136	1,572	1,572	1,572

Table 56: *E-B+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-560
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,205
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-231
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,996
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-560
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,212
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-116
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,887
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	496
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	9,423
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	183
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	2,300
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	399
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	12,800
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	496
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,008
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	183
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	2,300
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	199
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	5,186

Table 57: *E-B+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	329
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	591
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	27,327
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,182
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	156

Table 57: *E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	68.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	99.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,761

Table 58: *REF scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.09	3.21	0	0	0	0
Sales of cooking units - Electric Resistance (%)	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Sales of cooking units - Gas (%)	60.3	60.3	60.3	60.3	60.3	60.3	60.3
Sales of space heating units - Electric Heat Pump (%)	5.79	35.1	36.6	38.9	40.5	42.1	44.4
Sales of space heating units - Electric Resistance (%)	25.8	23.1	22.7	22.1	21.2	19.8	17.5
Sales of space heating units - Fossil (%)	6.03	6.01	6.08	6.04	5.95	5.95	5.96
Sales of space heating units - Gas (%)	62.3	35.7	34.6	33	32.4	32.1	32.2
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	30.5	42.6	42.5	42.6	42.5	42.5	42.4
Sales of water heating units - Gas Furnace (%)	68.2	56.1	56.2	56.2	56.3	56.3	56.4
Sales of water heating units - Other (%)	1.38	1.21	1.22	1.22	1.22	1.22	1.22

Table 59: *REF scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.119	0.138	0.16	0.186	0.216	0.25	0.29
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.68	2.07	2.21	2.05	1.85	1.73	1.64
Vehicle sales - Light-duty - EV (%)	3.16	5.08	5.81	7.12	8.7	10.2	11.3
Vehicle sales - Light-duty - gasoline (%)	90.9	87.5	85.5	83.8	81.8	79.9	78.3
Vehicle sales - Light-duty - hybrid (%)	4.04	4.91	6.02	6.6	7.2	7.83	8.37
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.381	0.353	0.315	0.314	0.315	0.326
Vehicle sales - Light-duty - other (%)	0.108	0.111	0.108	0.109	0.108	0.107	0.11
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

Table 60: *REF scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	121	123	124	125	127	132	141
Final energy use - Industry (PJ)	310	325	335	340	350	358	369
Final energy use - Residential (PJ)	177	167	164	162	163	166	169
Final energy use - Transportation (PJ)	431	408	377	358	359	370	385

Table 61: *REF scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	13,857	14,543	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	32.3	32.3	32.3	32.3	32.3	32.3
Sales of cooking units - Gas (%)	69.9	67.7	67.7	67.7	67.7	67.7	67.7
Sales of space heating units - Electric Heat Pump (%)	1.94	29.6	70.8	79.1	79.5	79.5	79.5
Sales of space heating units - Electric Resistance (%)	2	6.3	12.1	15.9	18.7	19.1	19.2
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	96.1	64.1	17.1	5.05	1.83	1.38	1.33
Sales of water heating units - Electric Heat Pump (%)	0.059	0.129	0.128	0.129	0.129	0.127	0.127

Table 61: *REF scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	1.74	3.67	3.65	3.65	3.67	3.67	3.68
Sales of water heating units - Gas Furnace (%)	97.4	94.4	94.5	94.5	94.4	94.4	94.4
Sales of water heating units - Other (%)	0.794	1.77	1.77	1.77	1.78	1.78	1.79

Table 62: *REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.84	2.89	4.38	4.61	4.42	4.6

Table 63: *REF scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-3.92	0	-9.16	-7.43
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.482	0	-0.805	-0.847
Business-as-usual carbon sink - Total (Mt CO2e/y)	-4.4	0	-9.97	-8.27
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	952
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	43,286
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,687
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	4,643
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	646
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,773
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,378
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	9,732
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	19,153
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	3,321
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	477
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,380
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	281
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	1,783
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	329
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	591
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	482
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	4,866
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	1,451
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,120
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	715
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	27,327

Table 63: *REF scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	984
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	3,213
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	482
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,182
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	930
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	7,299
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	10,302
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	2,221
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	156
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	228
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	2,368
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	238
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	0	131
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	643
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	544
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,101
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,409
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	77.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	214
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	907
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	119
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	0	68.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	322
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	94.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	666
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,470
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	117
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	221

Table 63: *REF scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	1,637
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	179
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)	0	0	0	99.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	483
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	682
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,342
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,761

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	1,120	549	309	246	216	202
Monetary damages from air pollution - Natural Gas (million 2019$)	0	242	212	229	166	153	128
Monetary damages from air pollution - Transportation (million 2019$)	0	685	706	728	753	779	805
Premature deaths from air pollution - Coal (deaths)	0	126	61.6	34.7	27.6	24.2	22.6
Premature deaths from air pollution - Natural Gas (deaths)	0	27.4	24	25.8	18.7	17.3	14.5
Premature deaths from air pollution - Transportation (deaths)	0	77	79.4	81.8	84.7	87.6	90.5