Net-Zero America - georgia 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	8.06	8.87	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric Heat Pump (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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	1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376	0	3.15	0	12.8	0	20.6
Public EV charging plugs - L2 (1000 units)	2.43	0	75.7	0	308	0	494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.335	0.196	0.061	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	0.021	0.004	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)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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	34,949	38,935	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	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 (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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	7.03	7.31	10.9	11.6	9.14	9.44

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	0.034	0	0	0.013
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0.007	6.93	0.666	0.001
Capital invested - Solar PV - Base (billion $2018)	0	0	6.5	23.3	14.7	31.2	25.3
Capital invested - Solar PV - Constrained (billion $2018)	0	1.41	10.8	26.5	21	26.4	28.1

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	33.7	33.7	33.7	47
Biomass w/ccu power plant (GWh)	0	0	0	8.06	7,781	8,528	8,529
Solar - Base land use assumptions (GWh)	2,538	0	10,709	41,457	27,660	62,310	53,596
Solar - Constrained land use assumptions (GWh)	2,371	0	10,193	27,292	42,821	55,930	49,132

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	18.6	628	1,015	1,134
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	408	13,059	7,815	2,416
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	6	14	16
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	1	6	7	8
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	2
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	0.55	18.4	25.9	31.9
Annual - BECCS (MMT)	0	0	0	0.47	16.5	25.8	28.8
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0.08	1.93	0.05	3.05
Cumulative - All (MMT)	0	0	0	0.55	19	44.8	76.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - BECCS (MMT)	0	0	0	0.47	17	42.8	71.6
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0.08	2.01	2.06	5.11

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	5.28	7.23	12.1	16.8
Injection wells (wells)	0	0	4	18	30	52	66
Resource characterization, appraisal, permitting costs (million $2020)	0	101	277	379	379	379	379
Wells and facilities construction costs (million $2020)	0	0	135	528	941	1,573	1,953

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	570	1,282	2,064	3,105	3,550
Cumulative investment - All (million $2018)	0	0	2,891	5,025	5,797	6,725	7,046
Cumulative investment - Spur (million $2018)	0	0	0	206	978	1,906	2,226
Cumulative investment - Trunk (million $2018)	0	0	2,891	4,819	4,819	4,819	4,819
Spur (km)	0	0	0	376	1,159	2,199	2,645
Trunk (km)	0	0	570	906	906	906	906

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	-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,940
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,075
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,771
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.6

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	935

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	781
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,047

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

Item	2020	2025	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,392

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	9,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	461	0.845	0.766	0.539	0.355	0.029
Monetary damages from air pollution - Natural Gas (million 2019$)	0	310	291	175	133	67.2	25.4
Monetary damages from air pollution - Transportation (million 2019$)	0	3,449	3,336	2,621	1,565	731	289
Premature deaths from air pollution - Coal (deaths)	0	51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	35	32.8	19.8	15	7.59	2.87
Premature deaths from air pollution - Transportation (deaths)	0	388	375	295	176	82.2	32.5

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	477	518	841	481	1,473	1,714	1,546
By economic sector - Construction (jobs)	9,812	8,017	13,649	25,968	24,743	36,486	43,167
By economic sector - Manufacturing (jobs)	8,304	13,877	25,461	25,847	21,005	24,522	20,768
By economic sector - Mining (jobs)	4,533	3,112	2,251	1,494	912	602	360
By economic sector - Other (jobs)	810	579	1,616	4,570	4,627	8,156	10,212
By economic sector - Pipeline (jobs)	750	733	929	757	444	412	396
By economic sector - Professional (jobs)	5,717	4,605	6,026	10,432	11,691	17,726	21,767
By economic sector - Trade (jobs)	4,710	3,315	4,064	7,122	7,274	11,466	14,462
By economic sector - Utilities (jobs)	14,307	12,277	14,692	19,695	20,934	26,102	31,429
By education level - All sectors - Associates degree or some college (jobs)	15,284	14,596	21,930	30,902	29,700	40,706	46,413
By education level - All sectors - Bachelors degree (jobs)	10,625	10,049	14,015	18,743	18,146	24,630	27,889
By education level - All sectors - Doctoral degree (jobs)	342	295	385	582	602	869	1,026
By education level - All sectors - High school diploma or less (jobs)	20,637	19,782	30,088	41,798	40,316	54,974	61,812
By education level - All sectors - Masters or professional degree (jobs)	2,533	2,309	3,112	4,341	4,339	6,007	6,967
By resource sector - Biomass (jobs)	1,621	1,824	2,220	1,246	4,360	6,262	6,637
By resource sector - CO2 (jobs)	0	54.7	2,697	2,528	1,044	1,978	2,463
By resource sector - Coal (jobs)	4,143	1,328	0	0	0	0	0
By resource sector - Grid (jobs)	15,328	13,098	16,979	28,948	32,373	45,105	57,917
By resource sector - Natural Gas (jobs)	7,947	7,360	6,976	5,694	6,745	4,317	3,553
By resource sector - Nuclear (jobs)	3,202	3,150	3,100	2,705	2,175	1,690	605
By resource sector - Oil (jobs)	8,486	7,190	5,570	3,788	2,362	1,358	666
By resource sector - Solar (jobs)	8,688	12,993	31,052	50,735	41,815	60,787	64,464
By resource sector - Wind (jobs)	6.73	33.8	933	720	2,229	5,690	7,803
Median wages - Annual - All ($2019 per job)	56,581	56,677	55,664	55,966	57,160	57,723	58,897
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	7,953	7,516	11,176	15,784	15,180	20,750	23,661
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	3,200	2,807	4,041	6,176	6,059	8,443	9,921
On-Site or In-Plant Training - Total jobs - None (jobs)	7,953	7,660	11,410	15,790	15,238	20,886	23,555
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	404	381	570	824	802	1,102	1,275
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	29,912	28,669	42,332	57,791	55,824	76,006	85,696
On-the-Job Training - All sectors - 1 to 4 years (jobs)	10,215	9,621	14,270	20,250	19,483	26,638	30,450

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 4 to 10 years (jobs)	3,077	2,670	3,893	6,097	6,004	8,423	9,951
On-the-Job Training - All sectors - None (jobs)	2,686	2,524	3,690	5,212	5,023	6,978	7,930
On-the-Job Training - All sectors - Over 10 years (jobs)	465	478	755	1,028	943	1,275	1,393
On-the-Job Training - All sectors - Up to 1 year (jobs)	32,977	31,738	46,921	63,779	61,649	83,873	94,384
Related work experience - All sectors - 1 to 4 years (jobs)	17,962	16,928	24,699	34,161	33,101	45,188	51,334
Related work experience - All sectors - 4 to 10 years (jobs)	11,526	10,896	15,900	22,109	21,297	29,042	33,061
Related work experience - All sectors - None (jobs)	7,077	6,707	9,946	13,923	13,558	18,587	21,169
Related work experience - All sectors - Over 10 years (jobs)	3,117	3,075	4,541	6,069	5,750	7,728	8,636
Related work experience - All sectors - Up to 1 year (jobs)	9,739	9,425	14,443	20,104	19,397	26,641	29,908
Wage income - All (million $2019)	2,796	2,666	3,870	5,394	5,322	7,343	8,489

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	564	572	482	387	291	183	127
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	11,650
Natural gas production - Annual (tcf)	0	0	0	0	0	0	0
Oil consumption - Annual (million bbls)	174	162	137	101	67.5	41.5	21.7
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	3,127
Oil production - Annual (million bbls)	0	0	0	0	0	0	0

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	7.98	8.75	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Sales of space heating units - Electric Heat Pump (%)	25.4	38	42.2	54.2	72.4	84.2	88.3
Sales of space heating units - Electric Resistance (%)	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of water heating units - Electric Heat Pump (%)	0	1.99	7.66	24	49	65.3	70.9
Sales of water heating units - Electric Resistance (%)	47.2	62.3	59.3	50.6	37.5	28.9	26
Sales of water heating units - Gas Furnace (%)	50	33.6	30.9	23.3	11.4	3.65	0.952
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15

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	274	545	1,871	5,792	8,472
Public EV charging plugs - DC Fast (1000 units)	0.376	0	1.11	0	4.86	0	13.2
Public EV charging plugs - L2 (1000 units)	2.43	0	26.7	0	117	0	316
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 (%)	1.48	1.9	2.04	1.62	1.03	0.527	0.226

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.99	4.9	12.3	26.6	49.1	72.5	87.8
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	78.9	65.8	45.4	24.3	10.8
Vehicle sales - Light-duty - hybrid (%)	4.87	5.66	6.33	5.72	4.25	2.48	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.378	0.321	0.243	0.172	0.095	0.044
Vehicle sales - Light-duty - other (%)	0.099	0.103	0.093	0.081	0.058	0.032	0.015
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)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654

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	34,927	38,922	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	7.3	19.2	24.1	38.5	61	76.9	83
Sales of space heating units - Electric Resistance (%)	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of space heating units - Gas Furnace (%)	86	68.4	63.6	49.6	27.2	11	4.45
Sales of water heating units - Electric Heat Pump (%)	0.221	2.04	7.05	21.5	43.6	58	63
Sales of water heating units - Electric Resistance (%)	5.5	7.53	9.45	15.2	24	29.8	31.8
Sales of water heating units - Gas Furnace (%)	92.1	86.3	79.4	59.6	29.1	9.31	2.42
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75

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	5.72	5.83	7.6	7.92	9.61	10.1

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	-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,940
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,075
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,771
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	935

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	781
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	944

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

Item	2020	2025	2050
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.9

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	9,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	461	0.845	0.766	0.539	0.355	0.029
Monetary damages from air pollution - Natural Gas (million 2019$)	0	308	210	87.8	29.9	9.21	5.25
Monetary damages from air pollution - Transportation (million 2019$)	0	3,513	3,692	3,720	3,460	2,838	1,999
Premature deaths from air pollution - Coal (deaths)	0	51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	34.8	23.7	9.91	3.38	1.04	0.593
Premature deaths from air pollution - Transportation (deaths)	0	395	415	418	389	319	225

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	8.06	8.87	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric Heat Pump (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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	1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376	0	3.15	0	12.8	0	20.6
Public EV charging plugs - L2 (1000 units)	2.43	0	75.7	0	308	0	494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.335	0.196	0.061	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	0.021	0.004	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)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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	34,949	38,935	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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	7.03	7.31	10.9	11.6	9.14	9.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion $2018)	0	0	0	0	0	0.214	18.5
Capital invested - Solar PV - Base (billion $2018)	0	0.849	8.24	44	39.1	25.6	31.1

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	514	52,411
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	51,557
Solar - Base land use assumptions (GWh)	2,538	1,249	13,510	78,330	73,909	51,434	66,150
Solar - Constrained land use assumptions (GWh)	2,538	3,247	29,534	65,148	69,596	69,056	66,359

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	-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,940
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,075
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,771
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	935

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	781
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	25,469

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

Item	2020	2025	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	125

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

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	9,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	461	0.845	0.766	0.539	0.355	0.029
Monetary damages from air pollution - Natural Gas (million 2019$)	0	329	278	137	81.3	18.7	6.69
Monetary damages from air pollution - Transportation (million 2019$)	0	3,449	3,336	2,621	1,565	731	289
Premature deaths from air pollution - Coal (deaths)	0	51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	37.1	31.4	15.5	9.18	2.11	0.755
Premature deaths from air pollution - Transportation (deaths)	0	388	375	295	176	82.2	32.5

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	8.06	8.87	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Sales of space heating units - Electric Heat Pump (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15

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	1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376	0	3.15	0	12.8	0	20.6
Public EV charging plugs - L2 (1000 units)	2.43	0	75.7	0	308	0	494
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 (%)	1.47	1.74	1.22	0.391	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.2	16.1	47.7	82.3	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.4	77	47.5	16	3.22	0.588	0
Vehicle sales - Light-duty - hybrid (%)	4.69	4.74	3.31	1.22	0.298	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.335	0.196	0.061	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.098	0.094	0.06	0.021	0.004	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)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499

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	34,949	38,935	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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	7.03	7.31	10.9	11.6	9.14	9.44

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	0.592	1.02	4.63	8.35	15	1.17
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0	7.72	9.68	11.9	0.605

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,538	872	1,690	8,238	15,763	30,094	2,482
Solar - Constrained land use assumptions (GWh)	2,538	0	0	13,732	18,280	23,667	1,279

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	-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,940
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,075
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,771
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	835

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	935

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	781
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	675

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

Item	2020	2025	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	93.6

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	9,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	461	0.845	0.766	0.539	0.355	0.029
Monetary damages from air pollution - Natural Gas (million 2019$)	0	314	293	303	239	81.4	25.1
Monetary damages from air pollution - Transportation (million 2019$)	0	3,449	3,336	2,621	1,565	731	289
Premature deaths from air pollution - Coal (deaths)	0	51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	35.5	33.1	34.3	27	9.2	2.83
Premature deaths from air pollution - Transportation (deaths)	0	388	375	295	176	82.2	32.5

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	7.98	8.75	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Sales of space heating units - Electric Heat Pump (%)	25.4	38	42.2	54.2	72.4	84.2	88.3
Sales of space heating units - Electric Resistance (%)	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of water heating units - Electric Heat Pump (%)	0	1.99	7.66	24	49	65.3	70.9
Sales of water heating units - Electric Resistance (%)	47.2	62.3	59.3	50.6	37.5	28.9	26
Sales of water heating units - Gas Furnace (%)	50	33.6	30.9	23.3	11.4	3.65	0.952
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15

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	274	545	1,871	5,792	8,472
Public EV charging plugs - DC Fast (1000 units)	0.376	0	1.11	0	4.86	0	13.2
Public EV charging plugs - L2 (1000 units)	2.43	0	26.7	0	117	0	316
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 (%)	1.48	1.9	2.04	1.62	1.03	0.527	0.226
Vehicle sales - Light-duty - EV (%)	1.99	4.9	12.3	26.6	49.1	72.5	87.8
Vehicle sales - Light-duty - gasoline (%)	91.5	87.1	78.9	65.8	45.4	24.3	10.8
Vehicle sales - Light-duty - hybrid (%)	4.87	5.66	6.33	5.72	4.25	2.48	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.378	0.321	0.243	0.172	0.095	0.044
Vehicle sales - Light-duty - other (%)	0.099	0.103	0.093	0.081	0.058	0.032	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37

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

Item	2020	2025	2030	2035	2040	2045	2050
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)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654

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	34,927	38,922	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	7.3	19.2	24.1	38.5	61	76.9	83
Sales of space heating units - Electric Resistance (%)	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of space heating units - Gas Furnace (%)	86	68.4	63.6	49.6	27.2	11	4.45
Sales of water heating units - Electric Heat Pump (%)	0.221	2.04	7.05	21.5	43.6	58	63
Sales of water heating units - Electric Resistance (%)	5.5	7.53	9.45	15.2	24	29.8	31.8
Sales of water heating units - Gas Furnace (%)	92.1	86.3	79.4	59.6	29.1	9.31	2.42
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75

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	5.72	5.83	7.6	7.92	9.61	10.1

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	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	20.6	13.5	0	0

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	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	23,083	38,180	38,180	38,180

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	0	1,341	2,217	2,884	2,939

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

Item	2020	2025	2030	2035	2040	2045	2050
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	18,864	12,338	8,109	678
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	9	10
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	18	30	30	30
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
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 53: *E-B+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	22.9	37.8	48.2	48.1
Annual - BECCS (MMT)	0	0	0	22.8	37.8	48.2	48.1
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0.07	0.05	0.05	0.04
Cumulative - All (MMT)	0	0	0	22.9	60.7	109	157
Cumulative - BECCS (MMT)	0	0	0	22.8	60.6	109	157
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0.07	0.12	0.17	0.21

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	6.42	11.9	15.8	16.7
Injection wells (wells)	0	0	4	18	32	54	68
Resource characterization, appraisal, permitting costs (million $2020)	0	101	292	404	404	404	404
Wells and facilities construction costs (million $2020)	0	0	141	548	976	1,633	2,027

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	570	2,000	2,851	3,430	4,050
Cumulative investment - All (million $2018)	0	0	2,891	6,153	7,284	8,156	8,572
Cumulative investment - Spur (million $2018)	0	0	0	1,333	2,272	3,144	3,560
Cumulative investment - Trunk (million $2018)	0	0	2,891	4,819	5,012	5,012	5,012
Spur (km)	0	0	0	1,095	1,945	2,525	3,144
Trunk (km)	0	0	570	906	906	906	906

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	-306
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,445
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	-58.6
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,810
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-306

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,784
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	-29.3
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,120
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	191
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,605
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	85.3
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	147
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	107
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,135
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	191
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	757
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	85.3
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	147
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	53.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,233

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	781
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,887

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

Item	2020	2025	2050
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,963

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

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	9,239

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	7.85	7.66	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.5	66.5	66.5	66.5	66.5	66.5	66.5
Sales of cooking units - Gas (%)	33.5	33.5	33.5	33.5	33.5	33.5	33.5
Sales of space heating units - Electric Heat Pump (%)	23.1	53.2	54.3	56	57.1	58.3	60.1
Sales of space heating units - Electric Resistance (%)	19	17.4	17.2	16.5	15.9	14.8	12.9
Sales of space heating units - Fossil (%)	4.53	3.7	3.73	3.74	3.7	3.7	3.74
Sales of space heating units - Gas (%)	53.4	25.6	24.8	23.8	23.3	23.2	23.3
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	47.2	63.3	63.3	63.2	63.1	63	63
Sales of water heating units - Gas Furnace (%)	50	34.6	34.6	34.7	34.8	34.8	34.9
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.15	2.16

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 (%)	1.47	1.9	2.17	2.02	1.82	1.69	1.61
Vehicle sales - Light-duty - EV (%)	3.84	5.96	6.76	8.33	10.1	11.6	12.8
Vehicle sales - Light-duty - gasoline (%)	89.8	86.1	83.9	81.9	79.8	77.9	76.3
Vehicle sales - Light-duty - hybrid (%)	4.71	5.54	6.77	7.33	7.87	8.41	8.81
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.374	0.341	0.302	0.298	0.298	0.308
Vehicle sales - Light-duty - other (%)	0.098	0.102	0.098	0.099	0.098	0.097	0.099
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)	252	257	260	262	266	276	290
Final energy use - Industry (PJ)	420	441	459	477	500	522	549
Final energy use - Residential (PJ)	362	345	342	342	347	357	368
Final energy use - Transportation (PJ)	1,058	1,005	938	900	906	935	973

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	34,430	35,753	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric Heat Pump (%)	7.3	29.1	63.5	71.8	72.4	72.4	72.4
Sales of space heating units - Electric Resistance (%)	6.68	9.42	14.6	20.2	24.8	25.6	25.6
Sales of space heating units - Fossil (%)	0	4.09	2.54	1.21	0.181	0.016	0
Sales of space heating units - Gas Furnace (%)	86	57.4	19.3	6.83	2.61	2	1.94
Sales of water heating units - Electric Heat Pump (%)	0.221	0.279	0.274	0.275	0.276	0.274	0.275
Sales of water heating units - Electric Resistance (%)	5.5	6.83	6.74	6.75	6.78	6.74	6.75
Sales of water heating units - Gas Furnace (%)	92.1	88.7	88.7	88.7	88.7	88.7	88.7
Sales of water heating units - Other (%)	2.13	4.16	4.3	4.23	4.29	4.32	4.3

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	7.5	7.83	10.5	11.1	9.45	9.79

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-11.1	0	-19	-15.4
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-6.93	0	-11.6	-12.2
Business-as-usual carbon sink - Total (Mt CO2e/y)	-18	0	-30.5	-27.5
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	781

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

Item	2020	2025	2030	2050
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	61,940
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	5,666
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	5,922
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	391
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	20,952
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,996
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	586
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	41,389
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	3,959
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	374

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	2,376
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	95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	11,342
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	1,188
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	50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	1,788
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	72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	9,239

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	1,971	1,339	1,087	984	941	932
Monetary damages from air pollution - Natural Gas (million 2019$)	0	306	381	399	439	482	526
Monetary damages from air pollution - Transportation (million 2019$)	0	3,505	3,734	3,959	4,203	4,447	4,695
Premature deaths from air pollution - Coal (deaths)	0	221	150	122	110	106	105
Premature deaths from air pollution - Natural Gas (deaths)	0	34.5	43	45.1	49.6	54.5	59.4
Premature deaths from air pollution - Transportation (deaths)	0	394	420	445	473	500	528