Net-Zero America - ohio state report

Larson et al. 2020

February 2021

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	9.7	12.8	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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	2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326	0	3.65	0	16	0	25.9
Public EV charging plugs - L2 (1000 units)	1.06	0	87.7	0	386	0	624
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.331	0.191	0.059	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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	36,680	40,065	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	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 (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	6.24	6.43	13.3	14.2	13.1	13.8

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	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	0.621	12.5	9.71	12.6	4.83
Capital invested - Solar PV - Constrained (billion $2018)	0	1.55	0.276	10.4	9.72	11.5	5.9
Capital invested - Wind - Base (billion $2018)	0	0	5.07	13.6	21.4	2.52	3.08
Capital invested - Wind - Constrained (billion $2018)	0	0	12.9	11.3	0	0	0.2

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	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	1,454	0	915	19,820	16,205	22,080	8,874
Solar - Constrained land use assumptions (GWh)	1,334	0	2,761	16,908	20,103	22,310	12,598
Wind - Base land use assumptions (GWh)	2,973	0	11,912	33,278	50,514	5,936	7,442
Wind - Constrained land use assumptions (GWh)	2,973	0	25,595	24,964	0	0	0

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	0	0	402	1,858
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	6,167	22,362
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	7	30
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	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	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 9: *E+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	7.93	36.7
Annual - BECCS (MMT)	0	0	0	0	0	7.93	36.7
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	7.93	44.6
Cumulative - BECCS (MMT)	0	0	0	0	0	7.93	44.6
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
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	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million $2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million $2020)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	477	477	477	778	2,027
Cumulative investment - All (million $2018)	0	0	1,555	1,555	1,555	1,905	3,017
Cumulative investment - Spur (million $2018)	0	0	0	0	0	350	1,462
Cumulative investment - Trunk (million $2018)	0	0	1,555	1,555	1,555	1,555	1,555
Spur (km)	0	0	0	0	0	301	1,550
Trunk (km)	0	0	477	477	477	477	477

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	-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-6,932
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-4,245
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,439
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523

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	1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,578

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166

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	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	40.4
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	96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	60.8
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	139

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	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,902

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,199	5.78	5.76	5.53	4.21	0.41
Monetary damages from air pollution - Natural Gas (million 2019$)	0	382	309	197	163	88.5	34.3
Monetary damages from air pollution - Transportation (million 2019$)	0	3,979	3,697	2,802	1,624	753	313
Premature deaths from air pollution - Coal (deaths)	0	247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Natural Gas (deaths)	0	43.2	34.9	22.2	18.4	10	3.88
Premature deaths from air pollution - Transportation (deaths)	0	448	416	315	183	84.6	35.2

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	983	991	1,049	946	522	572	1,838
By economic sector - Construction (jobs)	10,659	9,969	11,487	23,730	28,313	28,695	27,060
By economic sector - Manufacturing (jobs)	10,579	18,228	21,175	27,550	26,341	21,459	26,714
By economic sector - Mining (jobs)	13,847	11,133	8,438	6,292	4,037	2,522	1,363
By economic sector - Other (jobs)	543	431	631	2,989	3,778	4,619	4,316
By economic sector - Pipeline (jobs)	1,605	1,603	1,561	1,101	823	555	476
By economic sector - Professional (jobs)	6,243	5,422	5,881	12,178	16,070	16,982	18,364
By economic sector - Trade (jobs)	6,535	5,336	5,040	8,351	9,996	10,432	10,368
By economic sector - Utilities (jobs)	13,441	12,259	12,458	19,950	24,333	23,209	23,300
By education level - All sectors - Associates degree or some college (jobs)	19,256	19,760	20,727	32,380	36,393	34,853	36,016
By education level - All sectors - Bachelors degree (jobs)	14,540	14,492	14,596	21,253	23,462	22,280	23,250
By education level - All sectors - Doctoral degree (jobs)	459	420	419	681	807	810	847
By education level - All sectors - High school diploma or less (jobs)	26,736	27,390	28,670	43,786	47,886	45,610	47,970
By education level - All sectors - Masters or professional degree (jobs)	3,445	3,311	3,307	4,987	5,665	5,492	5,715
By resource sector - Biomass (jobs)	2,457	2,429	2,442	2,131	1,241	2,132	8,003
By resource sector - CO2 (jobs)	0	0	1,539	0	0	131	1,132
By resource sector - Coal (jobs)	4,891	1,710	216	18	13.3	10.4	8.76
By resource sector - Grid (jobs)	11,342	10,491	12,032	29,799	39,082	39,898	42,049
By resource sector - Natural Gas (jobs)	18,236	18,143	15,108	12,583	10,498	6,865	3,994
By resource sector - Nuclear (jobs)	953	662	651	641	631	366	0
By resource sector - Oil (jobs)	20,941	19,280	16,571	13,779	9,722	6,954	4,254
By resource sector - Solar (jobs)	3,978	6,458	8,175	23,990	24,898	28,191	28,184
By resource sector - Wind (jobs)	1,640	6,200	10,985	20,146	28,128	24,499	26,172
Median wages - Annual - All ($2019 per job)	60,131	59,967	60,097	60,244	61,374	62,277	62,669
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	10,253	10,393	10,820	16,714	18,681	17,853	18,325
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	4,089	3,916	4,051	6,532	7,521	7,323	7,285
On-Site or In-Plant Training - Total jobs - None (jobs)	10,253	10,491	10,907	16,728	18,591	17,806	18,682

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)	503	516	548	872	993	954	981
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	39,340	40,057	41,394	62,240	68,427	65,110	68,525
On-the-Job Training - All sectors - 1 to 4 years (jobs)	13,115	13,258	13,803	21,420	24,058	23,014	23,535
On-the-Job Training - All sectors - 4 to 10 years (jobs)	3,820	3,634	3,793	6,314	7,357	7,217	7,153
On-the-Job Training - All sectors - None (jobs)	3,528	3,513	3,596	5,508	6,090	5,862	6,104
On-the-Job Training - All sectors - Over 10 years (jobs)	607	661	703	1,062	1,150	1,074	1,115
On-the-Job Training - All sectors - Up to 1 year (jobs)	43,367	44,308	45,825	68,782	75,558	71,879	75,890
Related work experience - All sectors - 1 to 4 years (jobs)	23,644	23,759	24,437	36,940	40,984	39,168	40,692
Related work experience - All sectors - 4 to 10 years (jobs)	15,031	15,181	15,678	23,869	26,667	25,442	26,263
Related work experience - All sectors - None (jobs)	9,151	9,280	9,636	14,744	16,343	15,666	16,368
Related work experience - All sectors - Over 10 years (jobs)	4,139	4,310	4,458	6,604	7,250	6,813	7,112
Related work experience - All sectors - Up to 1 year (jobs)	12,472	12,843	13,510	20,929	22,969	21,957	23,363
Wage income - All (million $2019)	3,875	3,920	4,070	6,211	7,010	6,792	7,132

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	869	882	743	596	449	282	196
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	17,958
Natural gas production - Annual (tcf)	2,585	2,865	2,708	2,358	1,994	1,581	1,228
Oil consumption - Annual (million bbls)	195	183	157	120	85.6	58.3	37
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	3,717
Oil production - Annual (million bbls)	27.8	30.1	30.2	30.2	23.9	19.4	12.9

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	9.67	12.6	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17

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	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.12	0	5.95	0	16.6
Public EV charging plugs - L2 (1000 units)	1.06	0	27	0	143	0	400
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.376	0.317	0.239	0.168	0.092	0.043
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
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)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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	36,676	40,057	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of space heating units - Gas Furnace (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas Furnace (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	5.04	5.08	6.88	7.14	11.1	11.9

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	-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-6,932

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	-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-4,245
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,439
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,578

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112

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	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	40.4
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	96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	60.8
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	139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,902

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,199	5.78	5.76	5.53	4.21	0.41
Monetary damages from air pollution - Natural Gas (million 2019$)	0	350	225	86.9	38.1	12.7	7.66
Monetary damages from air pollution - Transportation (million 2019$)	0	4,048	4,080	3,966	3,572	2,847	1,959
Premature deaths from air pollution - Coal (deaths)	0	247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Natural Gas (deaths)	0	39.5	25.5	9.81	4.31	1.44	0.866
Premature deaths from air pollution - Transportation (deaths)	0	455	459	446	402	320	220

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	9.7	12.8	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3

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 (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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	2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326	0	3.65	0	16	0	25.9
Public EV charging plugs - L2 (1000 units)	1.06	0	87.7	0	386	0	624
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.331	0.191	0.059	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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	36,680	40,065	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	6.24	6.43	13.3	14.2	13.1	13.8

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	1.49	2.39	24.4	14.9	8.53	10.3
Capital invested - Wind - Base (billion $2018)	0	0	11.4	22	18.4	0.135	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,976	3,522	38,403	24,543	14,799	19,567
Solar - Constrained land use assumptions (GWh)	1,454	612	6,994	35,358	16,495	3,550	27,649
Wind - Base land use assumptions (GWh)	2,973	0	26,510	51,446	40,723	275	0
Wind - Constrained land use assumptions (GWh)	2,973	0	47,355	3,203	0	0	75,490

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	-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-6,932
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-4,245
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,439
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,578

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	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	29.5

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	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	40.4
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	96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	60.8
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	139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,902

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,199	5.78	5.76	5.53	4.21	0.41
Monetary damages from air pollution - Natural Gas (million 2019$)	0	316	231	136	90.5	30.2	7.22
Monetary damages from air pollution - Transportation (million 2019$)	0	3,979	3,697	2,802	1,624	753	313
Premature deaths from air pollution - Coal (deaths)	0	247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Natural Gas (deaths)	0	35.7	26	15.4	10.2	3.41	0.815
Premature deaths from air pollution - Transportation (deaths)	0	448	416	315	183	84.6	35.2

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	9.7	12.8	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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	2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326	0	3.65	0	16	0	25.9
Public EV charging plugs - L2 (1000 units)	1.06	0	87.7	0	386	0	624
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.331	0.191	0.059	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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	36,680	40,065	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	6.24	6.43	13.3	14.2	13.1	13.8

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	0.381	0.599	1.35	0
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0	0.265	2.47	1.43	0
Capital invested - Wind - Base (billion $2018)	0	0	0.252	0	0.132	0	0.036
Capital invested - Wind - Constrained (billion $2018)	0	0	0.873	0	0.71	0.217	0.157

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	0	0	611	1,014	2,420	0
Solar - Constrained land use assumptions (GWh)	1,454	0	0	425	4,187	2,562	0
Wind - Base land use assumptions (GWh)	2,973	0	606	0	358	0	108
Wind - Constrained land use assumptions (GWh)	2,973	0	2,006	0	1,815	562	442

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	-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-6,932
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,255

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	-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-4,245
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,439
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,578

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	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583

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	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	40.4
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	96

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	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	60.8
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	139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,902

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,199	5.78	5.76	5.53	4.21	0.41
Monetary damages from air pollution - Natural Gas (million 2019$)	0	358	286	365	270	94.9	28.9
Monetary damages from air pollution - Transportation (million 2019$)	0	3,979	3,697	2,802	1,624	753	313
Premature deaths from air pollution - Coal (deaths)	0	247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Natural Gas (deaths)	0	40.4	32.3	41.2	30.5	10.7	3.26
Premature deaths from air pollution - Transportation (deaths)	0	448	416	315	183	84.6	35.2

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	9.67	12.6	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3

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 (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17

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	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.12	0	5.95	0	16.6
Public EV charging plugs - L2 (1000 units)	1.06	0	27	0	143	0	400
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.376	0.317	0.239	0.168	0.092	0.043
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
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)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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	36,676	40,057	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of space heating units - Gas Furnace (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas Furnace (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	5.04	5.08	6.88	7.14	11.1	11.9

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	0	0	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	0	0	0.179	0.179

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	0	0	1,897	5,611
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	19,240	37,955
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	23	65
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	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	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	24.7	72.9
Annual - BECCS (MMT)	0	0	0	0	0	24.7	72.9
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	24.7	97.6
Cumulative - BECCS (MMT)	0	0	0	0	0	24.7	97.6
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
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	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million $2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million $2020)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	477	477	477	1,409	3,066
Cumulative investment - All (million $2018)	0	0	1,555	1,555	1,555	3,014	4,988
Cumulative investment - Spur (million $2018)	0	0	0	0	0	1,080	3,054
Cumulative investment - Trunk (million $2018)	0	0	1,555	1,555	1,555	1,934	1,934
Spur (km)	0	0	0	0	0	932	2,589
Trunk (km)	0	0	477	477	477	477	477

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	-1,772
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,907
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	-193
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-6,872
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,772
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,589
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	-96.4
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-4,458
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	903
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	7,832
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	166
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	129
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	351
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	9,381
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	903
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,674
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	166
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	129
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	175
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,047

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	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	29.5

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	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	40.4
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	96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	60.8
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	139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,902

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	9.28	9.99	0	0	0	0
Sales of cooking units - Electric Resistance (%)	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Sales of cooking units - Gas (%)	38.7	38.7	38.7	38.7	38.7	38.7	38.7
Sales of space heating units - Electric Heat Pump (%)	4.34	15.8	16.3	17.1	17.8	18.6	19.7
Sales of space heating units - Electric Resistance (%)	15.7	20.7	20.5	20.2	19.5	18.6	17.7
Sales of space heating units - Fossil (%)	5.21	7.94	7.37	6.96	6.98	7	6.99
Sales of space heating units - Gas (%)	74.7	55.6	55.9	55.8	55.7	55.8	55.7
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	32.2	48.7	48.5	48.4	48.4	48.3	48.2
Sales of water heating units - Gas Furnace (%)	67.7	51.2	51.4	51.4	51.5	51.6	51.6
Sales of water heating units - Other (%)	0.083	0.169	0.171	0.171	0.171	0.172	0.172

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 (%)	1.4	1.84	2.16	2.01	1.81	1.68	1.6
Vehicle sales - Light-duty - EV (%)	4.06	6.25	7.06	8.72	10.6	12.1	13.3
Vehicle sales - Light-duty - gasoline (%)	89.4	85.7	83.3	81.3	79.2	77.2	75.7
Vehicle sales - Light-duty - hybrid (%)	4.93	5.76	7	7.56	8.09	8.59	8.95
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.371	0.337	0.297	0.293	0.293	0.303
Vehicle sales - Light-duty - other (%)	0.095	0.099	0.095	0.096	0.095	0.094	0.096
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)	372	372	369	360	351	351	360
Final energy use - Industry (PJ)	602	634	654	668	689	709	731
Final energy use - Residential (PJ)	555	517	496	481	472	466	461
Final energy use - Transportation (PJ)	953	894	818	774	775	799	830

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	36,280	37,607	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	44.2	44.3	44.3	44.3	44.4	44.5
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Sales of space heating units - Electric Heat Pump (%)	1.41	12.6	44.7	71.1	75.4	75.9	75.9
Sales of space heating units - Electric Resistance (%)	4.39	4.3	8.91	17.1	22.8	23.6	23.7
Sales of space heating units - Fossil (%)	5.44	2.76	1.39	0.243	0.027	0.001	0
Sales of space heating units - Gas Furnace (%)	88.8	80.4	45	11.5	1.77	0.436	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	0.344	0.348	0.348	0.342	0.344	0.345

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 (%)	4.26	3.24	3.2	3.21	3.19	3.18	3.18
Sales of water heating units - Gas Furnace (%)	95	96.2	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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	5.42	5.51	10.6	11.3	10.6	11.1

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	0.94	0	-7.03	-6.29
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.29	0	-2.32	-2.42
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.352	0	-9.35	-8.7
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	180
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	13,699

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	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	40.4
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	96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	411

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	1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	60.8
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	139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,902

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	5,616	3,730	3,272	3,037	2,944	2,760
Monetary damages from air pollution - Natural Gas (million 2019$)	0	287	334	429	450	425	367
Monetary damages from air pollution - Transportation (million 2019$)	0	4,043	4,133	4,226	4,344	4,463	4,584
Premature deaths from air pollution - Coal (deaths)	0	630	419	367	341	330	310
Premature deaths from air pollution - Natural Gas (deaths)	0	32.4	37.8	48.5	50.8	48	41.5
Premature deaths from air pollution - Transportation (deaths)	0	455	465	475	489	502	516