Net-Zero America - alabama state report

Larson et al. 2020

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

Notes

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

List of Tables

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.86	4.57	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.7	87.1	97.8	99.9	100	100	100
Sales of cooking units - Gas (%)	16.3	12.9	2.2	0.111	0	0	0
Sales of space heating units - Electric Heat Pump (%)	34.1	48.8	80.6	87.8	88.1	88	88
Sales of space heating units - Electric Resistance (%)	32.6	30.4	12.8	8.81	8.63	8.75	8.76
Sales of space heating units - Fossil (%)	6.33	6.33	2.2	1.25	1.2	1.18	1.18
Sales of space heating units - Gas (%)	27	14.4	4.38	2.16	2.08	2.05	2.05
Sales of water heating units - Electric Heat Pump (%)	0	12.1	64.3	75.9	76.4	76.4	76.4
Sales of water heating units - Electric Resistance (%)	72.5	72.8	30.8	21.4	21	21	21
Sales of water heating units - Gas Furnace (%)	23.5	12.5	2.34	0.099	0	0	0
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.62	2.63	2.63	2.64

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	1,020	2,605	4,234	6,409	6,981	6,653
Public EV charging plugs - DC Fast (1000 units)	0.07	0	2.03	0	9.05	0	14.7
Public EV charging plugs - L2 (1000 units)	0.285	0	48.9	0	217	0	352
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 (%)	1.51	1.78	1.24	0.397	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.04	15.6	47	82	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.6	48.2	16.3	3.26	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.55	4.63	3.26	1.2	0.294	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.337	0.2	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.062	0.022	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)	116	116	112	106	101	99.4	100
Final energy use - Industry (PJ)	551	582	615	609	632	649	656
Final energy use - Residential (PJ)	163	153	141	126	114	108	105
Final energy use - Transportation (PJ)	546	508	443	365	294	250	232

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	13,557	15,391	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	11.7	29.4	77	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	5.83	4.63	4.92	6.27	6.62	6.6	6.56
Sales of space heating units - Fossil (%)	0	2.9	0.562	0.024	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 (%)	82.5	63.1	17.5	2.95	1.48	1.44	1.44
Sales of water heating units - Electric Heat Pump (%)	0.191	10.6	55.6	65.6	66.1	66.1	66.1
Sales of water heating units - Electric Resistance (%)	7.05	10.1	28.1	32.2	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	90.8	77.7	14.7	0.619	0	0	0
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	3.72	3.8	5.83	6.14	5	5.13

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	0.009	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	11.9	0	0
Capital invested - Solar PV - Base (billion $2018)	0	0	8.49	8.3	8.81	17.6	21.6
Capital invested - Solar PV - Constrained (billion $2018)	0	0.546	5.41	8.67	9.99	17.4	20.8

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	8.94	8.94	8.94
Biomass w/ccu power plant (GWh)	0	0	0	0	13,376	13,376	13,376
Solar - Base land use assumptions (GWh)	762	0	13,661	14,509	16,301	34,459	44,765
Solar - Constrained land use assumptions (GWh)	762	0	7,675	14,889	15,552	40,275	45,687

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	184	681	1,049	1,049
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	3,509	10,945	7,022	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	4	4	11	11
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	10	10	10
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	3.24	10.3	22.7	36	37.5
Annual - BECCS (MMT)	0	0	0	4.51	17.3	26.4	26.3
Annual - Cement and lime (MMT)	0	0	3.24	3.35	3.32	6.84	7.07
Annual - NGCC (MMT)	0	0	0	2.46	2.07	2.77	4.1
Cumulative - All (MMT)	0	0	3.24	13.6	36.2	72.2	110

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - BECCS (MMT)	0	0	0	4.51	21.8	48.2	74.5
Cumulative - Cement and lime (MMT)	0	0	3.24	6.59	9.91	16.8	23.8
Cumulative - NGCC (MMT)	0	0	0	2.46	4.53	7.3	11.4

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	2.19	8.81	16.3	27.5	35.4
Injection wells (wells)	0	0	2	10	18	32	38
Resource characterization, appraisal, permitting costs (million $2020)	0	14.6	263	417	417	417	417
Wells and facilities construction costs (million $2020)	0	0	80.8	315	561	938	1,164

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	648	2,591	3,732	4,532	4,874
Cumulative investment - All (million $2018)	0	0	2,094	4,991	6,149	6,901	7,104
Cumulative investment - Spur (million $2018)	0	0	222	1,248	2,405	3,157	3,361
Cumulative investment - Trunk (million $2018)	0	0	1,872	3,743	3,743	3,743	3,743
Spur (km)	0	0	313	1,922	3,063	3,862	4,205
Trunk (km)	0	0	335	669	669	669	669

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	-57.1
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,225
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-58.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-2,340
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-57.1
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,171
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29.1
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-1,257
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	106
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,142
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	528
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	52.8

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	614

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	340
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	22,452
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	3,048
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,524
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	400
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,768

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	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,842
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	151
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,245

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	8,770

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	356	0.484	0.438	0.28	0.172	0.012
Monetary damages from air pollution - Natural Gas (million 2019$)	0	178	152	88.5	71.5	32.5	11.9
Monetary damages from air pollution - Transportation (million 2019$)	0	985	912	688	394	178	68.5
Premature deaths from air pollution - Coal (deaths)	0	39.9	0.054	0.049	0.031	0.019	0.001
Premature deaths from air pollution - Natural Gas (deaths)	0	20.1	17.2	9.99	8.07	3.67	1.34
Premature deaths from air pollution - Transportation (deaths)	0	111	103	77.4	44.4	20	7.7

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	180	207	421	539	1,339	1,627	1,339
By economic sector - Construction (jobs)	5,969	5,929	12,364	14,210	16,054	22,563	29,736
By economic sector - Manufacturing (jobs)	5,035	8,956	10,678	13,714	13,720	12,169	15,204
By economic sector - Mining (jobs)	6,890	5,168	3,824	2,875	1,979	1,428	977
By economic sector - Other (jobs)	319	292	1,573	1,918	2,529	4,410	6,741
By economic sector - Pipeline (jobs)	673	667	817	856	628	561	568
By economic sector - Professional (jobs)	4,180	3,843	5,608	6,120	7,886	11,430	14,822
By economic sector - Trade (jobs)	3,610	2,898	3,909	4,098	4,796	7,083	9,798
By economic sector - Utilities (jobs)	10,843	10,656	12,382	13,961	15,065	18,246	22,436
By education level - All sectors - Associates degree or some college (jobs)	11,511	11,930	16,253	18,586	20,354	25,339	32,663
By education level - All sectors - Bachelors degree (jobs)	8,165	8,305	10,434	11,479	12,440	15,350	19,570
By education level - All sectors - Doctoral degree (jobs)	265	252	333	350	404	549	706
By education level - All sectors - High school diploma or less (jobs)	15,785	16,182	22,092	25,197	27,829	34,487	43,830
By education level - All sectors - Masters or professional degree (jobs)	1,971	1,950	2,464	2,680	2,970	3,792	4,853
By resource sector - Biomass (jobs)	746	890	1,161	1,535	4,031	5,935	5,718
By resource sector - CO2 (jobs)	0	5.69	2,217	3,546	2,622	3,152	3,827
By resource sector - Coal (jobs)	5,625	3,136	1,714	1,496	1,309	1,185	1,051
By resource sector - Grid (jobs)	10,196	10,559	13,544	18,082	21,853	29,969	39,050
By resource sector - Natural Gas (jobs)	9,255	9,132	8,036	6,638	7,116	5,084	3,801
By resource sector - Nuclear (jobs)	2,704	2,660	2,383	1,365	252	0	0
By resource sector - Oil (jobs)	6,987	6,244	5,177	4,041	2,741	1,846	1,054
By resource sector - Solar (jobs)	1,595	3,090	13,258	16,139	19,083	28,813	42,414
By resource sector - Wind (jobs)	591	2,900	4,086	5,449	4,989	3,533	4,707
Median wages - Annual - All ($2019 per job)	57,022	57,323	56,551	56,786	57,256	57,935	58,613
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	6,067	6,220	8,438	9,583	10,455	13,005	16,678
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	2,409	2,371	3,380	3,808	4,205	5,428	6,975
On-Site or In-Plant Training - Total jobs - None (jobs)	5,913	6,146	8,318	9,388	10,349	12,900	16,536
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	293	307	431	500	554	698	898
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	23,016	23,574	31,009	35,013	38,434	47,485	60,535
On-the-Job Training - All sectors - 1 to 4 years (jobs)	7,787	7,977	10,848	12,314	13,422	16,716	21,450

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)	2,303	2,256	3,298	3,738	4,156	5,414	6,983
On-the-Job Training - All sectors - None (jobs)	2,004	2,034	2,755	3,068	3,371	4,287	5,544
On-the-Job Training - All sectors - Over 10 years (jobs)	335	370	518	589	627	759	978
On-the-Job Training - All sectors - Up to 1 year (jobs)	25,270	25,981	34,158	38,582	42,421	52,341	66,667
Related work experience - All sectors - 1 to 4 years (jobs)	13,923	14,113	18,576	20,886	22,874	28,378	36,218
Related work experience - All sectors - 4 to 10 years (jobs)	8,750	8,971	11,929	13,442	14,648	18,180	23,272
Related work experience - All sectors - None (jobs)	5,299	5,446	7,402	8,425	9,341	11,688	14,944
Related work experience - All sectors - Over 10 years (jobs)	2,380	2,509	3,246	3,662	3,929	4,760	6,084
Related work experience - All sectors - Up to 1 year (jobs)	7,347	7,580	10,422	11,877	13,204	16,511	21,105
Wage income - All (million $2019)	2,150	2,214	2,917	3,310	3,665	4,607	5,957

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	572	580	489	392	295	186	129
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	11,820
Natural gas production - Annual (tcf)	149	165	156	136	115	91.3	70.9
Oil consumption - Annual (million bbls)	93.4	87.1	73.9	54.9	37.3	23.4	12.6
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	1,701
Oil production - Annual (million bbls)	9.74	10.5	10.6	10.6	8.36	6.8	4.52

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.81	4.31	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.6	84	85.5	89.5	95	98.4	99.6
Sales of cooking units - Gas (%)	16.4	16	14.5	10.5	5.01	1.62	0.435
Sales of space heating units - Electric Heat Pump (%)	34.1	42.7	46.3	56.9	72.9	83.2	86.8
Sales of space heating units - Electric Resistance (%)	32.6	33.8	31.7	25.8	17	11.4	9.4
Sales of space heating units - Fossil (%)	6.33	7.13	6.71	5.24	3.12	1.79	1.34
Sales of space heating units - Gas (%)	27	16.4	15.2	12.1	7.04	3.65	2.47
Sales of water heating units - Electric Heat Pump (%)	0	2.09	8.02	25.1	51.3	68.4	74.3
Sales of water heating units - Electric Resistance (%)	72.5	80.9	76.2	62.3	41.2	27.4	22.6
Sales of water heating units - Gas Furnace (%)	23.5	14.4	13.2	9.97	4.91	1.56	0.408
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.64	2.65	2.64	2.64

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	163	347	1,168	3,685	5,365
Public EV charging plugs - DC Fast (1000 units)	0.07	0	0.612	0	3.34	0	9.39
Public EV charging plugs - L2 (1000 units)	0.285	0	14.7	0	80.3	0	225
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 (%)	1.52	1.94	2.05	1.63	1.04	0.533	0.228

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.93	4.78	12.1	26.2	48.7	72.3	87.7
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.3	66.3	45.8	24.6	10.9
Vehicle sales - Light-duty - hybrid (%)	4.72	5.51	6.18	5.61	4.18	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.379	0.324	0.246	0.174	0.097	0.045
Vehicle sales - Light-duty - other (%)	0.101	0.105	0.095	0.083	0.059	0.033	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)	116	116	115	113	110	107	105
Final energy use - Industry (PJ)	551	582	616	613	638	655	660
Final energy use - Residential (PJ)	163	154	147	140	131	121	113
Final energy use - Transportation (PJ)	546	513	465	427	397	363	322

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	13,551	15,374	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric Heat Pump (%)	11.7	20.3	25.7	41.5	66.1	83.2	89.6
Sales of space heating units - Electric Resistance (%)	5.83	4.63	4.65	4.79	5.28	5.94	6.33
Sales of space heating units - Fossil (%)	0	3.35	3.16	2.4	1.19	0.387	0.102
Sales of space heating units - Gas Furnace (%)	82.5	71.7	66.5	51.3	27.4	10.5	3.93
Sales of water heating units - Electric Heat Pump (%)	0.191	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	7.05	6.58	8.46	14.5	23.6	29.5	31.6
Sales of water heating units - Gas Furnace (%)	90.8	89.9	82.9	62.1	30.4	9.73	2.53
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	3.04	3.04	3.84	3.93	5.22	5.46

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	-57.1
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,225
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-58.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-2,340
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-57.1
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,171
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29.1

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	-1,257
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	106
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,142
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	528
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	52.8
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	614

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	340
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	22,452
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	3,048
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,524

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	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	400
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,768
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,842
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	34.5

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	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	151
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,245
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	8,770

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	356	0.484	0.438	0.28	0.172	0.012
Monetary damages from air pollution - Natural Gas (million 2019$)	0	173	114	47.2	18.7	6	3.52
Monetary damages from air pollution - Transportation (million 2019$)	0	1,002	1,004	970	869	687	468
Premature deaths from air pollution - Coal (deaths)	0	39.9	0.054	0.049	0.031	0.019	0.001
Premature deaths from air pollution - Natural Gas (deaths)	0	19.5	12.9	5.33	2.12	0.677	0.397
Premature deaths from air pollution - Transportation (deaths)	0	113	113	109	97.7	77.3	52.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.86	4.57	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.7	87.1	97.8	99.9	100	100	100
Sales of cooking units - Gas (%)	16.3	12.9	2.2	0.111	0	0	0
Sales of space heating units - Electric Heat Pump (%)	34.1	48.8	80.6	87.8	88.1	88	88
Sales of space heating units - Electric Resistance (%)	32.6	30.4	12.8	8.81	8.63	8.75	8.76
Sales of space heating units - Fossil (%)	6.33	6.33	2.2	1.25	1.2	1.18	1.18
Sales of space heating units - Gas (%)	27	14.4	4.38	2.16	2.08	2.05	2.05
Sales of water heating units - Electric Heat Pump (%)	0	12.1	64.3	75.9	76.4	76.4	76.4
Sales of water heating units - Electric Resistance (%)	72.5	72.8	30.8	21.4	21	21	21
Sales of water heating units - Gas Furnace (%)	23.5	12.5	2.34	0.099	0	0	0
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.62	2.63	2.63	2.64

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	1,020	2,605	4,234	6,409	6,981	6,653
Public EV charging plugs - DC Fast (1000 units)	0.07	0	2.03	0	9.05	0	14.7
Public EV charging plugs - L2 (1000 units)	0.285	0	48.9	0	217	0	352
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 (%)	1.51	1.78	1.24	0.397	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.04	15.6	47	82	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.6	48.2	16.3	3.26	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.55	4.63	3.26	1.2	0.294	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.337	0.2	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.062	0.022	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)	116	116	112	106	101	99.4	100
Final energy use - Industry (PJ)	551	582	615	609	632	649	656
Final energy use - Residential (PJ)	163	153	141	126	114	108	105
Final energy use - Transportation (PJ)	546	508	443	365	294	250	232

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	13,557	15,391	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	11.7	29.4	77	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	5.83	4.63	4.92	6.27	6.62	6.6	6.56
Sales of space heating units - Fossil (%)	0	2.9	0.562	0.024	0	0	0
Sales of space heating units - Gas Furnace (%)	82.5	63.1	17.5	2.95	1.48	1.44	1.44
Sales of water heating units - Electric Heat Pump (%)	0.191	10.6	55.6	65.6	66.1	66.1	66.1
Sales of water heating units - Electric Resistance (%)	7.05	10.1	28.1	32.2	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	90.8	77.7	14.7	0.619	0	0	0
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	3.72	3.8	5.83	6.14	5	5.13

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	3.29
Capital invested - Solar PV - Base (billion $2018)	0	2.39	5.53	18.1	24.6	35.5	53.9

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	0	7,836
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	6,693
Solar - Base land use assumptions (GWh)	762	3,444	8,876	31,714	45,342	69,442	111,553
Solar - Constrained land use assumptions (GWh)	762	0	12,019	30,122	48,067	62,644	110,750

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	-57.1
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,225
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-58.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-2,340
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-57.1
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,171
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29.1
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-1,257
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	106
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,142
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	528
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	52.8
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	614

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	340
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	22,452

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	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	3,048
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,524
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	400
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,768
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	201

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	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,842
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	151
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,245
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	8,770

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	356	0.484	0.438	0.28	0.172	0.012
Monetary damages from air pollution - Natural Gas (million 2019$)	0	207	156	86.3	52.2	11.5	3.94
Monetary damages from air pollution - Transportation (million 2019$)	0	985	912	688	394	178	68.5
Premature deaths from air pollution - Coal (deaths)	0	39.9	0.054	0.049	0.031	0.019	0.001
Premature deaths from air pollution - Natural Gas (deaths)	0	23.4	17.6	9.74	5.9	1.29	0.446
Premature deaths from air pollution - Transportation (deaths)	0	111	103	77.4	44.4	20	7.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.86	4.57	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.7	87.1	97.8	99.9	100	100	100
Sales of cooking units - Gas (%)	16.3	12.9	2.2	0.111	0	0	0
Sales of space heating units - Electric Heat Pump (%)	34.1	48.8	80.6	87.8	88.1	88	88
Sales of space heating units - Electric Resistance (%)	32.6	30.4	12.8	8.81	8.63	8.75	8.76
Sales of space heating units - Fossil (%)	6.33	6.33	2.2	1.25	1.2	1.18	1.18
Sales of space heating units - Gas (%)	27	14.4	4.38	2.16	2.08	2.05	2.05
Sales of water heating units - Electric Heat Pump (%)	0	12.1	64.3	75.9	76.4	76.4	76.4
Sales of water heating units - Electric Resistance (%)	72.5	72.8	30.8	21.4	21	21	21
Sales of water heating units - Gas Furnace (%)	23.5	12.5	2.34	0.099	0	0	0
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.62	2.63	2.63	2.64

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	1,020	2,605	4,234	6,409	6,981	6,653
Public EV charging plugs - DC Fast (1000 units)	0.07	0	2.03	0	9.05	0	14.7
Public EV charging plugs - L2 (1000 units)	0.285	0	48.9	0	217	0	352
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 (%)	1.51	1.78	1.24	0.397	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.04	15.6	47	82	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.6	48.2	16.3	3.26	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.55	4.63	3.26	1.2	0.294	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.337	0.2	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.062	0.022	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)	116	116	112	106	101	99.4	100
Final energy use - Industry (PJ)	551	582	615	609	632	649	656
Final energy use - Residential (PJ)	163	153	141	126	114	108	105
Final energy use - Transportation (PJ)	546	508	443	365	294	250	232

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	13,557	15,391	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	11.7	29.4	77	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	5.83	4.63	4.92	6.27	6.62	6.6	6.56
Sales of space heating units - Fossil (%)	0	2.9	0.562	0.024	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 (%)	82.5	63.1	17.5	2.95	1.48	1.44	1.44
Sales of water heating units - Electric Heat Pump (%)	0.191	10.6	55.6	65.6	66.1	66.1	66.1
Sales of water heating units - Electric Resistance (%)	7.05	10.1	28.1	32.2	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	90.8	77.7	14.7	0.619	0	0	0
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	3.72	3.8	5.83	6.14	5	5.13

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	0.69	3.37	4.54	3.65	0
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0.748	2.12	3.82	3.34	1.22

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	762	0	1,102	5,883	8,447	7,128	0
Solar - Constrained land use assumptions (GWh)	762	0	1,194	3,677	7,039	6,575	2,533

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	-57.1
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,225
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-58.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-2,340
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-57.1
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,171
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29.1
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-1,257
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	106
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,142
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	33
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	528

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	52.8
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	614

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	340
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	22,452
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	3,048
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,524
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	400

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	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,768
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,842
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	151

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	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,245
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	8,770

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	356	0.484	0.438	0.28	0.172	0.012
Monetary damages from air pollution - Natural Gas (million 2019$)	0	160	144	133	103	36	12.3
Monetary damages from air pollution - Transportation (million 2019$)	0	985	912	688	394	178	68.5
Premature deaths from air pollution - Coal (deaths)	0	39.9	0.054	0.049	0.031	0.019	0.001
Premature deaths from air pollution - Natural Gas (deaths)	0	18.1	16.3	15	11.6	4.07	1.39
Premature deaths from air pollution - Transportation (deaths)	0	111	103	77.4	44.4	20	7.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.81	4.31	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.6	84	85.5	89.5	95	98.4	99.6
Sales of cooking units - Gas (%)	16.4	16	14.5	10.5	5.01	1.62	0.435
Sales of space heating units - Electric Heat Pump (%)	34.1	42.7	46.3	56.9	72.9	83.2	86.8
Sales of space heating units - Electric Resistance (%)	32.6	33.8	31.7	25.8	17	11.4	9.4
Sales of space heating units - Fossil (%)	6.33	7.13	6.71	5.24	3.12	1.79	1.34
Sales of space heating units - Gas (%)	27	16.4	15.2	12.1	7.04	3.65	2.47
Sales of water heating units - Electric Heat Pump (%)	0	2.09	8.02	25.1	51.3	68.4	74.3
Sales of water heating units - Electric Resistance (%)	72.5	80.9	76.2	62.3	41.2	27.4	22.6
Sales of water heating units - Gas Furnace (%)	23.5	14.4	13.2	9.97	4.91	1.56	0.408
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.64	2.65	2.64	2.64

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	163	347	1,168	3,685	5,365
Public EV charging plugs - DC Fast (1000 units)	0.07	0	0.612	0	3.34	0	9.39
Public EV charging plugs - L2 (1000 units)	0.285	0	14.7	0	80.3	0	225
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 (%)	1.52	1.94	2.05	1.63	1.04	0.533	0.228
Vehicle sales - Light-duty - EV (%)	1.93	4.78	12.1	26.2	48.7	72.3	87.7
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.3	66.3	45.8	24.6	10.9
Vehicle sales - Light-duty - hybrid (%)	4.72	5.51	6.18	5.61	4.18	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.379	0.324	0.246	0.174	0.097	0.045
Vehicle sales - Light-duty - other (%)	0.101	0.105	0.095	0.083	0.059	0.033	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)	116	116	115	113	110	107	105
Final energy use - Industry (PJ)	551	582	616	613	638	655	660
Final energy use - Residential (PJ)	163	154	147	140	131	121	113
Final energy use - Transportation (PJ)	546	513	465	427	397	363	322

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	13,551	15,374	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric Heat Pump (%)	11.7	20.3	25.7	41.5	66.1	83.2	89.6
Sales of space heating units - Electric Resistance (%)	5.83	4.63	4.65	4.79	5.28	5.94	6.33
Sales of space heating units - Fossil (%)	0	3.35	3.16	2.4	1.19	0.387	0.102
Sales of space heating units - Gas Furnace (%)	82.5	71.7	66.5	51.3	27.4	10.5	3.93
Sales of water heating units - Electric Heat Pump (%)	0.191	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	7.05	6.58	8.46	14.5	23.6	29.5	31.6
Sales of water heating units - Gas Furnace (%)	90.8	89.9	82.9	62.1	30.4	9.73	2.53
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	3.04	3.04	3.84	3.93	5.22	5.46

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	7.01	16.4	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	7,863	26,215	26,215	26,215

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	479	2,220	3,039	3,039

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	6,531	22,561	9,661	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	10	21	21
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	6	20	20	20
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	2	2	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	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	3.24	11.2	39.1	55	55.8
Annual - BECCS (MMT)	0	0	0	7.89	35.8	48.2	48.1
Annual - Cement and lime (MMT)	0	0	3.24	3.35	3.32	6.84	7.07
Annual - NGCC (MMT)	0	0	0	0	0	0	0.69
Cumulative - All (MMT)	0	0	3.24	14.5	53.6	109	164
Cumulative - BECCS (MMT)	0	0	0	7.89	43.6	91.8	140
Cumulative - Cement and lime (MMT)	0	0	3.24	6.59	9.91	16.8	23.8
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0.69

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	3.69	15	30.9	43.3	46.8
Injection wells (wells)	0	0	4	14	26	44	56
Resource characterization, appraisal, permitting costs (million $2020)	0	14.6	361	580	580	580	580
Wells and facilities construction costs (million $2020)	0	0	114	446	795	1,330	1,651

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	648	2,004	2,846	4,113	4,308
Cumulative investment - All (million $2018)	0	0	2,093	5,131	6,675	7,991	8,051
Cumulative investment - Spur (million $2018)	0	0	221	1,388	2,806	4,123	4,183
Cumulative investment - Trunk (million $2018)	0	0	1,872	3,743	3,869	3,869	3,869
Spur (km)	0	0	313	1,335	2,177	3,443	3,639
Trunk (km)	0	0	335	669	669	669	669

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	-216
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,063
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	-53.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-2,332
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-216

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	-1,085
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	-26.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-1,328
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	118
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,276
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	45.6
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	327
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	96.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,863
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	118
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	485
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	45.6
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	327
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	48.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,024

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	340
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	22,452
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	3,048

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	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,524
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	400
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	3,768
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,842

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	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	151
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,245
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	8,770

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	3.76	3.8	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.5	83.5	83.5	83.5	83.5	83.5	83.5
Sales of cooking units - Gas (%)	16.5	16.5	16.5	16.5	16.5	16.5	16.5
Sales of space heating units - Electric Heat Pump (%)	32.1	57	57.8	59.1	60.4	62.1	64.7
Sales of space heating units - Electric Resistance (%)	33.6	26.8	26.4	25.6	24.5	23	20.3
Sales of space heating units - Fossil (%)	6.48	4.04	4.09	4.01	3.92	3.88	3.9
Sales of space heating units - Gas (%)	27.8	12.1	11.7	11.3	11.2	11.1	11.1
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	72.5	82.6	82.7	82.5	82.4	82.4	82.3
Sales of water heating units - Gas Furnace (%)	23.5	14.8	14.7	14.9	15	15	15
Sales of water heating units - Other (%)	3.93	2.64	2.61	2.64	2.66	2.66	2.66

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 (%)	1.52	1.94	2.18	2.03	1.82	1.7	1.62
Vehicle sales - Light-duty - EV (%)	3.69	5.76	6.55	8.07	9.81	11.3	12.5
Vehicle sales - Light-duty - gasoline (%)	90	86.4	84.2	82.3	80.2	78.3	76.7
Vehicle sales - Light-duty - hybrid (%)	4.56	5.4	6.6	7.17	7.73	8.29	8.72
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.375	0.344	0.305	0.301	0.302	0.312
Vehicle sales - Light-duty - other (%)	0.1	0.104	0.101	0.101	0.1	0.099	0.102
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)	116	118	119	119	120	124	129
Final energy use - Industry (PJ)	551	594	623	639	664	684	709
Final energy use - Residential (PJ)	163	154	151	149	149	150	153
Final energy use - Transportation (PJ)	546	512	468	441	440	453	469

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	13,308	13,855	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	45.6	45.9	45.7	46	45.9	45.7
Sales of cooking units - Gas (%)	56.5	54.4	54.1	54.3	54	54.1	54.3
Sales of space heating units - Electric Heat Pump (%)	11.7	32	71.2	79	79.3	79.3	79.4
Sales of space heating units - Electric Resistance (%)	5.83	6.42	12	15.8	18.7	19.2	19.2
Sales of space heating units - Fossil (%)	0	2.68	0.471	0.024	0	0	0
Sales of space heating units - Gas Furnace (%)	82.5	58.9	16.3	5.24	1.95	1.49	1.44
Sales of water heating units - Electric Heat Pump (%)	0.191	0.157	0.15	0.153	0.152	0.148	0.15
Sales of water heating units - Electric Resistance (%)	7.05	5.85	5.67	5.75	5.7	5.62	5.68
Sales of water heating units - Gas Furnace (%)	90.8	92.4	92.6	92.5	92.6	92.7	92.6
Sales of water heating units - Other (%)	1.97	1.59	1.58	1.59	1.59	1.58	1.57

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	4.01	4.13	5.56	5.83	5.01	5.15

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-56.9	0	-17.8	-14.4
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-6.11	0	-10.2	-10.7
Business-as-usual carbon sink - Total (Mt CO2e/y)	-63	0	-28	-25.1
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	340

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	58,635
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,902
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	11,580
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	6,158
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	22,452
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	592
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	3,048
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	7,006
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	5,558
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	170
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	19,687
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	4,448
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	3,133
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	7,484
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	207
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	1,524
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	531
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,873
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	255
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	39,107
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,110
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	8,014
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	4,591
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	14,968
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	400
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	2,286
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	3,768
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	3,715
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	55.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	258

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	5,905
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	2,269
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	56.3
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	199
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,842
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	10,786
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	27.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	2,262
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	1,134
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	29.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	101
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	34.5
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	1,115
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,946
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	41.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	4,084
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	1,707
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	42.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	151
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	249
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	2,245
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	8,770

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	1,451	984	751	659	622	618
Monetary damages from air pollution - Natural Gas (million 2019$)	0	206	214	221	247	242	262
Monetary damages from air pollution - Transportation (million 2019$)	0	1,001	1,017	1,034	1,055	1,077	1,099
Premature deaths from air pollution - Coal (deaths)	0	163	110	84.2	74	69.8	69.4
Premature deaths from air pollution - Natural Gas (deaths)	0	23.3	24.2	25	27.9	27.4	29.6
Premature deaths from air pollution - Transportation (deaths)	0	113	114	116	119	121	124