Net-Zero America - arizona 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	9.03	12.9	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	86.5	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric Heat Pump (%)	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Sales of space heating units - Electric Resistance (%)	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric Heat Pump (%)	0	11.1	59.1	70.5	71.1	71.1	71.1
Sales of water heating units - Electric Resistance (%)	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Sales of water heating units - Gas Furnace (%)	49.7	29.2	6.29	0.391	0.01	0	0
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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	1,096	2,868	4,551	6,933	7,503	7,177
Public EV charging plugs - DC Fast (1000 units)	0.323	0	1.88	0	7.6	0	12.2
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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 (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.338	0.201	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	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)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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	15,691	17,430	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	9.42	24.7	74.5	91.3	93	93.1	93.1
Sales of space heating units - Electric Resistance (%)	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	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 (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.56	5.85	7.13	7.54	7.14	7.45

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	0.005	0.135	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0.057
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0.315
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	0	0	1.17
Capital invested - Solar PV - Constrained (billion $2018)	0	1.03	0	0	1.13	0.159	6.01
Capital invested - Wind - Base (billion $2018)	0	0	0.096	0.499	0.141	0.13	0.33
Capital invested - Wind - Constrained (billion $2018)	0	0.159	0.739	5.99	10.7	12.7	9.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	10.1	276	276	276	276	276
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	57.2
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	354
Solar - Base land use assumptions (GWh)	14,540	0	0	0	0	0	3,095
Solar - Constrained land use assumptions (GWh)	13,756	0	0	0	1,205	9,782	5,452
Wind - Base land use assumptions (GWh)	1,920	0	227	1,183	334	320	862
Wind - Constrained land use assumptions (GWh)	2,143	613	1,061	13,815	21,261	21,504	22,291

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0.64	13.2	14.8	14.9	15.2	44.8
Conversion capital investment - Cumulative 5-yr (million $2018)	0	5.8	151	30.3	3.23	4.74	665
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	1
Number of facilities - Diesel (quantity)	0	0	0	2	2	2	2
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	2
Number of facilities - Power (quantity)	0	2	2	2	2	2	2
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	2
Number of facilities - Pyrolysis (quantity)	0	0	0	2	2	2	2
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Sng (quantity)	0	2	2	2	2	2	2
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	0.01	0.01	3.33	3.5	4.27
Annual - BECCS (MMT)	0	0	0	0	0	0	0.67
Annual - Cement and lime (MMT)	0	0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)	0	0	0.01	0.01	0.01	0.08	0.07
Cumulative - All (MMT)	0	0	0.01	0.02	3.35	6.85	11.1
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0.67
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	6.74	10.3
Cumulative - NGCC (MMT)	0	0	0.01	0.02	0.03	0.11	0.18

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	415	415	504	514	885
Cumulative investment - All (million $2018)	0	0	445	445	531	537	740
Cumulative investment - Spur (million $2018)	0	0	5.14	5.13	90.9	97.6	300
Cumulative investment - Trunk (million $2018)	0	0	440	440	440	440	440
Spur (km)	0	0	9.36	9.36	98.6	108	479
Trunk (km)	0	0	406	406	406	406	406

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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-450
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-9.92
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-460
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.96
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-232
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	506
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	521
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0

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	257
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.61
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	264

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	48.1
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,053
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	96.2

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	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0
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	20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	244
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0
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	29.7

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	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,988

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	155	0.208	0.208	0.127	0.077	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	204	143	115	102	62.2	11.7
Monetary damages from air pollution - Transportation (million 2019$)	0	1,446	1,367	1,051	610	275	101
Premature deaths from air pollution - Coal (deaths)	0	17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)	0	23.1	16.1	13	11.6	7.02	1.32
Premature deaths from air pollution - Transportation (deaths)	0	163	154	118	68.6	30.9	11.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	95.1	96.6	118	120	76.5	32.7	55.5
By economic sector - Construction (jobs)	14,634	12,181	11,584	11,952	12,453	11,946	16,076
By economic sector - Manufacturing (jobs)	4,869	5,140	7,178	8,643	7,914	6,751	7,449
By economic sector - Mining (jobs)	2,553	1,940	1,239	774	443	226	106
By economic sector - Other (jobs)	2,051	1,529	1,565	1,827	2,128	2,392	4,297
By economic sector - Pipeline (jobs)	411	400	390	260	197	119	104
By economic sector - Professional (jobs)	5,870	5,261	4,878	5,036	5,275	5,284	7,561
By economic sector - Trade (jobs)	4,501	3,777	3,306	3,377	3,549	3,635	5,564
By economic sector - Utilities (jobs)	10,373	12,549	11,868	11,464	11,412	10,291	9,631
By education level - All sectors - Associates degree or some college (jobs)	14,322	13,646	13,474	13,997	14,170	13,307	16,555
By education level - All sectors - Bachelors degree (jobs)	9,095	8,645	8,407	8,512	8,358	7,824	9,779
By education level - All sectors - Doctoral degree (jobs)	326	291	272	271	268	261	361
By education level - All sectors - High school diploma or less (jobs)	19,405	18,187	17,954	18,643	18,643	17,380	21,718
By education level - All sectors - Masters or professional degree (jobs)	2,208	2,105	2,019	2,030	2,008	1,904	2,429
By resource sector - Biomass (jobs)	246	248	284	290	200	123	251
By resource sector - CO2 (jobs)	0	0	442	9.81	95.9	39	273
By resource sector - Coal (jobs)	1,750	1,309	391	4.06	3	2.32	1.94
By resource sector - Grid (jobs)	11,765	17,764	17,025	18,372	18,856	16,843	17,400
By resource sector - Natural Gas (jobs)	5,547	4,563	3,873	3,719	4,692	4,265	1,996
By resource sector - Nuclear (jobs)	2,160	2,125	2,091	1,213	0.031	0.093	0.136
By resource sector - Oil (jobs)	5,036	4,241	3,276	2,218	1,371	776	371
By resource sector - Solar (jobs)	17,900	10,849	11,171	13,760	15,000	16,322	28,124
By resource sector - Wind (jobs)	953	1,775	3,573	3,866	3,228	2,306	2,425
Median wages - Annual - All ($2019 per job)	57,399	59,133	59,519	59,798	60,498	61,285	61,297
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	7,479	7,107	6,976	7,199	7,258	6,794	8,403
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	3,220	3,023	2,891	2,941	3,019	2,848	3,533
On-Site or In-Plant Training - Total jobs - None (jobs)	7,388	6,883	6,795	7,014	6,995	6,580	8,359

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)	388	375	368	383	393	369	450
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	26,881	25,485	25,096	25,914	25,781	24,086	30,096
On-the-Job Training - All sectors - 1 to 4 years (jobs)	9,649	9,179	8,999	9,274	9,367	8,773	10,825
On-the-Job Training - All sectors - 4 to 10 years (jobs)	3,186	2,985	2,854	2,915	3,014	2,853	3,557
On-the-Job Training - All sectors - None (jobs)	2,532	2,322	2,267	2,322	2,304	2,180	2,835
On-the-Job Training - All sectors - Over 10 years (jobs)	460	412	418	435	428	399	507
On-the-Job Training - All sectors - Up to 1 year (jobs)	29,530	27,975	27,589	28,507	28,334	26,471	33,118
Related work experience - All sectors - 1 to 4 years (jobs)	16,256	15,430	15,090	15,510	15,502	14,519	18,105
Related work experience - All sectors - 4 to 10 years (jobs)	10,556	10,025	9,812	10,074	10,094	9,447	11,697
Related work experience - All sectors - None (jobs)	6,546	6,218	6,109	6,314	6,362	5,967	7,459
Related work experience - All sectors - Over 10 years (jobs)	2,758	2,644	2,629	2,710	2,676	2,485	3,046
Related work experience - All sectors - Up to 1 year (jobs)	9,241	8,558	8,486	8,844	8,812	8,258	10,534
Wage income - All (million $2019)	2,604	2,535	2,508	2,599	2,629	2,493	3,117

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	293	298	251	201	152	95.4	66.1
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	6,065
Natural gas production - Annual (tcf)	0.051	0.056	0.053	0.046	0.039	0.031	0.024
Oil consumption - Annual (million bbls)	103	95.3	80.2	58.8	39.2	23.7	12.1
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	1,832
Oil production - Annual (million bbls)	0.013	0.014	0.014	0.014	0.011	0.009	0.006

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	8.98	12.7	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	83.2	84.8	89	94.7	98.3	99.5
Sales of cooking units - Gas (%)	17.2	16.8	15.2	11	5.27	1.7	0.457
Sales of space heating units - Electric Heat Pump (%)	20.5	32.5	36.8	49.4	69.2	82.3	86.9
Sales of space heating units - Electric Resistance (%)	25.1	32.5	30.6	25.2	16.8	11.2	9.24
Sales of space heating units - Fossil (%)	3.8	5.13	5.09	4.25	2.87	2.13	2.05
Sales of space heating units - Gas (%)	50.6	29.9	27.6	21.1	11.1	4.33	1.85
Sales of water heating units - Electric Heat Pump (%)	0	1.92	7.38	23.1	47.4	63.4	69.1
Sales of water heating units - Electric Resistance (%)	46.7	61.2	58.5	50.3	37.7	29.5	26.6
Sales of water heating units - Gas Furnace (%)	49.7	33.6	30.9	23.3	11.7	3.86	1.03
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.25	3.25	3.24	3.24

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	188	371	1,276	3,945	5,771
Public EV charging plugs - DC Fast (1000 units)	0.323	0	0.669	0	2.89	0	7.8
Public EV charging plugs - L2 (1000 units)	1.11	0	16.1	0	69.5	0	188
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 (%)	1.53	1.95	2.05	1.63	1.04	0.534	0.229
Vehicle sales - Light-duty - EV (%)	1.92	4.75	12	26.1	48.6	72.2	87.6
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.4	66.4	45.9	24.7	10.9
Vehicle sales - Light-duty - hybrid (%)	4.68	5.48	6.15	5.58	4.17	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.379	0.324	0.247	0.175	0.097	0.045
Vehicle sales - Light-duty - other (%)	0.102	0.105	0.095	0.083	0.06	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)	154	154	154	153	150	146	143
Final energy use - Industry (PJ)	138	139	137	144	160	164	168
Final energy use - Residential (PJ)	190	188	187	184	176	167	161
Final energy use - Transportation (PJ)	578	547	504	469	441	408	369

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	15,683	17,443	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	9.42	15.4	21.2	37.7	63.9	82.8	90.3
Sales of space heating units - Electric Resistance (%)	8.85	3.71	3.77	3.94	4.58	5.53	6.06
Sales of space heating units - Fossil (%)	0	0.221	0.208	0.157	0.076	0.024	0.007
Sales of space heating units - Gas Furnace (%)	81.7	80.6	74.8	58.2	31.5	11.7	3.68
Sales of water heating units - Electric Heat Pump (%)	0.083	1.86	7.04	22	45.1	60.6	66.1
Sales of water heating units - Electric Resistance (%)	4.09	2.3	4.52	11	21.1	28	30.5
Sales of water heating units - Gas Furnace (%)	94.7	95.5	88	66.6	33.4	11.1	2.96
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.08	5.31	5.56	5.79	6.91	7.24

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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-450
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-9.92
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-460

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	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.96
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-232
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	506
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	521
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	257
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.61
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	264

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0

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	48.1
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,053
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	96.2
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0
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	20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	244
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0
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	29.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,988

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	155	0.208	0.208	0.127	0.077	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	208	132	89.1	45.1	19.5	3.06
Monetary damages from air pollution - Transportation (million 2019$)	0	1,471	1,506	1,485	1,353	1,087	750
Premature deaths from air pollution - Coal (deaths)	0	17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)	0	23.5	14.9	10.1	5.09	2.2	0.346
Premature deaths from air pollution - Transportation (deaths)	0	165	169	167	152	122	84.4

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	9.03	12.9	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	86.5	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric Heat Pump (%)	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Sales of space heating units - Electric Resistance (%)	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric Heat Pump (%)	0	11.1	59.1	70.5	71.1	71.1	71.1

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 (%)	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Sales of water heating units - Gas Furnace (%)	49.7	29.2	6.29	0.391	0.01	0	0
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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	1,096	2,868	4,551	6,933	7,503	7,177
Public EV charging plugs - DC Fast (1000 units)	0.323	0	1.88	0	7.6	0	12.2
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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 (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.338	0.201	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	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)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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	15,691	17,430	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	9.42	24.7	74.5	91.3	93	93.1	93.1
Sales of space heating units - Electric Resistance (%)	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.56	5.85	7.13	7.54	7.14	7.45

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	3.77	5.43	4.09
Capital invested - Wind - Base (billion $2018)	0	0	0.196	0.451	0.325	0.263	1.53

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	14,540	0	0	0	8,845	13,464	10,690
Solar - Constrained land use assumptions (GWh)	14,540	0	0	2,685	13,875	23,681	15,359
Wind - Base land use assumptions (GWh)	1,920	0	454	1,061	750	646	3,895
Wind - Constrained land use assumptions (GWh)	2,143	850	2,002	25,592	43,651	6,325	2,044

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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-450
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-9.92
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-460
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.96
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-232
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	506
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	521
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	257
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.61
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	264

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	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	48.1
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,053
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	96.2
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	295

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	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0
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	20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	244
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0
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	29.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,988

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	155	0.208	0.208	0.127	0.077	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	181	154	72	48.8	22.7	2.68
Monetary damages from air pollution - Transportation (million 2019$)	0	1,446	1,367	1,051	610	275	101
Premature deaths from air pollution - Coal (deaths)	0	17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)	0	20.4	17.4	8.13	5.51	2.56	0.302
Premature deaths from air pollution - Transportation (deaths)	0	163	154	118	68.6	30.9	11.4

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	9.03	12.9	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	86.5	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	17.2	13.5	2.31	0.116	0	0	0
Sales of space heating units - Electric Heat Pump (%)	20.5	39.8	77.9	87.9	88.7	88.6	88.5
Sales of space heating units - Electric Resistance (%)	25.1	29.4	12.9	8.67	8.4	8.53	8.6
Sales of space heating units - Fossil (%)	3.8	4.75	2.83	2.2	1.94	1.88	1.97
Sales of space heating units - Gas (%)	50.6	26.1	6.34	1.28	0.966	0.96	0.955
Sales of water heating units - Electric Heat Pump (%)	0	11.1	59.1	70.5	71.1	71.1	71.1
Sales of water heating units - Electric Resistance (%)	46.7	56.4	31.4	25.8	25.6	25.6	25.6
Sales of water heating units - Gas Furnace (%)	49.7	29.2	6.29	0.391	0.01	0	0
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.24	3.23	3.24	3.24

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	1,096	2,868	4,551	6,933	7,503	7,177
Public EV charging plugs - DC Fast (1000 units)	0.323	0	1.88	0	7.6	0	12.2
Public EV charging plugs - L2 (1000 units)	1.11	0	45.2	0	183	0	293
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 (%)	1.52	1.79	1.25	0.398	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	4.01	15.5	46.9	82	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.7	77.7	48.4	16.3	3.27	0.589	0
Vehicle sales - Light-duty - hybrid (%)	4.51	4.61	3.24	1.2	0.293	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.338	0.201	0.062	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.1	0.096	0.063	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)	154	154	150	142	136	133	134
Final energy use - Industry (PJ)	138	138	137	143	157	161	165
Final energy use - Residential (PJ)	190	187	180	168	158	153	152
Final energy use - Transportation (PJ)	577	543	484	411	345	303	285

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	15,691	17,430	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	9.42	24.7	74.5	91.3	93	93.1	93.1
Sales of space heating units - Electric Resistance (%)	8.85	3.72	4.18	5.96	6.38	6.41	6.34
Sales of space heating units - Fossil (%)	0	0.191	0.037	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	81.7	71.4	21.3	2.75	0.604	0.53	0.531
Sales of water heating units - Electric Heat Pump (%)	0.083	10.5	56.1	67.4	68.1	68.1	68.1
Sales of water heating units - Electric Resistance (%)	4.09	5.98	25.6	31.1	31.5	31.5	31.5
Sales of water heating units - Gas Furnace (%)	94.7	83.1	18	1.12	0.029	0	0
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.56	5.85	7.13	7.54	7.14	7.45

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0	0.805	0.25	0	0
Capital invested - Wind - Base (billion $2018)	0	0	0	0.09	0.214	0.166	0.116
Capital invested - Wind - Constrained (billion $2018)	0	0.159	0.253	0.498	3.38	1.47	7.97

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	14,540	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	14,540	0	0	1,738	578	0	0
Wind - Base land use assumptions (GWh)	1,920	0	0	227	538	428	322
Wind - Constrained land use assumptions (GWh)	1,920	330	506	971	6,160	2,781	15,721

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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-450
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-9.92
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-460
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0

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	-227
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.96
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-232
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	506
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	521
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	257
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.61
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	264

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	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	48.1

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	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,053
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	96.2
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0
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	20.5

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	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	244
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0
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	29.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,988

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	155	0.208	0.208	0.127	0.077	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	236	168	145	151	82.7	9.62
Monetary damages from air pollution - Transportation (million 2019$)	0	1,446	1,367	1,051	610	275	101
Premature deaths from air pollution - Coal (deaths)	0	17.4	0.023	0.023	0.014	0.009	0
Premature deaths from air pollution - Natural Gas (deaths)	0	26.7	19	16.3	17.1	9.34	1.09
Premature deaths from air pollution - Transportation (deaths)	0	163	154	118	68.6	30.9	11.4

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	8.98	12.7	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.8	83.2	84.8	89	94.7	98.3	99.5
Sales of cooking units - Gas (%)	17.2	16.8	15.2	11	5.27	1.7	0.457
Sales of space heating units - Electric Heat Pump (%)	20.5	32.5	36.8	49.4	69.2	82.3	86.9
Sales of space heating units - Electric Resistance (%)	25.1	32.5	30.6	25.2	16.8	11.2	9.24
Sales of space heating units - Fossil (%)	3.8	5.13	5.09	4.25	2.87	2.13	2.05
Sales of space heating units - Gas (%)	50.6	29.9	27.6	21.1	11.1	4.33	1.85
Sales of water heating units - Electric Heat Pump (%)	0	1.92	7.38	23.1	47.4	63.4	69.1
Sales of water heating units - Electric Resistance (%)	46.7	61.2	58.5	50.3	37.7	29.5	26.6

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 (%)	49.7	33.6	30.9	23.3	11.7	3.86	1.03
Sales of water heating units - Other (%)	3.58	3.23	3.22	3.25	3.25	3.24	3.24

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	188	371	1,276	3,945	5,771
Public EV charging plugs - DC Fast (1000 units)	0.323	0	0.669	0	2.89	0	7.8
Public EV charging plugs - L2 (1000 units)	1.11	0	16.1	0	69.5	0	188
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 (%)	1.53	1.95	2.05	1.63	1.04	0.534	0.229
Vehicle sales - Light-duty - EV (%)	1.92	4.75	12	26.1	48.6	72.2	87.6
Vehicle sales - Light-duty - gasoline (%)	91.6	87.3	79.4	66.4	45.9	24.7	10.9
Vehicle sales - Light-duty - hybrid (%)	4.68	5.48	6.15	5.58	4.17	2.46	1.19
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.379	0.324	0.247	0.175	0.097	0.045
Vehicle sales - Light-duty - other (%)	0.102	0.105	0.095	0.083	0.06	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 47: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	154	154	154	153	150	146	143
Final energy use - Industry (PJ)	138	139	137	144	160	164	168
Final energy use - Residential (PJ)	190	188	187	184	176	167	161
Final energy use - Transportation (PJ)	578	547	504	469	441	408	369

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	15,683	17,443	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	9.42	15.4	21.2	37.7	63.9	82.8	90.3
Sales of space heating units - Electric Resistance (%)	8.85	3.71	3.77	3.94	4.58	5.53	6.06
Sales of space heating units - Fossil (%)	0	0.221	0.208	0.157	0.076	0.024	0.007
Sales of space heating units - Gas Furnace (%)	81.7	80.6	74.8	58.2	31.5	11.7	3.68
Sales of water heating units - Electric Heat Pump (%)	0.083	1.86	7.04	22	45.1	60.6	66.1
Sales of water heating units - Electric Resistance (%)	4.09	2.3	4.52	11	21.1	28	30.5
Sales of water heating units - Gas Furnace (%)	94.7	95.5	88	66.6	33.4	11.1	2.96
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.08	5.31	5.56	5.79	6.91	7.24

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	0.002	0.061	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0.007	0.02
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0.001	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	4.19	124	124	124	124	124
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	6.99	26.8
Biomass w/ccu power plant (GWh)	0	0	0	0	0	1.2	1.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0.513	8.84	10.5	10.6	30.4	39.8
Conversion capital investment - Cumulative 5-yr (million $2018)	0	2.42	68	21.8	2.59	253	166
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	1	1
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0.15	3.44	3.83	4.06
Annual - BECCS (MMT)	0	0	0	0	0	0.31	0.44
Annual - Cement and lime (MMT)	0	0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)	0	0	0	0.15	0.12	0.1	0.08
Cumulative - All (MMT)	0	0	0	0.15	3.59	7.42	11.5
Cumulative - BECCS (MMT)	0	0	0	0	0	0.31	0.75
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	6.74	10.3
Cumulative - NGCC (MMT)	0	0	0	0.15	0.27	0.37	0.45

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	406	415	504	708	708
Cumulative investment - All (million $2018)	0	0	440	445	531	643	646
Cumulative investment - Spur (million $2018)	0	0	0	5.33	91.1	203	207
Cumulative investment - Trunk (million $2018)	0	0	440	440	440	440	440
Spur (km)	0	0	0	9.36	98.6	303	303
Trunk (km)	0	0	406	406	406	406	406

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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-450
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	-9.92
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-460
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
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	-4.96
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-232
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,249
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,264
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	257
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.61
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	264

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	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	48.1
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,053
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	96.2
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	295

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	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0
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	20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	244
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0
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	29.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,988

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	8.41	8.88	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.6	82.6	82.6	82.6	82.6	82.6	82.6
Sales of cooking units - Gas (%)	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Sales of space heating units - Electric Heat Pump (%)	19.5	39.9	40.6	41.7	43.2	45.2	47.9
Sales of space heating units - Electric Resistance (%)	25.4	29.6	29.2	28.6	27.5	25.7	23
Sales of space heating units - Fossil (%)	3.83	3.9	4.03	3.98	3.57	3.36	3.58
Sales of space heating units - Gas (%)	51.3	26.5	26.2	25.7	25.7	25.7	25.6
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	46.7	62.2	62.4	62.4	62.4	62.5	62.5
Sales of water heating units - Gas Furnace (%)	49.7	34.5	34.4	34.3	34.3	34.3	34.2
Sales of water heating units - Other (%)	3.58	3.23	3.23	3.25	3.26	3.26	3.26

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 (%)	1.53	1.94	2.18	2.03	1.83	1.7	1.62
Vehicle sales - Light-duty - EV (%)	3.65	5.72	6.51	8.01	9.74	11.3	12.4
Vehicle sales - Light-duty - gasoline (%)	90.1	86.5	84.3	82.4	80.3	78.4	76.8
Vehicle sales - Light-duty - hybrid (%)	4.53	5.37	6.57	7.13	7.7	8.26	8.69
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.376	0.344	0.305	0.302	0.302	0.313
Vehicle sales - Light-duty - other (%)	0.101	0.105	0.101	0.101	0.101	0.1	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)	154	157	160	162	165	172	181
Final energy use - Industry (PJ)	138	144	147	154	162	173	185
Final energy use - Residential (PJ)	190	190	195	202	212	222	230
Final energy use - Transportation (PJ)	577	551	515	496	500	516	538

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	15,479	16,145	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric Heat Pump (%)	9.42	27.3	68.2	78	78.7	78.8	78.8
Sales of space heating units - Electric Resistance (%)	8.85	5.52	11.3	16.2	20	20.6	20.6
Sales of space heating units - Fossil (%)	0	0.189	0.074	0.026	0.004	0	0
Sales of space heating units - Gas Furnace (%)	81.7	67	20.4	5.76	1.23	0.588	0.532
Sales of water heating units - Electric Heat Pump (%)	0.083	0.031	0.031	0.031	0.031	0.031	0.031

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 (%)	4.09	1.51	1.51	1.53	1.5	1.51	1.5
Sales of water heating units - Gas Furnace (%)	94.7	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	1.09	0.39	0.388	0.391	0.39	0.389	0.388

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	5.57	5.85	6.55	6.89	7.44	7.8

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	7.56	0	2.19	0.629
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.039	0	-0.082	-0.086
Business-as-usual carbon sink - Total (Mt CO2e/y)	7.52	0	2.11	0.543
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,802
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	16,318
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,857
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	7,019
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	144
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	410
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	96.6
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	4,989
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	903
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	5,789
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	310
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	2,696
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	48.1
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	143
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	7.32
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,682
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,352
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,053

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	1,083
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	4,858
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	96.2
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	277
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	52
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	3,335
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	295
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	251
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	3,579
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	0
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	38.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	2.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,654
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,821
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	147
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	236
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,371
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	0
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	20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	0.476
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	1,001
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,776
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	221
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	244

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	2,475
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	0
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	29.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	3.44
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	2,015
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,988

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	263	149	78.7	59.6	55.1	51.8
Monetary damages from air pollution - Natural Gas (million 2019$)	0	294	286	260	195	204	98.9
Monetary damages from air pollution - Transportation (million 2019$)	0	1,469	1,526	1,582	1,645	1,708	1,772
Premature deaths from air pollution - Coal (deaths)	0	29.6	16.7	8.83	6.68	6.18	5.81
Premature deaths from air pollution - Natural Gas (deaths)	0	33.2	32.3	29.3	22	23	11.2
Premature deaths from air pollution - Transportation (deaths)	0	165	172	178	185	192	199