Net-Zero America - montana 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	0.766	0.814	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45.7	57.3	92.7	99.6	100	100	100
Sales of cooking units - Gas (%)	54.3	42.7	7.31	0.368	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.38	15	36.8	80.8	89	89.6	89.4
Sales of space heating units - Electric Resistance (%)	7.67	12.7	10	4.36	3.39	3.35	3.38
Sales of space heating units - Fossil (%)	12.7	18.7	15.1	7.32	5.58	5.36	5.5
Sales of space heating units - Gas (%)	73.2	53.7	38.1	7.52	2.07	1.74	1.73
Sales of water heating units - Electric Heat Pump (%)	0	0.885	12.1	36.6	40.9	41.1	41.1
Sales of water heating units - Electric Resistance (%)	14.1	27	35.5	53.8	57.2	57.4	57.4
Sales of water heating units - Gas Furnace (%)	84.6	70.7	51	8.14	0.479	0	0
Sales of water heating units - Other (%)	1.29	1.44	1.45	1.46	1.47	1.47	1.48

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	355	907	1,474	2,231	2,430	2,316
Public EV charging plugs - DC Fast (1000 units)	0.064	0	0.767	0	3.41	0	5.52
Public EV charging plugs - L2 (1000 units)	0.076	0	18.5	0	82.2	0	133
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 (%)	1.99	2.19	1.44	0.465	0.082	0.013	0
Vehicle sales - Light-duty - EV (%)	2.46	10.8	39.4	79	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.3	83	56.1	19.4	3.67	0.602	0
Vehicle sales - Light-duty - hybrid (%)	3	3.52	2.71	1.06	0.248	0.051	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.364	0.239	0.076	0.015	0.002	0
Vehicle sales - Light-duty - other (%)	0.121	0.118	0.082	0.029	0.006	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)	39.7	39.7	38.9	36.8	34.2	32.3	31.5
Final energy use - Industry (PJ)	59.8	61.8	62	63.1	66.8	68.2	69.6
Final energy use - Residential (PJ)	52.9	50.4	48	42.8	36.5	31.6	28.2
Final energy use - Transportation (PJ)	114	107	94.2	79	65.2	56.7	53

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	2,913	3,241	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 (%)	1.5	8.17	31.2	81.3	90.2	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.52	3.43	4.91	8.08	8.65	8.7	8.7
Sales of space heating units - Fossil (%)	0.745	0.218	0.042	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 (%)	96.2	88.2	63.9	10.6	1.1	0.5	0.497
Sales of water heating units - Electric Heat Pump (%)	0.014	1.08	14.4	43.7	48.9	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.703	2.51	15.8	44.8	50.1	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.684	0.713	1.5	1.62	1.36	1.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Wind - Base (billion $2018)	0	0	6.09	15.4	28.1	21.2	1.68
Capital invested - Wind - Constrained (billion $2018)	0	0	14.1	16.9	22.7	17.6	1.66

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Wind - Base land use assumptions (GWh)	5,019	0	16,177	42,568	81,071	63,846	5,307
Wind - Constrained land use assumptions (GWh)	5,019	0	33,159	45,952	58,547	46,618	4,015

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	51.6	244	351
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	651	2,428	1,352
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	1	7	11
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0.02	0.86	3.99	5.78
Annual - BECCS (MMT)	0	0	0	0	0.84	3.96	5.7
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0.02	0.03	0.03	0.09
Cumulative - All (MMT)	0	0	0	0.02	0.88	4.87	10.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - BECCS (MMT)	0	0	0	0	0.84	4.8	10.5
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0.02	0.05	0.08	0.17

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	1.1	3.52	6.32	9.47	13.1
Injection wells (wells)	0	0	2	8	14	23	28
Resource characterization, appraisal, permitting costs (million $2020)	0	70.3	211	281	281	281	281
Wells and facilities construction costs (million $2020)	0	0	58.5	228	406	680	844

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	803	979	976	1,581	2,108
Cumulative investment - All (million $2018)	0	0	1,000	1,096	1,101	1,440	1,718
Cumulative investment - Spur (million $2018)	0	0	89.1	185	191	529	807
Cumulative investment - Trunk (million $2018)	0	0	911	911	911	911	911
Spur (km)	0	0	171	348	345	949	1,476
Trunk (km)	0	0	631	631	631	631	631

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	-3,913
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-379
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,292
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	-2,050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-190
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,239
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	6,058
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	586
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	6,645
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	3,176
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	293

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	3,469

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	4,315
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	18,160
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	9,080
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,427
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,249

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	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	129
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,502
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	48.1
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	900
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	3,049

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	7,726

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	29.3	0.026	0.026	0.021	0.013	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	8.16	4.5	3.31	2.97	1.97	0.803
Monetary damages from air pollution - Transportation (million 2019$)	0	31.4	28.6	21.2	11.8	5.17	1.86
Premature deaths from air pollution - Coal (deaths)	0	3.29	0.003	0.003	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.922	0.508	0.374	0.336	0.223	0.091
Premature deaths from air pollution - Transportation (deaths)	0	3.53	3.22	2.38	1.33	0.581	0.21

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	0.756	0.872	1.77	0.676	61.5	237	282
By economic sector - Construction (jobs)	2,589	2,303	4,690	9,475	18,099	20,940	17,188
By economic sector - Manufacturing (jobs)	1,890	1,801	2,738	3,857	4,732	4,623	4,155
By economic sector - Mining (jobs)	2,521	1,560	977	757	523	420	316
By economic sector - Other (jobs)	271	208	389	890	1,774	2,245	2,228
By economic sector - Pipeline (jobs)	181	183	299	187	155	166	159
By economic sector - Professional (jobs)	1,379	1,256	2,527	6,074	12,320	15,731	14,431
By economic sector - Trade (jobs)	2,118	1,474	1,737	3,436	6,579	8,409	7,904
By economic sector - Utilities (jobs)	1,355	1,593	3,822	8,066	16,794	18,507	13,362
By education level - All sectors - Associates degree or some college (jobs)	3,637	3,131	5,444	10,497	19,726	22,975	19,268
By education level - All sectors - Bachelors degree (jobs)	2,568	2,232	3,578	6,825	12,704	15,069	12,960
By education level - All sectors - Doctoral degree (jobs)	82.5	73.7	128	272	527	658	595
By education level - All sectors - High school diploma or less (jobs)	5,437	4,426	7,162	13,403	24,741	28,549	23,705
By education level - All sectors - Masters or professional degree (jobs)	579	516	870	1,745	3,339	4,025	3,497
By resource sector - Biomass (jobs)	3.13	3.74	4.88	1.93	185	864	1,204
By resource sector - CO2 (jobs)	0	37.3	1,182	508	539	966	1,161
By resource sector - Coal (jobs)	2,818	1,275	289	38.3	28.4	22.1	18.5
By resource sector - Grid (jobs)	1,518	2,065	5,617	14,735	31,818	34,432	23,747
By resource sector - Natural Gas (jobs)	1,119	1,057	866	678	516	356	304
By resource sector - Nuclear (jobs)	0	0	0.003	0.007	0	0	0
By resource sector - Oil (jobs)	3,206	2,936	2,511	2,051	1,458	1,047	650
By resource sector - Solar (jobs)	2,567	1,501	1,612	2,268	2,400	2,542	3,997
By resource sector - Wind (jobs)	1,073	1,504	5,100	12,462	24,093	31,048	28,942
Median wages - Annual - All ($2019 per job)	56,992	58,901	59,961	61,023	62,415	63,410	64,072
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	1,912	1,641	2,823	5,410	10,152	11,785	9,819
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	734	650	1,192	2,346	4,507	5,268	4,377
On-Site or In-Plant Training - Total jobs - None (jobs)	1,935	1,662	2,785	5,331	9,916	11,671	9,961
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	87.4	79.9	150	295	563	655	544
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	7,635	6,346	10,231	19,360	35,900	41,898	35,324
On-the-Job Training - All sectors - 1 to 4 years (jobs)	2,404	2,085	3,647	7,027	13,234	15,381	12,818

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)	699	619	1,166	2,324	4,496	5,254	4,356
On-the-Job Training - All sectors - None (jobs)	691	579	926	1,756	3,251	3,831	3,282
On-the-Job Training - All sectors - Over 10 years (jobs)	114	99.5	169	309	553	640	544
On-the-Job Training - All sectors - Up to 1 year (jobs)	8,395	6,996	11,273	21,326	39,504	46,171	39,023
Related work experience - All sectors - 1 to 4 years (jobs)	4,520	3,793	6,201	11,815	22,058	25,790	21,730
Related work experience - All sectors - 4 to 10 years (jobs)	2,759	2,388	4,053	7,777	14,575	17,054	14,369
Related work experience - All sectors - None (jobs)	1,712	1,466	2,463	4,677	8,745	10,185	8,533
Related work experience - All sectors - Over 10 years (jobs)	736	642	1,074	2,030	3,749	4,361	3,671
Related work experience - All sectors - Up to 1 year (jobs)	2,577	2,090	3,391	6,444	11,911	13,886	11,720
Wage income - All (million $2019)	701	611	1,030	1,998	3,810	4,520	3,846

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	66.4	67.4	56.8	45.5	34.3	21.6	15
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	1,372
Natural gas production - Annual (tcf)	46.4	51.4	48.6	42.3	35.8	28.4	22
Oil consumption - Annual (million bbls)	40	38.1	33.4	26.3	19.3	13.8	9.02
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	802
Oil production - Annual (million bbls)	25.8	27.9	28	28	22.2	18	12

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	0.764	0.811	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45.5	46.9	51.9	65.1	83.3	94.6	98.6
Sales of cooking units - Gas (%)	54.5	53.1	48.1	34.9	16.7	5.38	1.45
Sales of space heating units - Electric Heat Pump (%)	6.38	13.4	14.6	18.9	28.9	41.1	47.9
Sales of space heating units - Electric Resistance (%)	7.67	12.8	12.6	12.2	11.2	9.66	8.73
Sales of space heating units - Fossil (%)	12.7	18.9	19	17.6	14.9	12.7	12
Sales of space heating units - Gas (%)	73.2	54.8	53.7	51.3	45	36.6	31.3
Sales of water heating units - Electric Heat Pump (%)	0	0.236	0.883	3.03	8.23	14.8	18.7
Sales of water heating units - Electric Resistance (%)	14.1	26.5	27.1	28.9	33	37.9	40.9
Sales of water heating units - Gas Furnace (%)	84.6	71.8	70.5	66.6	57.3	45.8	39
Sales of water heating units - Other (%)	1.29	1.45	1.46	1.47	1.48	1.48	1.48

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	56.9	121	407	1,283	1,868
Public EV charging plugs - DC Fast (1000 units)	0.064	0	0.231	0	1.26	0	3.54
Public EV charging plugs - L2 (1000 units)	0.076	0	5.57	0	30.4	0	85.3
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 (%)	1.99	2.33	2.14	1.73	1.14	0.597	0.254

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.38	3.57	9.48	22	44.1	69.2	86.4
Vehicle sales - Light-duty - gasoline (%)	93.3	89.6	83.4	71.5	51	27.9	12.2
Vehicle sales - Light-duty - hybrid (%)	3.08	3.99	4.56	4.36	3.48	2.18	1.1
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.393	0.352	0.279	0.205	0.117	0.054
Vehicle sales - Light-duty - other (%)	0.122	0.125	0.117	0.104	0.077	0.043	0.02
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)	39.7	39.8	39.5	39.3	39	38.5	38.2
Final energy use - Industry (PJ)	59.8	62	62.6	64.9	69.5	70.8	71.6
Final energy use - Residential (PJ)	52.9	50.4	48.8	47.5	46.1	44.2	41.9
Final energy use - Transportation (PJ)	114	108	97.9	90.4	84.6	78	70.1

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	2,913	3,236	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 (%)	1.5	6.8	8.07	12.3	22.6	35.6	43.2
Sales of space heating units - Electric Resistance (%)	1.52	3.34	3.42	3.7	4.38	5.25	5.76
Sales of space heating units - Fossil (%)	0.745	0.256	0.248	0.218	0.176	0.148	0.138
Sales of space heating units - Gas Furnace (%)	96.2	89.6	88.3	83.8	72.8	59	50.9
Sales of water heating units - Electric Heat Pump (%)	0.014	0.311	1.08	3.65	9.87	17.8	22.4
Sales of water heating units - Electric Resistance (%)	0.703	1.74	2.51	5.07	11.2	19.1	23.7
Sales of water heating units - Gas Furnace (%)	99.1	97.6	96	90.9	78.5	62.8	53.5
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.533	0.545	0.763	0.799	1.2	1.28

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	-3,913
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-379
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,292
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	-2,050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-190

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,239
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	6,058
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	586
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	6,645
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	3,176
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	293
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,469

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	4,315
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	18,160
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	9,080

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	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,427
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,249
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	129
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,502
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	48.1

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	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	900
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	3,049
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	7,726

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	29.3	0.026	0.026	0.021	0.013	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	8.47	4.06	2.53	1.59	0.897	0.528
Monetary damages from air pollution - Transportation (million 2019$)	0	31.8	31.3	29.7	26.1	20.2	13.5
Premature deaths from air pollution - Coal (deaths)	0	3.29	0.003	0.003	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.956	0.458	0.286	0.18	0.101	0.06
Premature deaths from air pollution - Transportation (deaths)	0	3.58	3.52	3.34	2.93	2.27	1.51

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	0.766	0.814	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45.7	57.3	92.7	99.6	100	100	100
Sales of cooking units - Gas (%)	54.3	42.7	7.31	0.368	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.38	15	36.8	80.8	89	89.6	89.4
Sales of space heating units - Electric Resistance (%)	7.67	12.7	10	4.36	3.39	3.35	3.38
Sales of space heating units - Fossil (%)	12.7	18.7	15.1	7.32	5.58	5.36	5.5
Sales of space heating units - Gas (%)	73.2	53.7	38.1	7.52	2.07	1.74	1.73
Sales of water heating units - Electric Heat Pump (%)	0	0.885	12.1	36.6	40.9	41.1	41.1
Sales of water heating units - Electric Resistance (%)	14.1	27	35.5	53.8	57.2	57.4	57.4
Sales of water heating units - Gas Furnace (%)	84.6	70.7	51	8.14	0.479	0	0
Sales of water heating units - Other (%)	1.29	1.44	1.45	1.46	1.47	1.47	1.48

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	355	907	1,474	2,231	2,430	2,316
Public EV charging plugs - DC Fast (1000 units)	0.064	0	0.767	0	3.41	0	5.52
Public EV charging plugs - L2 (1000 units)	0.076	0	18.5	0	82.2	0	133
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 (%)	1.99	2.19	1.44	0.465	0.082	0.013	0
Vehicle sales - Light-duty - EV (%)	2.46	10.8	39.4	79	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.3	83	56.1	19.4	3.67	0.602	0
Vehicle sales - Light-duty - hybrid (%)	3	3.52	2.71	1.06	0.248	0.051	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.364	0.239	0.076	0.015	0.002	0
Vehicle sales - Light-duty - other (%)	0.121	0.118	0.082	0.029	0.006	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)	39.7	39.7	38.9	36.8	34.2	32.3	31.5
Final energy use - Industry (PJ)	59.8	61.8	62	63.1	66.8	68.2	69.6
Final energy use - Residential (PJ)	52.9	50.4	48	42.8	36.5	31.6	28.2
Final energy use - Transportation (PJ)	114	107	94.2	79	65.2	56.7	53

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	2,913	3,241	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 (%)	1.5	8.17	31.2	81.3	90.2	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.52	3.43	4.91	8.08	8.65	8.7	8.7
Sales of space heating units - Fossil (%)	0.745	0.218	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	96.2	88.2	63.9	10.6	1.1	0.5	0.497
Sales of water heating units - Electric Heat Pump (%)	0.014	1.08	14.4	43.7	48.9	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.703	2.51	15.8	44.8	50.1	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.684	0.713	1.5	1.62	1.36	1.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion $2018)	0	0	6.97	38.5	52.8	46	55.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	5,019	0	18,423	106,433	149,752	133,206	162,262
Wind - Constrained land use assumptions (GWh)	5,019	0	36,764	91,058	117,649	71,623	155,570

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	-3,913
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-379
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,292
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	-2,050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-190
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,239
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	6,058
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	586
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	6,645
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	3,176
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	293
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,469

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	4,315
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	18,160

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

Item	2020	2025	2050
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	9,080
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,427
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,249
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	129
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,502

Table 33: *E+RE+ 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	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	48.1
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	900
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	3,049
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	7,726

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	29.3	0.026	0.026	0.021	0.013	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	7.45	3.7	1.91	1.51	0.909	0.379
Monetary damages from air pollution - Transportation (million 2019$)	0	31.4	28.6	21.2	11.8	5.17	1.86
Premature deaths from air pollution - Coal (deaths)	0	3.29	0.003	0.003	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.842	0.418	0.216	0.17	0.103	0.043
Premature deaths from air pollution - Transportation (deaths)	0	3.53	3.22	2.38	1.33	0.581	0.21

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	0.766	0.814	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45.7	57.3	92.7	99.6	100	100	100
Sales of cooking units - Gas (%)	54.3	42.7	7.31	0.368	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.38	15	36.8	80.8	89	89.6	89.4
Sales of space heating units - Electric Resistance (%)	7.67	12.7	10	4.36	3.39	3.35	3.38
Sales of space heating units - Fossil (%)	12.7	18.7	15.1	7.32	5.58	5.36	5.5
Sales of space heating units - Gas (%)	73.2	53.7	38.1	7.52	2.07	1.74	1.73
Sales of water heating units - Electric Heat Pump (%)	0	0.885	12.1	36.6	40.9	41.1	41.1
Sales of water heating units - Electric Resistance (%)	14.1	27	35.5	53.8	57.2	57.4	57.4
Sales of water heating units - Gas Furnace (%)	84.6	70.7	51	8.14	0.479	0	0
Sales of water heating units - Other (%)	1.29	1.44	1.45	1.46	1.47	1.47	1.48

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	355	907	1,474	2,231	2,430	2,316
Public EV charging plugs - DC Fast (1000 units)	0.064	0	0.767	0	3.41	0	5.52
Public EV charging plugs - L2 (1000 units)	0.076	0	18.5	0	82.2	0	133
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 (%)	1.99	2.19	1.44	0.465	0.082	0.013	0
Vehicle sales - Light-duty - EV (%)	2.46	10.8	39.4	79	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.3	83	56.1	19.4	3.67	0.602	0
Vehicle sales - Light-duty - hybrid (%)	3	3.52	2.71	1.06	0.248	0.051	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.364	0.239	0.076	0.015	0.002	0
Vehicle sales - Light-duty - other (%)	0.121	0.118	0.082	0.029	0.006	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)	39.7	39.7	38.9	36.8	34.2	32.3	31.5
Final energy use - Industry (PJ)	59.8	61.8	62	63.1	66.8	68.2	69.6
Final energy use - Residential (PJ)	52.9	50.4	48	42.8	36.5	31.6	28.2
Final energy use - Transportation (PJ)	114	107	94.2	79	65.2	56.7	53

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	2,913	3,241	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 (%)	1.5	8.17	31.2	81.3	90.2	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.52	3.43	4.91	8.08	8.65	8.7	8.7
Sales of space heating units - Fossil (%)	0.745	0.218	0.042	0.002	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 (%)	96.2	88.2	63.9	10.6	1.1	0.5	0.497
Sales of water heating units - Electric Heat Pump (%)	0.014	1.08	14.4	43.7	48.9	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.703	2.51	15.8	44.8	50.1	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.684	0.713	1.5	1.62	1.36	1.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion $2018)	0	0	3.32	2.67	16	13.4	0
Capital invested - Wind - Constrained (billion $2018)	0	0	4.62	8.11	17.2	11.2	0

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

Item	2020	2025	2030	2035	2040	2045
Wind - Base land use assumptions (GWh)	5,019	0	8,928	7,497	46,532	41,025
Wind - Constrained land use assumptions (GWh)	5,019	0	11,765	22,225	48,474	30,917

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	-3,913
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-379
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,292
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	-2,050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-190
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,239
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	6,058
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	586
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	6,645
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	3,176

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	293
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,469

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	4,315
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	18,160
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	9,080
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,427

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	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,249
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	129
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,502
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	48.1
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	900

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	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	3,049
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	7,726

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	29.3	0.026	0.026	0.021	0.013	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	8.16	4.5	4.37	4.98	2.56	0.684
Monetary damages from air pollution - Transportation (million 2019$)	0	31.4	28.6	21.2	11.8	5.17	1.86
Premature deaths from air pollution - Coal (deaths)	0	3.29	0.003	0.003	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.922	0.508	0.494	0.562	0.289	0.077
Premature deaths from air pollution - Transportation (deaths)	0	3.53	3.22	2.38	1.33	0.581	0.21

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	0.764	0.811	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45.5	46.9	51.9	65.1	83.3	94.6	98.6
Sales of cooking units - Gas (%)	54.5	53.1	48.1	34.9	16.7	5.38	1.45
Sales of space heating units - Electric Heat Pump (%)	6.38	13.4	14.6	18.9	28.9	41.1	47.9
Sales of space heating units - Electric Resistance (%)	7.67	12.8	12.6	12.2	11.2	9.66	8.73
Sales of space heating units - Fossil (%)	12.7	18.9	19	17.6	14.9	12.7	12
Sales of space heating units - Gas (%)	73.2	54.8	53.7	51.3	45	36.6	31.3
Sales of water heating units - Electric Heat Pump (%)	0	0.236	0.883	3.03	8.23	14.8	18.7
Sales of water heating units - Electric Resistance (%)	14.1	26.5	27.1	28.9	33	37.9	40.9
Sales of water heating units - Gas Furnace (%)	84.6	71.8	70.5	66.6	57.3	45.8	39
Sales of water heating units - Other (%)	1.29	1.45	1.46	1.47	1.48	1.48	1.48

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	56.9	121	407	1,283	1,868
Public EV charging plugs - DC Fast (1000 units)	0.064	0	0.231	0	1.26	0	3.54
Public EV charging plugs - L2 (1000 units)	0.076	0	5.57	0	30.4	0	85.3
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 (%)	1.99	2.33	2.14	1.73	1.14	0.597	0.254
Vehicle sales - Light-duty - EV (%)	1.38	3.57	9.48	22	44.1	69.2	86.4
Vehicle sales - Light-duty - gasoline (%)	93.3	89.6	83.4	71.5	51	27.9	12.2
Vehicle sales - Light-duty - hybrid (%)	3.08	3.99	4.56	4.36	3.48	2.18	1.1
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.393	0.352	0.279	0.205	0.117	0.054
Vehicle sales - Light-duty - other (%)	0.122	0.125	0.117	0.104	0.077	0.043	0.02
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)	39.7	39.8	39.5	39.3	39	38.5	38.2
Final energy use - Industry (PJ)	59.8	62	62.6	64.9	69.5	70.8	71.6
Final energy use - Residential (PJ)	52.9	50.4	48.8	47.5	46.1	44.2	41.9
Final energy use - Transportation (PJ)	114	108	97.9	90.4	84.6	78	70.1

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	2,913	3,236	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 (%)	1.5	6.8	8.07	12.3	22.6	35.6	43.2
Sales of space heating units - Electric Resistance (%)	1.52	3.34	3.42	3.7	4.38	5.25	5.76
Sales of space heating units - Fossil (%)	0.745	0.256	0.248	0.218	0.176	0.148	0.138
Sales of space heating units - Gas Furnace (%)	96.2	89.6	88.3	83.8	72.8	59	50.9
Sales of water heating units - Electric Heat Pump (%)	0.014	0.311	1.08	3.65	9.87	17.8	22.4
Sales of water heating units - Electric Resistance (%)	0.703	1.74	2.51	5.07	11.2	19.1	23.7
Sales of water heating units - Gas Furnace (%)	99.1	97.6	96	90.9	78.5	62.8	53.5
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.533	0.545	0.763	0.799	1.2	1.28

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	0.007	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0.029	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	7.37	7.39
Biomass w/ccu power plant (GWh)	0	0	0	0	0	32.3	32.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	276	394	484

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	0	3,205	1,391	1,046
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	4	6	8
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0.02	4.15	5.92	7.33
Annual - BECCS (MMT)	0	0	0	0	4.12	5.89	7.23
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0.02	0.03	0.03	0.09
Cumulative - All (MMT)	0	0	0	0.02	4.17	10.1	17.4
Cumulative - BECCS (MMT)	0	0	0	0	4.12	10	17.2
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0.02	0.05	0.08	0.17

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	2.77	10.7	21.4	28.6	30.9
Injection wells (wells)	0	0	5	20	35	59	73
Resource characterization, appraisal, permitting costs (million $2020)	0	70.3	323	506	506	506	506
Wells and facilities construction costs (million $2020)	0	0	152	593	1,057	1,767	2,194

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	803	979	1,119	1,413	2,232
Cumulative investment - All (million $2018)	0	0	1,000	1,101	1,204	1,382	1,840
Cumulative investment - Spur (million $2018)	0	0	89.2	191	294	471	929
Cumulative investment - Trunk (million $2018)	0	0	911	911	911	911	911
Spur (km)	0	0	171	348	487	781	1,601
Trunk (km)	0	0	631	631	631	631	631

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	-41.1
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,856
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	-373
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-4,270
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-41.1

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	-2,020
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	-186
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,247
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	71.9
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	14,741
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	26.2
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	576
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	15,427
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	71.9
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	3,129
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	26.2
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	11.7
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	288
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,527

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	4,315
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	18,160

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	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	9,080
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,427
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,249
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	129
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,502

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	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	48.1
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	900
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	3,049
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	7,726

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	0.752	0.765	0	0	0	0
Sales of cooking units - Electric Resistance (%)	45	45	45	45	45	45	45
Sales of cooking units - Gas (%)	55	55	55	55	55	55	55
Sales of space heating units - Electric Heat Pump (%)	5.75	17	17.3	17.9	18.4	19	19.4
Sales of space heating units - Electric Resistance (%)	7.76	12.4	12.2	12.2	12.1	11.8	11.2
Sales of space heating units - Fossil (%)	12.8	17.8	18.1	17.5	16.3	15.8	16.4
Sales of space heating units - Gas (%)	73.7	52.8	52.4	52.5	53.2	53.4	53
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	14.1	26.3	26.5	26.7	26.9	27	27.1
Sales of water heating units - Gas Furnace (%)	84.6	72.2	72.1	71.9	71.6	71.5	71.4
Sales of water heating units - Other (%)	1.29	1.45	1.46	1.47	1.48	1.49	1.49

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 (%)	1.99	2.33	2.26	2.1	1.91	1.79	1.7
Vehicle sales - Light-duty - EV (%)	2.12	3.76	4.3	5.17	6.37	7.62	8.71
Vehicle sales - Light-duty - gasoline (%)	92.6	89.4	88.1	86.8	85.2	83.3	81.5
Vehicle sales - Light-duty - hybrid (%)	3.02	3.95	4.84	5.43	6.09	6.85	7.62
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.392	0.372	0.337	0.339	0.344	0.356
Vehicle sales - Light-duty - other (%)	0.122	0.125	0.123	0.125	0.125	0.125	0.129
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)	39.7	40.5	41.2	41.2	41.3	42.1	44
Final energy use - Industry (PJ)	59.8	64.3	67.6	71.3	75.8	81.9	87.9
Final energy use - Residential (PJ)	52.9	50.7	49.9	49.5	49.7	50.2	50.6
Final energy use - Transportation (PJ)	114	108	98.9	93.7	93.4	95.8	99

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	2,877	3,019	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 (%)	1.5	13.9	46.9	73.9	78.3	78.8	78.8
Sales of space heating units - Electric Resistance (%)	1.52	4.25	8.7	15.6	19.9	20.6	20.7
Sales of space heating units - Fossil (%)	0.745	0.237	0.139	0.039	0.005	0	0
Sales of space heating units - Gas Furnace (%)	96.2	81.6	44.3	10.4	1.72	0.56	0.498
Sales of water heating units - Electric Heat Pump (%)	0.014	0.03	0.03	0.03	0.03	0.03	0.03
Sales of water heating units - Electric Resistance (%)	0.703	1.46	1.46	1.47	1.46	1.47	1.46
Sales of water heating units - Gas Furnace (%)	99.1	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.168	0.382	0.381	0.382	0.381	0.382	0.382

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	0.658	0.684	0.911	0.962	0.877	0.911

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-13.8	0	5.12	1.47
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.514	0	-1.07	-1.12
Business-as-usual carbon sink - Total (Mt CO2e/y)	-14.3	0	4.05	0.342
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	4,315

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	52,197
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	950
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	7,336
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	123
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,890
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	2,115
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	18,160
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	9,758
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	7,549
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	2,162
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	18,935
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	2,818
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	62.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	630
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	740
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	9,080
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	739
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	2,545
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	3,239
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	35,565
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	554
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	5,077
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	92
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,260
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,427
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	13,620
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	5,249
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	5,047
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	706
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	129

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	3,741
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	45.4
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	201
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	1,201
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	277
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	2,502
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	8,802
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	353
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	121
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,433
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	22.7
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	106
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	600
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	48.1
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	1,514
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,198
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	529
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	125
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	2,587
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	34.2
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	153
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	900
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	347
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	3,049
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	7,726

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	60.3	33.8	16.6	12.8	11.4	10.7
Monetary damages from air pollution - Natural Gas (million 2019$)	0	9.15	8.16	8.02	6	5.54	3.98
Monetary damages from air pollution - Transportation (million 2019$)	0	31.9	31.7	31.6	31.7	31.7	31.7
Premature deaths from air pollution - Coal (deaths)	0	6.77	3.79	1.87	1.44	1.28	1.2
Premature deaths from air pollution - Natural Gas (deaths)	0	1.03	0.922	0.906	0.677	0.625	0.45
Premature deaths from air pollution - Transportation (deaths)	0	3.58	3.57	3.56	3.56	3.56	3.56