

Net-Zero America - arkansas 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).

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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	2.31	2.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.7	62.8	93.6	99.7	100	100	100
Sales of cooking units - Gas (%)	47.3	37.2	6.37	0.321	0	0	0
Sales of space heating units - Electric Heat Pump (%)	11.9	27.2	74.3	84.8	85.3	85.2	85.2
Sales of space heating units - Electric Resistance (%)	34.9	33.8	14.2	9.82	9.65	9.82	9.86
Sales of space heating units - Fossil (%)	8.14	11.9	5.59	4.18	4.11	4.04	4.03
Sales of space heating units - Gas (%)	45.1	27.1	5.9	1.18	0.978	0.957	0.954
Sales of water heating units - Electric Heat Pump (%)	0	11.3	59.7	70.6	71.1	71.1	71.1
Sales of water heating units - Electric Resistance (%)	44.5	51.9	32.1	27.6	27.4	27.4	27.4
Sales of water heating units - Gas Furnace (%)	53.7	35.3	6.65	0.277	0	0	0
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.49	1.49	1.5	1.5

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	542	1,384	2,253	3,409	3,714	3,539
Public EV charging plugs - DC Fast (1000 units)	0.043	0	1.12	0	5.01	0	8.11
Public EV charging plugs - L2 (1000 units)	0.243	0	26.9	0	120	0	195
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 (%)	1.81	2.04	1.36	0.439	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.04	12.5	42.3	80.1	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.3	81	53.1	18.2	3.51	0.597	0
Vehicle sales - Light-duty - hybrid (%)	3.57	3.93	2.92	1.11	0.266	0.056	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.354	0.224	0.071	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.113	0.11	0.074	0.026	0.005	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)	90	90.4	87	81.6	77.4	76.4	78.1
Final energy use - Industry (PJ)	236	242	246	246	250	250	255
Final energy use - Residential (PJ)	123	117	108	95.6	85.1	78.9	76.1
Final energy use - Transportation (PJ)	324	303	265	220	179	155	146

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	10,539	12,307	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	2.92	27.3	77.1	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2.74	4.44	4.73	6.05	6.35	6.37	6.39
Sales of space heating units - Fossil (%)	0	0	0	0	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 (%)	94.3	68.3	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.08	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	2.31	8.07	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	96.5	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.42	2.48	3.87	4.09	4.01	4.2

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	0.022	0	0	0.032
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	4.37	0	0.029
Capital invested - Solar PV - Base (billion \$2018)	0	1.14	0.219	3.29	4.23	0.151	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0.354	1.18	3.58	3.11	0.641	0
Capital invested - Wind - Base (billion \$2018)	0	3.48	8.29	10.5	12.8	10.5	21.2
Capital invested - Wind - Constrained (billion \$2018)	0	7.97	11.9	18.7	25.5	0.59	24.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	21.7	21.7	21.7	53.4
Biomass w/ccu power plant (GWh)	0	0	0	0	4,907	4,907	4,940
Solar - Base land use assumptions (GWh)	409	1,634	348	5,704	7,789	293	0
Solar - Constrained land use assumptions (GWh)	390	0	2,376	8,004	5,204	551	0
Wind - Base land use assumptions (GWh)	315	7,953	20,431	28,313	34,898	28,467	60,107
Wind - Constrained land use assumptions (GWh)	1,989	17,265	30,171	46,574	73,989	1,830	74,128

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	79.9	391	858	1,068
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	0	1,551	6,476	8,924	4,059
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	4	14	17
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	4	4	5
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	1.95	9.81	21.3	26.4
Annual - BECCS (MMT)	0	0	0	1.95	9.81	21.3	26.4
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	1.95	11.8	33	59.5
Cumulative - BECCS (MMT)	0	0	0	1.95	11.8	33	59.5
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	2.19	8.81	16.3	25.8	35.4
Injection wells (wells)	0	0	2	10	18	30	38
Resource characterization, appraisal, permitting costs (million \$2020)	0	14.2	255	404	404	404	404
Wells and facilities construction costs (million \$2020)	0	0	78.2	305	543	909	1,128

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	39.8	140	420	894	1,699
Cumulative investment - All (million \$2018)	0	0	244	540	812	1,335	2,026
Cumulative investment - Spur (million \$2018)	0	0	0	50.8	323	846	1,537
Cumulative investment - Trunk (million \$2018)	0	0	244	489	489	489	489
Spur (km)	0	0	0	60.8	341	815	1,619
Trunk (km)	0	0	39.8	79.6	79.6	79.6	79.6

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	-243
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-10,076
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-64.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-10,383
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-243
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,130
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-32.4
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,405
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,955
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	118
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	3,170
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,507
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	58.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,662

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,549
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,608
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	29,786
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	9,217

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	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	58.3
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	561
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	56
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	175
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	844
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	81.2

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	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,737

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	321	0.218	0.207	0.161	0.105	0.004
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	113	64.1	34	28.5	12.5	6.16
Monetary damages from air pollution - Transportation (million 2019\$)	0	404	374	283	163	74.8	30.8
Premature deaths from air pollution - Coal (deaths)	0	36	0.024	0.023	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	12.8	7.24	3.84	3.21	1.41	0.695
Premature deaths from air pollution - Transportation (deaths)	0	45.5	42.1	31.8	18.3	8.42	3.46

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	106	122	247	259	772	1,312	1,336
By economic sector - Construction (jobs)	3,854	4,896	6,363	11,223	15,191	14,823	20,176
By economic sector - Manufacturing (jobs)	3,347	5,351	6,235	8,016	8,218	7,279	9,324
By economic sector - Mining (jobs)	5,485	4,370	3,274	2,308	1,469	913	501
By economic sector - Other (jobs)	201	378	481	1,264	1,956	1,707	2,330
By economic sector - Pipeline (jobs)	464	462	422	348	245	210	294
By economic sector - Professional (jobs)	2,919	3,306	4,324	7,167	10,566	12,169	16,526
By economic sector - Trade (jobs)	2,461	2,329	2,667	4,131	5,742	6,200	8,554
By economic sector - Utilities (jobs)	6,463	5,433	5,851	9,006	12,339	13,051	18,471
By education level - All sectors - Associates degree or some college (jobs)	7,727	8,235	9,338	13,898	17,964	18,160	24,604
By education level - All sectors - Bachelors degree (jobs)	5,816	5,967	6,481	9,160	11,755	12,197	16,367
By education level - All sectors - Doctoral degree (jobs)	197	206	233	346	474	521	698
By education level - All sectors - High school diploma or less (jobs)	10,139	10,795	12,232	18,040	23,297	23,593	31,540
By education level - All sectors - Masters or professional degree (jobs)	1,421	1,442	1,582	2,278	3,008	3,194	4,302
By resource sector - Biomass (jobs)	438	523	682	737	2,323	4,786	5,704
By resource sector - CO2 (jobs)	0	5.51	379	463	249	721	1,891
By resource sector - Coal (jobs)	2,316	901	80.8	0	0	0	0
By resource sector - Grid (jobs)	6,566	5,282	7,780	14,354	20,576	22,284	32,952
By resource sector - Natural Gas (jobs)	9,700	9,323	7,514	5,850	5,167	3,424	1,726
By resource sector - Nuclear (jobs)	946	549	0.005	0.01	0.011	0.023	0.035
By resource sector - Oil (jobs)	4,064	3,609	2,977	2,297	1,546	1,027	571
By resource sector - Solar (jobs)	901	2,982	2,521	6,677	8,730	4,946	5,816
By resource sector - Wind (jobs)	369	3,471	7,932	13,343	17,906	20,476	28,852
Median wages - Annual - All (\$2019 per job)	53,841	53,507	53,547	53,429	54,135	55,332	56,196
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	4,065	4,292	4,836	7,148	9,211	9,294	12,561
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	1,653	1,721	1,962	2,972	3,911	3,977	5,402
On-Site or In-Plant Training - Total jobs - None (jobs)	4,052	4,337	4,872	7,160	9,290	9,515	12,757

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)	201	216	251	381	498	508	693
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	15,329	16,078	17,944	26,061	33,587	34,369	46,099
On-the-Job Training - All sectors - 1 to 4 years (jobs)	5,245	5,538	6,243	9,246	11,929	12,040	16,297
On-the-Job Training - All sectors - 4 to 10 years (jobs)	1,556	1,631	1,885	2,911	3,863	3,924	5,347
On-the-Job Training - All sectors - None (jobs)	1,380	1,449	1,598	2,345	3,041	3,108	4,169
On-the-Job Training - All sectors - Over 10 years (jobs)	230	262	294	430	537	527	703
On-the-Job Training - All sectors - Up to 1 year (jobs)	16,888	17,766	19,845	28,789	37,127	38,066	50,995
Related work experience - All sectors - 1 to 4 years (jobs)	9,357	9,737	10,843	15,763	20,344	20,782	27,917
Related work experience - All sectors - 4 to 10 years (jobs)	6,007	6,307	7,048	10,298	13,269	13,528	18,258
Related work experience - All sectors - None (jobs)	3,571	3,765	4,235	6,234	8,105	8,276	11,117
Related work experience - All sectors - Over 10 years (jobs)	1,653	1,750	1,931	2,762	3,489	3,529	4,753
Related work experience - All sectors - Up to 1 year (jobs)	4,711	5,087	5,808	8,665	11,289	11,550	15,465
Wage income - All (million \$2019)	1,362	1,426	1,599	2,336	3,059	3,191	4,356

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	275	279	235	189	142	89.4	62
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	5,687
Natural gas production - Annual (tcf)	650	720	681	593	501	397	309
Oil consumption - Annual (million bbls)	58.3	54.3	46.3	34.6	23.5	14.8	7.61
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	1,065
Oil production - Annual (million bbls)	6.01	6.5	6.52	6.52	5.16	4.2	2.79

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	2.28	2.67	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.5	53.8	58.1	69.6	85.5	95.3	98.7
Sales of cooking units - Gas (%)	47.5	46.2	41.9	30.4	14.5	4.68	1.26
Sales of space heating units - Electric Heat Pump (%)	11.9	18.1	23.5	39	62.6	78	83.3
Sales of space heating units - Electric Resistance (%)	34.9	37.6	35.2	28.7	19	12.7	10.5
Sales of space heating units - Fossil (%)	8.14	13.1	12.5	10.3	7.08	5.03	4.32
Sales of space heating units - Gas (%)	45.1	31.2	28.8	22	11.3	4.24	1.82
Sales of water heating units - Electric Heat Pump (%)	0	1.94	7.45	23.3	47.7	63.6	69.1
Sales of water heating units - Electric Resistance (%)	44.5	55.7	53.5	47.1	37	30.5	28.2
Sales of water heating units - Gas Furnace (%)	53.7	40.9	37.5	28.1	13.8	4.37	1.13
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.51	1.52	1.5	1.5

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	86.7	184	621	1,961	2,854
Public EV charging plugs - DC Fast (1000 units)	0.043	0	0.334	0	1.85	0	5.2
Public EV charging plugs - L2 (1000 units)	0.243	0	8.03	0	44.4	0	125
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 (%)	1.82	2.19	2.11	1.69	1.1	0.572	0.244
Vehicle sales - Light-duty - EV (%)	1.58	4.01	10.5	23.6	45.9	70.4	86.9
Vehicle sales - Light-duty - gasoline (%)	92.7	88.7	81.8	69.5	49	26.6	11.7
Vehicle sales - Light-duty - hybrid (%)	3.69	4.55	5.17	4.83	3.75	2.29	1.14
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.388	0.341	0.266	0.193	0.109	0.05
Vehicle sales - Light-duty - other (%)	0.114	0.118	0.109	0.096	0.07	0.039	0.018
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)	90	90.7	90.4	89.6	87.6	85.4	84.4
Final energy use - Industry (PJ)	236	243	246	249	254	253	258
Final energy use - Residential (PJ)	123	118	114	110	103	94.4	86.6
Final energy use - Transportation (PJ)	324	305	276	255	238	219	197

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	10,527	12,223	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	2.92	17.8	23.5	40	65.6	83.3	89.8
Sales of space heating units - Electric Resistance (%)	2.74	4.44	4.48	4.65	5.07	5.74	6.19
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	94.3	77.8	72	55.4	29.3	11	3.97
Sales of water heating units - Electric Heat Pump (%)	0.08	1.96	7.15	22.1	45	59.9	65.1
Sales of water heating units - Electric Resistance (%)	2.31	4.44	6.56	12.7	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	96.5	91.8	84.5	63.4	31	9.91	2.58
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.1	2.13	2.57	2.64	3.75	3.95

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	-243
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-10,076
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-64.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-10,383

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 tCO ₂ e/y)	0	0	-243
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)	0	0	-5,130
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-32.4
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-5,405
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,955
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	118
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	3,170
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,507
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	58.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,662

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,549

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,608
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	29,786
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	9,217
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	58.3
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	561
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	56
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	175
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	844
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	81.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,737

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	321	0.218	0.207	0.161	0.105	0.004
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	110	54	24.9	11.9	4.21	3.25
Monetary damages from air pollution - Transportation (million 2019\$)	0	410	410	397	357	283	194
Premature deaths from air pollution - Coal (deaths)	0	36	0.024	0.023	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	12.4	6.1	2.82	1.34	0.476	0.367
Premature deaths from air pollution - Transportation (deaths)	0	46.1	46.1	44.7	40.1	31.8	21.8

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	2.31	2.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.7	62.8	93.6	99.7	100	100	100
Sales of cooking units - Gas (%)	47.3	37.2	6.37	0.321	0	0	0
Sales of space heating units - Electric Heat Pump (%)	11.9	27.2	74.3	84.8	85.3	85.2	85.2
Sales of space heating units - Electric Resistance (%)	34.9	33.8	14.2	9.82	9.65	9.82	9.86
Sales of space heating units - Fossil (%)	8.14	11.9	5.59	4.18	4.11	4.04	4.03
Sales of space heating units - Gas (%)	45.1	27.1	5.9	1.18	0.978	0.957	0.954
Sales of water heating units - Electric Heat Pump (%)	0	11.3	59.7	70.6	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 (%)	44.5	51.9	32.1	27.6	27.4	27.4	27.4
Sales of water heating units - Gas Furnace (%)	53.7	35.3	6.65	0.277	0	0	0
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.49	1.49	1.5	1.5

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	542	1,384	2,253	3,409	3,714	3,539
Public EV charging plugs - DC Fast (1000 units)	0.043	0	1.12	0	5.01	0	8.11
Public EV charging plugs - L2 (1000 units)	0.243	0	26.9	0	120	0	195
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 (%)	1.81	2.04	1.36	0.439	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.04	12.5	42.3	80.1	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.3	81	53.1	18.2	3.51	0.597	0
Vehicle sales - Light-duty - hybrid (%)	3.57	3.93	2.92	1.11	0.266	0.056	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.354	0.224	0.071	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.113	0.11	0.074	0.026	0.005	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)	90	90.4	87	81.6	77.4	76.4	78.1
Final energy use - Industry (PJ)	236	242	246	246	250	250	255
Final energy use - Residential (PJ)	123	117	108	95.6	85.1	78.9	76.1
Final energy use - Transportation (PJ)	324	303	265	220	179	155	146

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	10,539	12,307	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	2.92	27.3	77.1	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2.74	4.44	4.73	6.05	6.35	6.37	6.39
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	94.3	68.3	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.08	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	2.31	8.07	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	96.5	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.42	2.48	3.87	4.09	4.01	4.2

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	0.463	3.64	3.66	3.27	10.3	9.23
Capital invested - Wind - Base (billion \$2018)	0	3.54	8.66	17.5	15.8	25.6	45.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	409	658	5,790	6,349	5,998	19,976	18,926
Solar - Constrained land use assumptions (GWh)	409	1,781	2,296	5,518	7,435	24,374	24,110
Wind - Base land use assumptions (GWh)	315	8,107	21,440	46,708	41,293	68,635	118,691
Wind - Constrained land use assumptions (GWh)	1,989	18,247	29,786	71,941	51,853	8,742	138,685

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	-243
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-10,076
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-64.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-10,383
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-243
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,130
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-32.4
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,405
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,955
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	118
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	3,170
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,507
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	58.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,662

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	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	1,549
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	4,608
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	29,786
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	9,217
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	58.3

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	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	561
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	56
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	175
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	844
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	81.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,737

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	321	0.218	0.207	0.161	0.105	0.004
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	104	59.6	24.6	17.2	5.17	2.89
Monetary damages from air pollution - Transportation (million 2019\$)	0	404	374	283	163	74.8	30.8
Premature deaths from air pollution - Coal (deaths)	0	36	0.024	0.023	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	11.7	6.74	2.78	1.95	0.583	0.326
Premature deaths from air pollution - Transportation (deaths)	0	45.5	42.1	31.8	18.3	8.42	3.46

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	2.31	2.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.7	62.8	93.6	99.7	100	100	100
Sales of cooking units - Gas (%)	47.3	37.2	6.37	0.321	0	0	0
Sales of space heating units - Electric Heat Pump (%)	11.9	27.2	74.3	84.8	85.3	85.2	85.2
Sales of space heating units - Electric Resistance (%)	34.9	33.8	14.2	9.82	9.65	9.82	9.86
Sales of space heating units - Fossil (%)	8.14	11.9	5.59	4.18	4.11	4.04	4.03
Sales of space heating units - Gas (%)	45.1	27.1	5.9	1.18	0.978	0.957	0.954
Sales of water heating units - Electric Heat Pump (%)	0	11.3	59.7	70.6	71.1	71.1	71.1
Sales of water heating units - Electric Resistance (%)	44.5	51.9	32.1	27.6	27.4	27.4	27.4
Sales of water heating units - Gas Furnace (%)	53.7	35.3	6.65	0.277	0	0	0
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.49	1.49	1.5	1.5

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	542	1,384	2,253	3,409	3,714	3,539
Public EV charging plugs - DC Fast (1000 units)	0.043	0	1.12	0	5.01	0	8.11
Public EV charging plugs - L2 (1000 units)	0.243	0	26.9	0	120	0	195
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 (%)	1.81	2.04	1.36	0.439	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.04	12.5	42.3	80.1	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.3	81	53.1	18.2	3.51	0.597	0
Vehicle sales - Light-duty - hybrid (%)	3.57	3.93	2.92	1.11	0.266	0.056	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.354	0.224	0.071	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.113	0.11	0.074	0.026	0.005	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)	90	90.4	87	81.6	77.4	76.4	78.1
Final energy use - Industry (PJ)	236	242	246	246	250	250	255
Final energy use - Residential (PJ)	123	117	108	95.6	85.1	78.9	76.1
Final energy use - Transportation (PJ)	324	303	265	220	179	155	146

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	10,539	12,307	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	2.92	27.3	77.1	91.1	92.3	92.3	92.3
Sales of space heating units - Electric Resistance (%)	2.74	4.44	4.73	6.05	6.35	6.37	6.39
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	94.3	68.3	18.2	2.83	1.38	1.34	1.33
Sales of water heating units - Electric Heat Pump (%)	0.08	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	2.31	8.07	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	96.5	79.4	15	0.632	0	0	0
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.42	2.48	3.87	4.09	4.01	4.2

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	0.463	1.85	2	1.93	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	1.81	2.13	1.76	3.38	2.64	0
Capital invested - Wind - Base (billion \$2018)	0	2.7	1.94	0.055	4.45	5.63	10.7
Capital invested - Wind - Constrained (billion \$2018)	0	4.74	4.41	0.402	6.29	6.57	19.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	409	658	2,950	3,475	3,539	0	0
Solar - Constrained land use assumptions (GWh)	409	2,576	3,399	3,044	6,216	5,152	0
Wind - Base land use assumptions (GWh)	0.381	6,347	4,671	165	12,376	16,859	33,130
Wind - Constrained land use assumptions (GWh)	1,673	11,345	11,299	1,186	17,721	18,659	55,022

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	-243
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-10,076
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-64.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-10,383
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-243

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)	0	0	-5,130
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-32.4
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-5,405
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,955
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	118
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	3,170
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	96.4
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,507
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	58.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,662

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,549
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,608

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	29,786
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	9,217
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	58.3
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	561
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	56

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	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	175
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	844
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	81.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,737

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	321	0.218	0.207	0.161	0.105	0.004
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	117	64.9	68	54.8	18.6	5.95
Monetary damages from air pollution - Transportation (million 2019\$)	0	404	374	283	163	74.8	30.8
Premature deaths from air pollution - Coal (deaths)	0	36	0.024	0.023	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	13.2	7.33	7.68	6.19	2.1	0.672
Premature deaths from air pollution - Transportation (deaths)	0	45.5	42.1	31.8	18.3	8.42	3.46

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	2.28	2.67	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.5	53.8	58.1	69.6	85.5	95.3	98.7
Sales of cooking units - Gas (%)	47.5	46.2	41.9	30.4	14.5	4.68	1.26
Sales of space heating units - Electric Heat Pump (%)	11.9	18.1	23.5	39	62.6	78	83.3
Sales of space heating units - Electric Resistance (%)	34.9	37.6	35.2	28.7	19	12.7	10.5
Sales of space heating units - Fossil (%)	8.14	13.1	12.5	10.3	7.08	5.03	4.32
Sales of space heating units - Gas (%)	45.1	31.2	28.8	22	11.3	4.24	1.82
Sales of water heating units - Electric Heat Pump (%)	0	1.94	7.45	23.3	47.7	63.6	69.1
Sales of water heating units - Electric Resistance (%)	44.5	55.7	53.5	47.1	37	30.5	28.2

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 (%)	53.7	40.9	37.5	28.1	13.8	4.37	1.13
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.51	1.52	1.5	1.5

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	86.7	184	621	1,961	2,854
Public EV charging plugs - DC Fast (1000 units)	0.043	0	0.334	0	1.85	0	5.2
Public EV charging plugs - L2 (1000 units)	0.243	0	8.03	0	44.4	0	125
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 (%)	1.82	2.19	2.11	1.69	1.1	0.572	0.244
Vehicle sales - Light-duty - EV (%)	1.58	4.01	10.5	23.6	45.9	70.4	86.9
Vehicle sales - Light-duty - gasoline (%)	92.7	88.7	81.8	69.5	49	26.6	11.7
Vehicle sales - Light-duty - hybrid (%)	3.69	4.55	5.17	4.83	3.75	2.29	1.14
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.388	0.341	0.266	0.193	0.109	0.05
Vehicle sales - Light-duty - other (%)	0.114	0.118	0.109	0.096	0.07	0.039	0.018
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)	90	90.7	90.4	89.6	87.6	85.4	84.4
Final energy use - Industry (PJ)	236	243	246	249	254	253	258
Final energy use - Residential (PJ)	123	118	114	110	103	94.4	86.6
Final energy use - Transportation (PJ)	324	305	276	255	238	219	197

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	10,527	12,223	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	2.92	17.8	23.5	40	65.6	83.3	89.8
Sales of space heating units - Electric Resistance (%)	2.74	4.44	4.48	4.65	5.07	5.74	6.19
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	94.3	77.8	72	55.4	29.3	11	3.97
Sales of water heating units - Electric Heat Pump (%)	0.08	1.96	7.15	22.1	45	59.9	65.1
Sales of water heating units - Electric Resistance (%)	2.31	4.44	6.56	12.7	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	96.5	91.8	84.5	63.4	31	9.91	2.58
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.1	2.13	2.57	2.64	3.75	3.95

Table 50: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.063
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	13.1	6.33	8.69	5.05

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	62.9
Biomass w/ccu power plant (GWh)	0	0	0	14,741	21,844	31,603	37,270

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	886	1,910	2,497	2,840
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	0	12,047	12,821	7,975	4,709
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	8	8	8
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	12	18	26	30
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	14.6	30.6	40.3	45.8
Annual - BECCS (MMT)	0	0	0	14.6	30.6	40.3	45.8
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	14.6	45.2	85.5	131
Cumulative - BECCS (MMT)	0	0	0	14.6	45.2	85.5	131
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	3.69	15	30.9	41.4	45.1
Injection wells (wells)	0	0	4	14	26	42	54
Resource characterization, appraisal, permitting costs (million \$2020)	0	14.2	350	562	562	562	562
Wells and facilities construction costs (million \$2020)	0	0	111	432	770	1,288	1,600

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	39.8	150	721	1,074	1,074
Cumulative investment - All (million \$2018)	0	0	284	887	1,728	2,267	2,443
Cumulative investment - Spur (million \$2018)	0	0	0	318	874	1,414	1,589
Cumulative investment - Trunk (million \$2018)	0	0	284	569	853	853	853
Spur (km)	0	0	0	69.9	602	955	955
Trunk (km)	0	0	39.8	79.6	119	119	119

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	-923
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-9,220
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	-49.6
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-10,192
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-923
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,678
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	-24.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,626
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	367
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	6,684
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	143
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	440
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	90.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	7,724
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	367
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,376
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	143
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	440
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	45.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	2,371

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,549
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,608
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	29,786
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	9,217
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	58.3

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	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	561
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	56
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	175
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	844
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	81.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,737

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	2.25	2.32	0	0	0	0
Sales of cooking units - Electric Resistance (%)	52.1	52.1	52.1	52.1	52.1	52.1	52.1
Sales of cooking units - Gas (%)	47.9	47.9	47.9	47.9	47.9	47.9	47.9
Sales of space heating units - Electric Heat Pump (%)	8.95	36.6	37.8	39.7	41.3	43.3	46.3
Sales of space heating units - Electric Resistance (%)	36.2	30.2	29.6	28.9	27.9	26.1	23
Sales of space heating units - Fossil (%)	8.35	8.61	8.72	8.67	8.53	8.52	8.55
Sales of space heating units - Gas (%)	46.5	24.5	23.8	22.8	22.3	22.1	22.2
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	44.5	56.5	56.6	56.6	56.5	56.5	56.5
Sales of water heating units - Gas Furnace (%)	53.7	42	41.9	41.8	42	42	42
Sales of water heating units - Other (%)	1.86	1.52	1.52	1.52	1.53	1.53	1.53

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 (%)	1.82	2.19	2.23	2.07	1.88	1.75	1.67
Vehicle sales - Light-duty - EV (%)	2.7	4.49	5.15	6.27	7.7	9.08	10.2
Vehicle sales - Light-duty - gasoline (%)	91.7	88.3	86.6	85.1	83.3	81.3	79.6
Vehicle sales - Light-duty - hybrid (%)	3.59	4.48	5.51	6.09	6.72	7.41	8.05
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.386	0.361	0.325	0.325	0.327	0.339
Vehicle sales - Light-duty - other (%)	0.114	0.118	0.115	0.116	0.116	0.115	0.118
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)	90	91.9	92.9	93.6	95.4	100	108
Final energy use - Industry (PJ)	236	248	257	261	270	278	287
Final energy use - Residential (PJ)	123	117	115	115	116	119	121
Final energy use - Transportation (PJ)	324	305	279	263	263	271	282

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	10,305	10,816	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	32.3	32.3	32.3	32.3	32.3	32.3
Sales of cooking units - Gas (%)	69.9	67.7	67.7	67.7	67.7	67.7	67.7
Sales of space heating units - Electric Heat Pump (%)	2.92	28.4	67	78.3	79.4	79.5	79.5
Sales of space heating units - Electric Resistance (%)	2.74	6.12	11.6	15.8	18.7	19.1	19.2
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	94.3	65.5	21.4	5.92	1.92	1.38	1.33
Sales of water heating units - Electric Heat Pump (%)	0.08	0.13	0.128	0.13	0.13	0.128	0.128

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 (%)	2.31	3.68	3.66	3.67	3.69	3.68	3.7
Sales of water heating units - Gas Furnace (%)	96.5	94.4	94.4	94.4	94.4	94.4	94.4
Sales of water heating units - Other (%)	1.07	1.78	1.78	1.78	1.79	1.79	1.8

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	2.28	2.33	3.46	3.64	3.57	3.72

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-22.2	0	-14.6	-11.9
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-3.76	0	-6.27	-6.6
Business-as-usual carbon sink - Total (Mt CO2e/y)	-26	0	-20.9	-18.5
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	356
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	46,154
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,334
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	9,227
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	3,044
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	13,825
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,120
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	1,077
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	11,526
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	4,644
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	178
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	13,471
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	222
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	3,544
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	1,549
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4,608
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	538
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	873
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,565
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	267
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	29,786

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	778
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	6,386
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	2,270
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	9,217
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	756
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	807
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	6,200
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	3,105
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	58.3
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	181
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	4,705
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	1,121
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	106
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	71.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	327
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,539
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	8,110
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	29.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	170
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,803
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	561
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	56
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	35.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	56.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	931
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	3,642
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	43.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	175

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	3,254
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	844
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	81.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	53.4
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	410
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,876
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	6,737

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	1,299	815	536	422	379	376
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	122	119	126	95.3	75.3	67.6
Monetary damages from air pollution - Transportation (million 2019\$)	0	410	416	424	433	443	453
Premature deaths from air pollution - Coal (deaths)	0	146	91.5	60.1	47.3	42.6	42.2
Premature deaths from air pollution - Natural Gas (deaths)	0	13.8	13.5	14.2	10.8	8.5	7.64
Premature deaths from air pollution - Transportation (deaths)	0	46.2	46.8	47.7	48.7	49.8	51