

# Net-Zero America - new jersey 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	7.13	8.05	0	0	0	0
Sales of cooking units - Electric Resistance (%)	33.6	47.7	91.1	99.5	100	100	100
Sales of cooking units - Gas (%)	66.4	52.3	8.94	0.45	0	0	0
Sales of space heating units - Electric Heat Pump (%)	4.07	17.8	67.1	90.9	93.9	94.1	94
Sales of space heating units - Electric Resistance (%)	6.87	9.53	5.27	2.94	2.62	2.66	2.75
Sales of space heating units - Fossil (%)	9.77	15	4.87	2.25	2.08	2.05	1.99
Sales of space heating units - Gas (%)	79.3	57.7	22.7	3.87	1.37	1.23	1.23
Sales of water heating units - Electric Heat Pump (%)	0	7.03	39.6	53.9	55.6	55.7	55.7
Sales of water heating units - Electric Resistance (%)	17.8	33.3	37.6	43.3	44.2	44.3	44.3
Sales of water heating units - Gas Furnace (%)	79.1	57.8	22.4	2.77	0.146	0	0
Sales of water heating units - Other (%)	3.14	1.9	0.397	0.064	0.049	0.049	0.05

Table 2: E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	1,151	2,985	4,782	7,266	7,885	7,530
Public EV charging plugs - DC Fast (1000 units)	0.341	0	1.73	0	7.27	0	11.7
Public EV charging plugs - L2 (1000 units)	0.794	0	41.6	0	175	0	281
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 (%)	1.28	1.58	1.15	0.366	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.81	17.9	50.5	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.4	74.9	44.6	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.29	5.17	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.324	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.018	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 3: E+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	306	301	289	269	251	242	241
Final energy use - Industry (PJ)	130	131	133	133	134	135	137
Final energy use - Residential (PJ)	376	351	316	265	217	183	164
Final energy use - Transportation (PJ)	683	640	573	490	414	364	340

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	41,628	45,491	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric Heat Pump (%)	0.831	16.8	53.8	78.3	81.8	82	81.9
Sales of space heating units - Electric Resistance (%)	2.64	4.45	11.2	16.1	17	17	17.2
Sales of space heating units - Fossil (%)	8.14	11.7	2.29	0.1	0	0	0

Table 4: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	88.4	67.1	32.7	5.5	1.14	0.906	0.899
Sales of water heating units - Electric Heat Pump (%)	0.247	7.96	43.7	60.3	62.3	62.4	62.4
Sales of water heating units - Electric Resistance (%)	1.46	5.37	23	35.5	37.3	37.4	37.4
Sales of water heating units - Gas Furnace (%)	97.6	85.5	33	4.08	0.216	0	0
Sales of water heating units - Other (%)	0.649	1.16	0.372	0.184	0.175	0.176	0.176

Table 5: *E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	3.49	3.59	11.3	12.3	10	10.7

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	0.008	0.35	0	0	0.019	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 - Offshore Wind - Base (billion \$2018)	0	0.236	0.183	0.208	0.284	41.2	14.5
Capital invested - Offshore Wind - Constrained (billion \$2018)	0	0.236	0.231	0.226	0.132	34.2	20.6
Capital invested - Solar PV - Base (billion \$2018)	0	1.39	1.17	0.71	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	3.68	0.736	0.911	0	0	0
Capital invested - Wind - Constrained (billion \$2018)	0	0	0	0.075	0.536	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	14.6	701	701	701	741	741
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
OffshoreWind - Base land use assumptions (GWh)	0	355	322	441	705	123,317	50,720
OffshoreWind - Constrained land use assumptions (GWh)	0	355	322	441	705	123,317	50,720
Solar - Base land use assumptions (GWh)	1,439	1,871	1,727	1,127	0	0	0
Solar - Constrained land use assumptions (GWh)	77.8	1,461	920	571	0	0	0
Wind - Base land use assumptions (GWh)	30.5	0	0	0	0	0	0
Wind - Constrained land use assumptions (GWh)	30.5	0	0	124	784	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	1.81	65.2	66.1	66.2	67.3	67.3
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	8.36	390	27.3	2.77	22.9	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	107	142	142	142	142
Cumulative investment - All (million \$2018)	0	0	230	438	438	438	438
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)	0	0	230	438	438	438	438
Spur (km)	0	0	0	0	0	0	0
Trunk (km)	0	0	107	142	142	142	142

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	-341
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-8.38
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-349
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	-178
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.19
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-182
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	172
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2

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

Item	2020	2025	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	188
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	89.9
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.62
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	97.6

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	963
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	218
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	761

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

Item	2020	2025	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	181
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	166
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	189
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	342



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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	747

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	981	0.682	0.678	0.631	0.413	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	720	538	367	359	245	100
Monetary damages from air pollution - Transportation (million 2019\$)	0	3,928	3,747	2,908	1,717	789	300
Premature deaths from air pollution - Coal (deaths)	0	110	0.076	0.076	0.071	0.046	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	81.4	60.8	41.4	40.6	27.6	11.3
Premature deaths from air pollution - Transportation (deaths)	0	442	421	327	193	88.7	33.7

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	70.8	81.7	243	271	229	187	151
By economic sector - Construction (jobs)	13,759	11,359	11,076	13,094	13,576	32,022	34,571
By economic sector - Manufacturing (jobs)	7,132	13,162	24,229	24,490	19,330	24,937	19,631
By economic sector - Mining (jobs)	3,810	3,110	2,210	1,447	893	518	276
By economic sector - Other (jobs)	1,842	1,388	1,462	1,835	2,076	3,898	5,731
By economic sector - Pipeline (jobs)	755	749	664	527	373	246	163
By economic sector - Professional (jobs)	5,110	4,624	4,637	5,486	5,831	16,754	20,653
By economic sector - Trade (jobs)	4,384	3,826	3,528	3,815	3,934	9,786	12,578
By economic sector - Utilities (jobs)	8,143	9,854	9,936	12,948	13,999	35,997	31,142
By education level - All sectors - Associates degree or some college (jobs)	14,031	15,146	18,317	20,396	19,406	40,441	40,573
By education level - All sectors - Bachelors degree (jobs)	9,217	9,888	11,721	12,678	11,817	24,557	25,102
By education level - All sectors - Doctoral degree (jobs)	315	296	308	337	331	799	931
By education level - All sectors - High school diploma or less (jobs)	19,270	20,577	25,102	27,709	26,009	52,564	51,966
By education level - All sectors - Masters or professional degree (jobs)	2,172	2,249	2,536	2,793	2,679	5,983	6,324
By resource sector - Biomass (jobs)	294	350	670	771	691	681	647
By resource sector - CO2 (jobs)	0	0	234	209	0	0	0
By resource sector - Coal (jobs)	223	209	70	0	0	0	0
By resource sector - Grid (jobs)	7,219	10,677	12,029	19,548	21,831	69,149	58,759
By resource sector - Natural Gas (jobs)	7,665	7,886	6,335	5,401	6,079	4,247	3,788
By resource sector - Nuclear (jobs)	1,863	1,833	1,803	1,540	953	360	0.169
By resource sector - Oil (jobs)	8,046	7,097	5,643	4,064	2,777	1,868	1,091
By resource sector - Solar (jobs)	19,684	20,012	30,166	31,521	25,480	25,447	30,596
By resource sector - Wind (jobs)	11.9	90.1	1,033	859	2,432	22,592	30,016
Median wages - Annual - All (\$2019 per job)	68,896	68,976	67,710	69,100	70,944	74,431	75,716

Table 15: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	7,351	7,815	9,291	10,346	9,862	20,695	20,676
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	3,065	3,020	3,238	3,715	3,720	8,466	8,688
On-Site or In-Plant Training - Total jobs - None (jobs)	7,385	7,869	9,562	10,457	9,788	19,941	20,322
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	371	397	467	532	518	1,128	1,128
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	26,833	29,054	35,426	38,863	36,354	74,114	74,082
On-the-Job Training - All sectors - 1 to 4 years (jobs)	9,451	10,014	11,830	13,206	12,638	26,734	26,766
On-the-Job Training - All sectors - 4 to 10 years (jobs)	2,995	2,920	3,101	3,600	3,646	8,415	8,669
On-the-Job Training - All sectors - None (jobs)	2,537	2,620	3,093	3,371	3,165	6,459	6,678
On-the-Job Training - All sectors - Over 10 years (jobs)	476	512	653	698	632	1,186	1,188
On-the-Job Training - All sectors - Up to 1 year (jobs)	29,547	32,088	39,308	43,038	40,160	81,549	81,595
Related work experience - All sectors - 1 to 4 years (jobs)	16,137	17,245	20,578	22,680	21,423	44,534	44,801
Related work experience - All sectors - 4 to 10 years (jobs)	10,451	11,147	13,241	14,621	13,857	29,072	29,285
Related work experience - All sectors - None (jobs)	6,459	6,888	8,228	9,137	8,692	18,002	18,050
Related work experience - All sectors - Over 10 years (jobs)	2,791	3,094	3,841	4,185	3,872	7,812	7,719
Related work experience - All sectors - Up to 1 year (jobs)	9,167	9,782	12,096	13,290	12,397	24,923	25,041
Wage income - All (million \$2019)	3,101	3,322	3,926	4,417	4,274	9,256	9,458

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	587	596	503	403	303	191	132
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	12,141
Natural gas production - Annual (tcf)	0	0	0	0	0	0	0
Oil consumption - Annual (million bbls)	165	160	138	108	79.4	57.2	35.6
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	3,314
Oil production - Annual (million bbls)	0	0	0	0	0	0	0

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	7.14	8.46	0	0	0	0
Sales of cooking units - Electric Resistance (%)	33.3	35.1	41.2	57.3	79.6	93.4	98.2
Sales of cooking units - Gas (%)	66.7	64.9	58.8	42.7	20.4	6.57	1.77
Sales of space heating units - Electric Heat Pump (%)	4.07	9.27	14.9	31.5	59.1	80.8	90.2
Sales of space heating units - Electric Resistance (%)	6.87	10.2	9.71	8.26	5.82	3.82	3.01
Sales of space heating units - Fossil (%)	9.77	16.9	15.8	12.4	7.29	3.83	2.52
Sales of space heating units - Gas (%)	79.3	63.6	59.6	47.8	27.8	11.6	4.3
Sales of water heating units - Electric Heat Pump (%)	0	1.31	5.02	15.9	33.8	47.5	53.3
Sales of water heating units - Electric Resistance (%)	17.8	32.8	33.2	34.8	38	41.5	43.4
Sales of water heating units - Gas Furnace (%)	79.1	63.7	59.7	47.8	27.4	10.7	3.19
Sales of water heating units - Other (%)	3.14	2.18	2.01	1.52	0.769	0.279	0.109

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	192	391	1,332	4,152	6,062
Public EV charging plugs - DC Fast (1000 units)	0.341	0	0.582	0	2.73	0	7.49
Public EV charging plugs - L2 (1000 units)	0.794	0	14	0	65.6	0	180
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 (%)	1.3	1.75	2.01	1.58	0.994	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.2	5.38	13.2	28.1	50.8	73.6	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.1	77.4	63.9	43.5	23.2	10.3
Vehicle sales - Light-duty - hybrid (%)	5.5	6.26	6.92	6.17	4.49	2.58	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.372	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.091	0.095	0.085	0.073	0.052	0.028	0.013
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)	306	301	299	297	292	284	276
Final energy use - Industry (PJ)	130	131	133	135	136	137	139
Final energy use - Residential (PJ)	376	353	337	317	287	250	214
Final energy use - Transportation (PJ)	684	645	598	556	522	481	433

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	41,604	45,411	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Sales of space heating units - Electric Heat Pump (%)	0.831	10.8	15	27.7	49.8	69	77.8
Sales of space heating units - Electric Resistance (%)	2.64	3.4	4.18	6.57	10.9	14.6	16.6
Sales of space heating units - Fossil (%)	8.14	13.5	12.9	9.99	5	1.6	0.431
Sales of space heating units - Gas Furnace (%)	88.4	72.3	67.9	55.8	34.4	14.9	5.15
Sales of water heating units - Electric Heat Pump (%)	0.247	1.77	5.84	17.8	37.6	53.1	59.7
Sales of water heating units - Electric Resistance (%)	1.46	2.65	4.65	10.7	21.4	30.9	35.4
Sales of water heating units - Gas Furnace (%)	97.6	94.3	88.2	70.5	40.4	15.7	4.7
Sales of water heating units - Other (%)	0.649	1.31	1.29	1.01	0.586	0.311	0.212

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	2.76	2.76	4.34	4.53	9.51	10.3

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

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)	0	0	-341
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)	0	0	-8.38
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)	0	0	-349
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)	0	0	-178
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)	0	0	-4.19
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)	0	0	-182
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	172
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	188
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	89.9
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.62
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	97.6

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	963

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

Item	2020	2025	2050
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	218
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	761
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	181
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	166

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	189
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	342
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	747

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	981	0.682	0.678	0.631	0.413	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	678	395	187	88.8	27	20.6
Monetary damages from air pollution - Transportation (million 2019\$)	0	4,005	4,154	4,132	3,799	3,086	2,158
Premature deaths from air pollution - Coal (deaths)	0	110	0.076	0.076	0.071	0.046	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	76.6	44.6	21.1	10	3.05	2.33
Premature deaths from air pollution - Transportation (deaths)	0	450	467	465	427	347	243

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	7.13	8.05	0	0	0	0
Sales of cooking units - Electric Resistance (%)	33.6	47.7	91.1	99.5	100	100	100
Sales of cooking units - Gas (%)	66.4	52.3	8.94	0.45	0	0	0
Sales of space heating units - Electric Heat Pump (%)	4.07	17.8	67.1	90.9	93.9	94.1	94

Table 25: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Resistance (%)	6.87	9.53	5.27	2.94	2.62	2.66	2.75
Sales of space heating units - Fossil (%)	9.77	15	4.87	2.25	2.08	2.05	1.99
Sales of space heating units - Gas (%)	79.3	57.7	22.7	3.87	1.37	1.23	1.23
Sales of water heating units - Electric Heat Pump (%)	0	7.03	39.6	53.9	55.6	55.7	55.7
Sales of water heating units - Electric Resistance (%)	17.8	33.3	37.6	43.3	44.2	44.3	44.3
Sales of water heating units - Gas Furnace (%)	79.1	57.8	22.4	2.77	0.146	0	0
Sales of water heating units - Other (%)	3.14	1.9	0.397	0.064	0.049	0.049	0.05

Table 26: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	1,151	2,985	4,782	7,266	7,885	7,530
Public EV charging plugs - DC Fast (1000 units)	0.341	0	1.73	0	7.27	0	11.7
Public EV charging plugs - L2 (1000 units)	0.794	0	41.6	0	175	0	281
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 (%)	1.28	1.58	1.15	0.366	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.81	17.9	50.5	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.4	74.9	44.6	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.29	5.17	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.324	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.018	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 27: E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	306	301	289	269	251	242	241
Final energy use - Industry (PJ)	130	131	133	133	134	135	137
Final energy use - Residential (PJ)	376	351	316	265	217	183	164
Final energy use - Transportation (PJ)	683	640	573	490	414	364	340

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	41,628	45,491	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric Heat Pump (%)	0.831	16.8	53.8	78.3	81.8	82	81.9
Sales of space heating units - Electric Resistance (%)	2.64	4.45	11.2	16.1	17	17	17.2
Sales of space heating units - Fossil (%)	8.14	11.7	2.29	0.1	0	0	0
Sales of space heating units - Gas Furnace (%)	88.4	67.1	32.7	5.5	1.14	0.906	0.899
Sales of water heating units - Electric Heat Pump (%)	0.247	7.96	43.7	60.3	62.3	62.4	62.4
Sales of water heating units - Electric Resistance (%)	1.46	5.37	23	35.5	37.3	37.4	37.4
Sales of water heating units - Gas Furnace (%)	97.6	85.5	33	4.08	0.216	0	0

Table 28: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	0.649	1.16	0.372	0.184	0.175	0.176	0.176

Table 29: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	3.49	3.59	11.3	12.3	10	10.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion \$2018)	0	0.236	0.183	0.38	22.9	33.3	4.26
Capital invested - Solar PV - Base (billion \$2018)	0	4.45	0.529	0	0	0	5.3
Capital invested - Wind - Base (billion \$2018)	0	0	0	0	0	0.524	0.315

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	355	322	801	57,655	101,667	15,060
OffshoreWind - Constrained land use assumptions (GWh)	0	355	410	797	57,365	44,869	71,214
Solar - Base land use assumptions (GWh)	1,439	6,021	777	0	0	0	10,318
Solar - Constrained land use assumptions (GWh)	1,439	3,674	1,956	0	0	0	17,104
Wind - Base land use assumptions (GWh)	30.5	0	0	0	0	868	483
Wind - Constrained land use assumptions (GWh)	30.5	0	0	675	233	0	0

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	-341
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-8.38
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-349
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	-178
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-4.19
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-182
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	172
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	188
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	89.9



Table 32: *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	7.62
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	97.6

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	963
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	218
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	761
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	181

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

Item	2020	2025	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	166
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	189
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	342
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0

Table 33: *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	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	747

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	981	0.682	0.678	0.631	0.413	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	627	462	296	227	84.2	15.7
Monetary damages from air pollution - Transportation (million 2019\$)	0	3,928	3,747	2,908	1,717	789	300
Premature deaths from air pollution - Coal (deaths)	0	110	0.076	0.076	0.071	0.046	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	70.8	52.2	33.4	25.6	9.52	1.77
Premature deaths from air pollution - Transportation (deaths)	0	442	421	327	193	88.7	33.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	7.13	8.05	0	0	0	0
Sales of cooking units - Electric Resistance (%)	33.6	47.7	91.1	99.5	100	100	100
Sales of cooking units - Gas (%)	66.4	52.3	8.94	0.45	0	0	0
Sales of space heating units - Electric Heat Pump (%)	4.07	17.8	67.1	90.9	93.9	94.1	94
Sales of space heating units - Electric Resistance (%)	6.87	9.53	5.27	2.94	2.62	2.66	2.75
Sales of space heating units - Fossil (%)	9.77	15	4.87	2.25	2.08	2.05	1.99
Sales of space heating units - Gas (%)	79.3	57.7	22.7	3.87	1.37	1.23	1.23
Sales of water heating units - Electric Heat Pump (%)	0	7.03	39.6	53.9	55.6	55.7	55.7
Sales of water heating units - Electric Resistance (%)	17.8	33.3	37.6	43.3	44.2	44.3	44.3
Sales of water heating units - Gas Furnace (%)	79.1	57.8	22.4	2.77	0.146	0	0
Sales of water heating units - Other (%)	3.14	1.9	0.397	0.064	0.049	0.049	0.05

Table 36: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	1,151	2,985	4,782	7,266	7,885	7,530
Public EV charging plugs - DC Fast (1000 units)	0.341	0	1.73	0	7.27	0	11.7
Public EV charging plugs - L2 (1000 units)	0.794	0	41.6	0	175	0	281
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 (%)	1.28	1.58	1.15	0.366	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.81	17.9	50.5	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.4	74.9	44.6	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.29	5.17	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.324	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.018	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0

Table 36: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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)	306	301	289	269	251	242	241
Final energy use - Industry (PJ)	130	131	133	133	134	135	137
Final energy use - Residential (PJ)	376	351	316	265	217	183	164
Final energy use - Transportation (PJ)	683	640	573	490	414	364	340

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	41,628	45,491	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Sales of space heating units - Electric Heat Pump (%)	0.831	16.8	53.8	78.3	81.8	82	81.9
Sales of space heating units - Electric Resistance (%)	2.64	4.45	11.2	16.1	17	17	17.2
Sales of space heating units - Fossil (%)	8.14	11.7	2.29	0.1	0	0	0
Sales of space heating units - Gas Furnace (%)	88.4	67.1	32.7	5.5	1.14	0.906	0.899
Sales of water heating units - Electric Heat Pump (%)	0.247	7.96	43.7	60.3	62.3	62.4	62.4
Sales of water heating units - Electric Resistance (%)	1.46	5.37	23	35.5	37.3	37.4	37.4
Sales of water heating units - Gas Furnace (%)	97.6	85.5	33	4.08	0.216	0	0
Sales of water heating units - Other (%)	0.649	1.16	0.372	0.184	0.175	0.176	0.176

Table 39: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	3.49	3.59	11.3	12.3	10	10.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion \$2018)	0	0.451	0.447	0.359	0.621	4.07	1.56
Capital invested - Offshore Wind - Constrained (billion \$2018)	0	0.507	0.267	0.527	0.533	3.39	1.03
Capital invested - Solar PV - Base (billion \$2018)	0	0.566	0.667	0.657	0.669	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0.309	1.06	0.212	0.31	0	0
Capital invested - Wind - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	677	801	754	1,517	11,890	5,163
OffshoreWind - Constrained land use assumptions (GWh)	0	765	475	1,108	1,308	9,913	3,398
Solar - Base land use assumptions (GWh)	1,439	774	1,014	1,055	1,143	0	0
Solar - Constrained land use assumptions (GWh)	1,439	423	1,583	339	526	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	30.5	0	0	0	0	0	0
Wind - Constrained land use assumptions (GWh)	30.5	0	0	0	0	0	0

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 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)	0	0	-341
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)	0	0	-8.38
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)	0	0	-349
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)	0	0	-178
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)	0	0	-4.19
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)	0	0	-182
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	172
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	15.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	188
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	89.9
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.62
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	97.6

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	963
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	218
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	761
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	181
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	158

Table 43: *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	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	166
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	189
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	342
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	747

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	981	0.682	0.678	0.631	0.413	0.029
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	678	537	605	482	214	59
Monetary damages from air pollution - Transportation (million 2019\$)	0	3,928	3,747	2,908	1,717	789	300
Premature deaths from air pollution - Coal (deaths)	0	110	0.076	0.076	0.071	0.046	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	76.6	60.7	68.3	54.4	24.2	6.67
Premature deaths from air pollution - Transportation (deaths)	0	442	421	327	193	88.7	33.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	7.14	8.46	0	0	0	0
Sales of cooking units - Electric Resistance (%)	33.3	35.1	41.2	57.3	79.6	93.4	98.2
Sales of cooking units - Gas (%)	66.7	64.9	58.8	42.7	20.4	6.57	1.77
Sales of space heating units - Electric Heat Pump (%)	4.07	9.27	14.9	31.5	59.1	80.8	90.2
Sales of space heating units - Electric Resistance (%)	6.87	10.2	9.71	8.26	5.82	3.82	3.01
Sales of space heating units - Fossil (%)	9.77	16.9	15.8	12.4	7.29	3.83	2.52
Sales of space heating units - Gas (%)	79.3	63.6	59.6	47.8	27.8	11.6	4.3
Sales of water heating units - Electric Heat Pump (%)	0	1.31	5.02	15.9	33.8	47.5	53.3
Sales of water heating units - Electric Resistance (%)	17.8	32.8	33.2	34.8	38	41.5	43.4
Sales of water heating units - Gas Furnace (%)	79.1	63.7	59.7	47.8	27.4	10.7	3.19
Sales of water heating units - Other (%)	3.14	2.18	2.01	1.52	0.769	0.279	0.109

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	192	391	1,332	4,152	6,062
Public EV charging plugs - DC Fast (1000 units)	0.341	0	0.582	0	2.73	0	7.49
Public EV charging plugs - L2 (1000 units)	0.794	0	14	0	65.6	0	180
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 (%)	1.3	1.75	2.01	1.58	0.994	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.2	5.38	13.2	28.1	50.8	73.6	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.1	77.4	63.9	43.5	23.2	10.3
Vehicle sales - Light-duty - hybrid (%)	5.5	6.26	6.92	6.17	4.49	2.58	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.372	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.091	0.095	0.085	0.073	0.052	0.028	0.013
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)	306	301	299	297	292	284	276
Final energy use - Industry (PJ)	130	131	133	135	136	137	139
Final energy use - Residential (PJ)	376	353	337	317	287	250	214
Final energy use - Transportation (PJ)	684	645	598	556	522	481	433

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	41,604	45,411	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Sales of space heating units - Electric Heat Pump (%)	0.831	10.8	15	27.7	49.8	69	77.8
Sales of space heating units - Electric Resistance (%)	2.64	3.4	4.18	6.57	10.9	14.6	16.6
Sales of space heating units - Fossil (%)	8.14	13.5	12.9	9.99	5	1.6	0.431



Table 48: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	88.4	72.3	67.9	55.8	34.4	14.9	5.15
Sales of water heating units - Electric Heat Pump (%)	0.247	1.77	5.84	17.8	37.6	53.1	59.7
Sales of water heating units - Electric Resistance (%)	1.46	2.65	4.65	10.7	21.4	30.9	35.4
Sales of water heating units - Gas Furnace (%)	97.6	94.3	88.2	70.5	40.4	15.7	4.7
Sales of water heating units - Other (%)	0.649	1.31	1.29	1.01	0.586	0.311	0.212

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	2.76	2.76	4.34	4.53	9.51	10.3

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	0.008	0.352	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	16.3	707	707	707	707	707
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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	14.3	180	183	183	184	593
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	9.36	392	34.4	5.46	9	4,899
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	7
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)	0	0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	107	142	142	142	142
Cumulative investment - All (million \$2018)	0	0	230	438	438	460	460
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)	0	0	230	438	438	460	460
Spur (km)	0	0	0	0	0	0	0
Trunk (km)	0	0	107	142	142	142	142

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	-18.8
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-324
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	-7.83
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-351
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-18.8
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-169
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	-3.91
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-191
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	9.08
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	403
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	4.53
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	2.71
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	14.2
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	434
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	9.08

Table 56: *E-B+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	85.2
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	4.53
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	2.71
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	7.12
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	109

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	963
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	218
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)	0	0	761

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

Item	2020	2025	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)	0	0	181
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	166
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	189
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	342

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	747

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	6.64	7	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Sales of cooking units - Gas (%)	67.2	67.2	67.2	67.2	67.2	67.2	67.2
Sales of space heating units - Electric Heat Pump (%)	2.27	23.8	24.8	26.1	26.8	27.3	28.1
Sales of space heating units - Electric Resistance (%)	7.12	8.97	8.81	8.6	8.48	7.9	7.12
Sales of space heating units - Fossil (%)	9.93	13.6	7.36	3.84	3.54	3.54	3.56
Sales of space heating units - Gas (%)	80.7	53.6	59.1	61.5	61.2	61.2	61.3
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	17.8	32.6	32.5	32.5	32.5	32.5	32.4
Sales of water heating units - Gas Furnace (%)	79.1	65.2	65.2	65.3	65.3	65.3	65.3
Sales of water heating units - Other (%)	3.14	2.24	2.24	2.24	2.24	2.24	2.24

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 (%)	1.29	1.74	2.14	2	1.79	1.66	1.58
Vehicle sales - Light-duty - EV (%)	4.44	6.75	7.58	9.37	11.3	12.9	14.1
Vehicle sales - Light-duty - gasoline (%)	88.8	84.9	82.5	80.3	78.1	76.2	74.7
Vehicle sales - Light-duty - hybrid (%)	5.31	6.12	7.41	7.95	8.45	8.89	9.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.367	0.331	0.29	0.285	0.284	0.294
Vehicle sales - Light-duty - other (%)	0.09	0.094	0.09	0.09	0.09	0.088	0.09
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)	306	305	307	309	314	329	352
Final energy use - Industry (PJ)	130	134	140	145	151	158	164
Final energy use - Residential (PJ)	376	350	336	325	318	315	313

Table 60: REF scenario - PILLAR 1: Efficiency/Electrification - Overview (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	684	651	614	593	597	615	636

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	41,117	42,334	0	0	0	0
Sales of cooking units - Electric Resistance (%)	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Sales of space heating units - Electric Heat Pump (%)	0.831	15.4	41.5	62.9	66.3	66.6	66.5
Sales of space heating units - Electric Resistance (%)	2.64	4.05	8.88	20.9	30.7	32.3	32.6
Sales of space heating units - Fossil (%)	8.14	13.2	10.3	4.62	0.695	0.058	0
Sales of space heating units - Gas Furnace (%)	88.4	67.4	39.3	11.6	2.31	0.996	0.899
Sales of water heating units - Electric Heat Pump (%)	0.247	0.326	0.328	0.328	0.329	0.331	0.332
Sales of water heating units - Electric Resistance (%)	1.46	1.94	1.92	1.93	1.93	1.93	1.93
Sales of water heating units - Gas Furnace (%)	97.6	96.4	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.649	1.34	1.42	1.41	1.43	1.46	1.47

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	2.77	2.78	8.27	8.93	8.04	8.51

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	0.55	0	-1.73	-1.55
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.047	0	-0.084	-0.088
Business-as-usual carbon sink - Total (Mt CO2e/y)	0.503	0	-1.82	-1.64
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	68.4
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	3,576
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,305
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	969
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	6.74
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	172
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	269
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	308
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	478
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	34.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	963
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	218

Table 63: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2050
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	372
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	3.43
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	57.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	94.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	161
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	51.4
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	2,269
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	761
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	671
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	5.02
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	115
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	181
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	319
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	11.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	177
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	494
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	2.48
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	25.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	8.74
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	158
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	877
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	5.6
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	166
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	189

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	1.24
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	13.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	95.8
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	473
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	8.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	171
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	342
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	1.87
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	19.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	11
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	193
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	747

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	2,547	1,631	1,530	1,490	1,465	1,345
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	490	504	774	797	817	789
Monetary damages from air pollution - Transportation (million 2019\$)	0	3,992	4,196	4,392	4,611	4,833	5,068
Premature deaths from air pollution - Coal (deaths)	0	286	183	172	167	164	151
Premature deaths from air pollution - Natural Gas (deaths)	0	55.3	56.9	87.5	90.1	92.3	89.1
Premature deaths from air pollution - Transportation (deaths)	0	449	472	494	519	544	570