

Net-Zero America - nevada 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	3.41	4.55	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.4	73.5	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.5	4.53	0.228	0	0	0
Sales of space heating units - Electric Heat Pump (%)	9.66	27.4	68.8	88.9	91.4	91.5	91.4
Sales of space heating units - Electric Resistance (%)	13.5	20.2	10.8	6.22	5.65	5.68	5.75
Sales of space heating units - Fossil (%)	2.25	3.38	1.94	1.18	1.02	0.999	1.02
Sales of space heating units - Gas (%)	74.6	49	18.5	3.73	1.9	1.81	1.81
Sales of water heating units - Electric Heat Pump (%)	0	8.43	46.6	60.9	62.4	62.5	62.5
Sales of water heating units - Electric Resistance (%)	23.2	37.5	32.8	35.1	35.7	35.8	35.8
Sales of water heating units - Gas Furnace (%)	75.1	52.3	18.8	2.22	0.114	0	0
Sales of water heating units - Other (%)	1.72	1.82	1.81	1.8	1.78	1.78	1.78

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	477	1,240	1,983	3,014	3,269	3,123
Public EV charging plugs - DC Fast (1000 units)	0.256	0	0.746	0	3.11	0	4.99
Public EV charging plugs - L2 (1000 units)	0.619	0	17.9	0	74.7	0	120
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 (%)	1.44	1.72	1.21	0.387	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.28	16.3	48.1	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.3	76.8	47.1	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.77	4.8	3.33	1.22	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.333	0.194	0.06	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.097	0.093	0.059	0.021	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)	89.2	89	85.7	80.3	75.1	72.2	71.6
Final energy use - Industry (PJ)	73.7	73.6	72.2	72.9	75.5	77.3	79.1
Final energy use - Residential (PJ)	94.5	92.3	87.6	79.2	71.6	67.4	65.8
Final energy use - Transportation (PJ)	291	274	249	218	190	171	162

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	7,465	8,314	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	3.34	20.2	63.4	88.9	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	3.3	3.45	4.17	6.37	6.82	6.85	6.84
Sales of space heating units - Fossil (%)	0.985	0.209	0.04	0.002	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	92.4	76.1	32.4	4.78	0.723	0.51	0.507
Sales of water heating units - Electric Heat Pump (%)	0.03	8.12	45.4	61.3	63.2	63.3	63.3
Sales of water heating units - Electric Resistance (%)	1.46	5.07	23	34.6	36.2	36.3	36.3
Sales of water heating units - Gas Furnace (%)	98.1	86.4	31.1	3.68	0.19	0	0
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.23	2.35	3.09	3.28	3.08	3.22

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	9.55	6.1	4.81	4.06
Capital invested - Solar PV - Constrained (billion \$2018)	0	3.93	0	4.62	3.7	2.12	1.58
Capital invested - Wind - Base (billion \$2018)	0	0.755	3.61	4.44	2.11	0.898	2.84
Capital invested - Wind - Constrained (billion \$2018)	0	0.262	1.01	0.429	0.94	0.089	0.787

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	13,021	0	0	21,541	14,515	12,087	10,775
Solar - Constrained land use assumptions (GWh)	12,657	0	0	3,812	4,423	3,148	8,802
Wind - Base land use assumptions (GWh)	2,421	1,498	7,621	9,902	4,883	2,157	7,226
Wind - Constrained land use assumptions (GWh)	657	538	1,658	1,092	1,453	76.4	1,732

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	0	0	0	0	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	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.01	0.03	0.05	0.04	0.03
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	0.01	0.03	0.05	0.04	0.03
Cumulative - All (MMT)	0	0	0.01	0.04	0.09	0.13	0.16
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	0.01	0.04	0.09	0.13	0.16

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	51.1	102	102	102	102
Cumulative investment - All (million \$2018)	0	0	26.6	53.3	53.4	53.4	53.3
Cumulative investment - Spur (million \$2018)	0	0	26.6	53.3	53.4	53.4	53.3
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	51.1	102	102	102	102
Trunk (km)	0	0	0	0	0	0	0

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	-227
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-1.61
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-229
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	-114
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-0.807
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-115
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	319
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	2.48
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	322
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	160
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	1.24
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	162

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	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	186
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	593
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1.27
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	1.52
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	65.1
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	6,960
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	3.05

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

Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	126
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	319
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0.459
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	9.3
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	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.7
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0.69
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	13.5

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,986

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	50	0.067	0.067	0.045	0.028	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	40.6	21.6	18.5	17.4	11.7	4.8
Monetary damages from air pollution - Transportation (million 2019\$)	0	473	466	372	224	105	40.3
Premature deaths from air pollution - Coal (deaths)	0	5.62	0.008	0.008	0.005	0.003	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.59	2.44	2.09	1.96	1.32	0.543
Premature deaths from air pollution - Transportation (deaths)	0	53.2	52.4	41.8	25.2	11.8	4.54

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	4.1	4.73	9.61	3.67	2.85	2.09	1.56
By economic sector - Construction (jobs)	7,390	6,041	7,276	15,232	15,004	14,345	16,626
By economic sector - Manufacturing (jobs)	3,003	3,127	5,003	6,673	6,273	5,545	6,319
By economic sector - Mining (jobs)	1,286	1,000	705	460	278	154	81.4
By economic sector - Other (jobs)	1,025	731	874	2,560	2,642	2,750	3,658
By economic sector - Pipeline (jobs)	268	264	236	203	156	109	61.4
By economic sector - Professional (jobs)	2,702	2,457	3,297	6,883	7,165	7,159	8,679
By economic sector - Trade (jobs)	2,038	1,734	2,077	4,320	4,514	4,619	5,832
By economic sector - Utilities (jobs)	4,071	5,031	6,499	10,552	11,485	11,333	12,433
By education level - All sectors - Associates degree or some college (jobs)	6,954	6,552	8,394	15,220	15,480	15,019	17,509
By education level - All sectors - Bachelors degree (jobs)	4,267	4,039	5,140	9,091	9,253	8,989	10,525
By education level - All sectors - Doctoral degree (jobs)	149	133	169	330	337	332	398
By education level - All sectors - High school diploma or less (jobs)	9,400	8,698	11,043	19,997	20,143	19,413	22,591
By education level - All sectors - Masters or professional degree (jobs)	1,018	968	1,232	2,246	2,308	2,263	2,668
By resource sector - Biomass (jobs)	17	20.3	26.5	10.5	8.58	7.64	6.65
By resource sector - CO2 (jobs)	0	0	116	233	232	231	61.2
By resource sector - Coal (jobs)	341	173	32.1	0	0	0	0
By resource sector - Grid (jobs)	4,947	7,640	10,855	19,010	20,735	20,480	23,582
By resource sector - Natural Gas (jobs)	3,507	2,984	2,544	2,232	2,373	2,272	1,564
By resource sector - Nuclear (jobs)	0	0	0.004	0.007	0	0	0
By resource sector - Oil (jobs)	2,431	2,072	1,639	1,165	767	485	276
By resource sector - Solar (jobs)	9,606	5,502	5,726	17,180	16,390	16,260	21,032
By resource sector - Wind (jobs)	939	1,998	5,038	7,054	7,015	6,281	7,168
Median wages - Annual - All (\$2019 per job)	58,770	60,296	60,802	61,169	62,341	63,413	64,215
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	3,622	3,400	4,322	7,823	7,938	7,685	8,928
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	1,558	1,442	1,792	3,345	3,406	3,309	3,829
On-Site or In-Plant Training - Total jobs - None (jobs)	3,554	3,281	4,192	7,631	7,716	7,472	8,753

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)	190	181	232	422	432	419	485
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	12,865	12,085	15,439	27,663	28,029	27,131	31,695
On-the-Job Training - All sectors - 1 to 4 years (jobs)	4,675	4,393	5,582	10,115	10,274	9,951	11,548
On-the-Job Training - All sectors - 4 to 10 years (jobs)	1,546	1,427	1,775	3,353	3,417	3,324	3,851
On-the-Job Training - All sectors - None (jobs)	1,203	1,091	1,375	2,542	2,566	2,490	2,936
On-the-Job Training - All sectors - Over 10 years (jobs)	228	202	259	468	464	442	513
On-the-Job Training - All sectors - Up to 1 year (jobs)	14,137	13,275	16,988	30,407	30,800	29,809	34,842
Related work experience - All sectors - 1 to 4 years (jobs)	7,776	7,314	9,297	16,720	16,981	16,466	19,218
Related work experience - All sectors - 4 to 10 years (jobs)	5,074	4,774	6,077	10,924	11,095	10,750	12,504
Related work experience - All sectors - None (jobs)	3,156	2,963	3,759	6,814	6,922	6,717	7,840
Related work experience - All sectors - Over 10 years (jobs)	1,327	1,260	1,624	2,855	2,890	2,787	3,239
Related work experience - All sectors - Up to 1 year (jobs)	4,455	4,079	5,220	9,572	9,632	9,296	10,890
Wage income - All (million \$2019)	1,281	1,230	1,580	2,868	2,963	2,919	3,448

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	229	232	196	157	118	74.3	51.5
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	4,725
Natural gas production - Annual (tcf)	0.003	0.004	0.003	0.003	0.003	0.002	0.002
Oil consumption - Annual (million bbls)	48.3	44.9	38.5	29.3	20.6	13.8	8.32
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	906
Oil production - Annual (million bbls)	0.306	0.33	0.332	0.331	0.262	0.213	0.142

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	3.39	4.49	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.2	67.1	70.2	78.4	89.7	96.7	99.1
Sales of cooking units - Gas (%)	33.8	32.9	29.8	21.6	10.3	3.33	0.896
Sales of space heating units - Electric Heat Pump (%)	9.66	20.3	25	38.9	62.1	80.4	88.2
Sales of space heating units - Electric Resistance (%)	13.5	21.8	20.6	17.6	12.4	8.21	6.44
Sales of space heating units - Fossil (%)	2.25	3.63	3.53	2.94	1.99	1.35	1.13
Sales of space heating units - Gas (%)	74.6	54.3	50.8	40.6	23.5	10.1	4.22
Sales of water heating units - Electric Heat Pump (%)	0	1.53	5.88	18.5	39	54	60.1
Sales of water heating units - Electric Resistance (%)	23.2	38.6	38.2	36.7	35.1	35	35.4
Sales of water heating units - Gas Furnace (%)	75.1	58	54.2	42.9	24.1	9.21	2.71
Sales of water heating units - Other (%)	1.72	1.82	1.82	1.82	1.8	1.79	1.78

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	80.1	162	553	1,721	2,514
Public EV charging plugs - DC Fast (1000 units)	0.256	0	0.253	0	1.17	0	3.2
Public EV charging plugs - L2 (1000 units)	0.619	0	6.09	0	28.1	0	76.9
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 (%)	1.45	1.88	2.04	1.61	1.02	0.524	0.225
Vehicle sales - Light-duty - EV (%)	2.01	4.96	12.4	26.8	49.4	72.7	87.8
Vehicle sales - Light-duty - gasoline (%)	91.4	86.9	78.7	65.5	45.1	24.2	10.7
Vehicle sales - Light-duty - hybrid (%)	4.96	5.74	6.41	5.78	4.28	2.5	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.377	0.32	0.242	0.17	0.094	0.044
Vehicle sales - Light-duty - other (%)	0.098	0.102	0.092	0.08	0.057	0.031	0.014
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)	89.2	89.2	88.5	87.3	84.9	81.8	79
Final energy use - Industry (PJ)	73.7	73.6	72.4	73.5	76.5	78.3	80
Final energy use - Residential (PJ)	94.5	92.7	91.9	90.1	85.9	79.9	74.4
Final energy use - Transportation (PJ)	291	276	258	242	229	214	195

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	7,460	8,285	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	3.34	13	18	32.6	57.8	78.9	88.5
Sales of space heating units - Electric Resistance (%)	3.3	3.43	3.51	3.82	4.64	5.8	6.5
Sales of space heating units - Fossil (%)	0.985	0.242	0.226	0.167	0.082	0.026	0.007
Sales of space heating units - Gas Furnace (%)	92.4	83.3	78.3	63.4	37.5	15.3	4.96
Sales of water heating units - Electric Heat Pump (%)	0.03	1.53	5.79	18.2	38.6	54.2	60.6
Sales of water heating units - Electric Resistance (%)	1.46	2.2	4.25	10.4	21	30.2	34.5
Sales of water heating units - Gas Furnace (%)	98.1	95.9	89.6	71	39.9	15.3	4.5
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.09	2.43	2.55	2.99	3.14

Table 22: E- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-1.61
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-229

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	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)	0	0	-114
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-0.807
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-115
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	319
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	2.48
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	322
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	160
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	1.24
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	162

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	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	186
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	593
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1.27

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	1.52
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	65.1
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	6,960
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	3.05
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	126
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	319
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0.459
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	9.3
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	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.7
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0.69
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	13.5
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	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,986

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	50	0.067	0.067	0.045	0.028	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	41.4	16.3	10.7	5.53	2.61	1.34
Monetary damages from air pollution - Transportation (million 2019\$)	0	482	515	527	497	413	295
Premature deaths from air pollution - Coal (deaths)	0	5.62	0.008	0.008	0.005	0.003	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.68	1.85	1.21	0.624	0.295	0.151
Premature deaths from air pollution - Transportation (deaths)	0	54.2	57.9	59.3	55.9	46.5	33.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	3.41	4.55	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.4	73.5	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.5	4.53	0.228	0	0	0
Sales of space heating units - Electric Heat Pump (%)	9.66	27.4	68.8	88.9	91.4	91.5	91.4
Sales of space heating units - Electric Resistance (%)	13.5	20.2	10.8	6.22	5.65	5.68	5.75
Sales of space heating units - Fossil (%)	2.25	3.38	1.94	1.18	1.02	0.999	1.02
Sales of space heating units - Gas (%)	74.6	49	18.5	3.73	1.9	1.81	1.81
Sales of water heating units - Electric Heat Pump (%)	0	8.43	46.6	60.9	62.4	62.5	62.5

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 (%)	23.2	37.5	32.8	35.1	35.7	35.8	35.8
Sales of water heating units - Gas Furnace (%)	75.1	52.3	18.8	2.22	0.114	0	0
Sales of water heating units - Other (%)	1.72	1.82	1.81	1.8	1.78	1.78	1.78

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	477	1,240	1,983	3,014	3,269	3,123
Public EV charging plugs - DC Fast (1000 units)	0.256	0	0.746	0	3.11	0	4.99
Public EV charging plugs - L2 (1000 units)	0.619	0	17.9	0	74.7	0	120
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 (%)	1.44	1.72	1.21	0.387	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.28	16.3	48.1	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.3	76.8	47.1	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.77	4.8	3.33	1.22	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.333	0.194	0.06	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.097	0.093	0.059	0.021	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)	89.2	89	85.7	80.3	75.1	72.2	71.6
Final energy use - Industry (PJ)	73.7	73.6	72.2	72.9	75.5	77.3	79.1
Final energy use - Residential (PJ)	94.5	92.3	87.6	79.2	71.6	67.4	65.8
Final energy use - Transportation (PJ)	291	274	249	218	190	171	162

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	7,465	8,314	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	3.34	20.2	63.4	88.9	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	3.3	3.45	4.17	6.37	6.82	6.85	6.84
Sales of space heating units - Fossil (%)	0.985	0.209	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	92.4	76.1	32.4	4.78	0.723	0.51	0.507
Sales of water heating units - Electric Heat Pump (%)	0.03	8.12	45.4	61.3	63.2	63.3	63.3
Sales of water heating units - Electric Resistance (%)	1.46	5.07	23	34.6	36.2	36.3	36.3
Sales of water heating units - Gas Furnace (%)	98.1	86.4	31.1	3.68	0.19	0	0
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.23	2.35	3.09	3.28	3.08	3.22

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	1.54	12.5	7.67	7.2	6.58
Capital invested - Wind - Base (billion \$2018)	0	1.35	3.98	5.69	4.12	3.06	6.92

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	13,021	0	3,207	28,043	18,212	17,901	17,428
Solar - Constrained land use assumptions (GWh)	13,021	0	2,777	4,885	7,544	10,378	13,224
Wind - Base land use assumptions (GWh)	2,421	2,665	8,336	12,652	9,440	7,094	16,351
Wind - Constrained land use assumptions (GWh)	657	1,372	1,108	2,374	808	234	1,058

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	-227
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-1.61
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-229
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	-114
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-0.807
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-115
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	319
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	2.48
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	322
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	160
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	1.24
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	162

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	186
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	593
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	1.27
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1.52
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	65.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	6,960
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3.05
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	126
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	319
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	258

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	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0.459
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	9.3
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	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.7
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0.69
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	13.5
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	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,986

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	50	0.067	0.067	0.045	0.028	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	37.2	19.5	10.2	6.86	3.42	1.19
Monetary damages from air pollution - Transportation (million 2019\$)	0	473	466	372	224	105	40.3
Premature deaths from air pollution - Coal (deaths)	0	5.62	0.008	0.008	0.005	0.003	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.21	2.21	1.15	0.775	0.387	0.134
Premature deaths from air pollution - Transportation (deaths)	0	53.2	52.4	41.8	25.2	11.8	4.54

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	3.41	4.55	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.4	73.5	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.6	26.5	4.53	0.228	0	0	0
Sales of space heating units - Electric Heat Pump (%)	9.66	27.4	68.8	88.9	91.4	91.5	91.4
Sales of space heating units - Electric Resistance (%)	13.5	20.2	10.8	6.22	5.65	5.68	5.75
Sales of space heating units - Fossil (%)	2.25	3.38	1.94	1.18	1.02	0.999	1.02
Sales of space heating units - Gas (%)	74.6	49	18.5	3.73	1.9	1.81	1.81
Sales of water heating units - Electric Heat Pump (%)	0	8.43	46.6	60.9	62.4	62.5	62.5
Sales of water heating units - Electric Resistance (%)	23.2	37.5	32.8	35.1	35.7	35.8	35.8
Sales of water heating units - Gas Furnace (%)	75.1	52.3	18.8	2.22	0.114	0	0
Sales of water heating units - Other (%)	1.72	1.82	1.81	1.8	1.78	1.78	1.78

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	477	1,240	1,983	3,014	3,269	3,123
Public EV charging plugs - DC Fast (1000 units)	0.256	0	0.746	0	3.11	0	4.99
Public EV charging plugs - L2 (1000 units)	0.619	0	17.9	0	74.7	0	120
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 (%)	1.44	1.72	1.21	0.387	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.28	16.3	48.1	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.3	76.8	47.1	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.77	4.8	3.33	1.22	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.333	0.194	0.06	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.097	0.093	0.059	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 37: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	89.2	89	85.7	80.3	75.1	72.2	71.6
Final energy use - Industry (PJ)	73.7	73.6	72.2	72.9	75.5	77.3	79.1
Final energy use - Residential (PJ)	94.5	92.3	87.6	79.2	71.6	67.4	65.8
Final energy use - Transportation (PJ)	291	274	249	218	190	171	162

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	7,465	8,314	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	3.34	20.2	63.4	88.9	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	3.3	3.45	4.17	6.37	6.82	6.85	6.84
Sales of space heating units - Fossil (%)	0.985	0.209	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	92.4	76.1	32.4	4.78	0.723	0.51	0.507
Sales of water heating units - Electric Heat Pump (%)	0.03	8.12	45.4	61.3	63.2	63.3	63.3
Sales of water heating units - Electric Resistance (%)	1.46	5.07	23	34.6	36.2	36.3	36.3
Sales of water heating units - Gas Furnace (%)	98.1	86.4	31.1	3.68	0.19	0	0
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.23	2.35	3.09	3.28	3.08	3.22

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	1.02	1.25	4.31	3.28	1.17	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	1.21	1.27	1.83	1.36	0.252	0
Capital invested - Wind - Base (billion \$2018)	0	0.732	0.847	2.48	2.62	1.24	1.86
Capital invested - Wind - Constrained (billion \$2018)	0	0.158	0.176	0.868	0.274	0.093	0.954

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	13,021	1,892	2,611	9,695	7,775	2,943	0
Solar - Constrained land use assumptions (GWh)	13,021	2,227	2,572	3,934	2,977	583	0
Wind - Base land use assumptions (GWh)	1,971	1,451	1,859	5,579	6,102	3,067	4,832
Wind - Constrained land use assumptions (GWh)	448	309	328	1,683	554	198	1,760

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-1.61
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-229
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)	0	0	-114
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-0.807
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-115
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	319
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	2.48
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	322
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	160
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	1.24
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	162

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	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	186
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	593
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1.27
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	1.52

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	65.1
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	6,960
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	3.05
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	126
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	319
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	258
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0.459
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	9.3

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.7
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0.69
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	13.5
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	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,986

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	50	0.067	0.067	0.045	0.028	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	46.7	28.6	29	34.3	22.5	5.07
Monetary damages from air pollution - Transportation (million 2019\$)	0	473	466	372	224	105	40.3
Premature deaths from air pollution - Coal (deaths)	0	5.62	0.008	0.008	0.005	0.003	0
Premature deaths from air pollution - Natural Gas (deaths)	0	5.27	3.23	3.28	3.87	2.54	0.573
Premature deaths from air pollution - Transportation (deaths)	0	53.2	52.4	41.8	25.2	11.8	4.54

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	3.39	4.49	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.2	67.1	70.2	78.4	89.7	96.7	99.1
Sales of cooking units - Gas (%)	33.8	32.9	29.8	21.6	10.3	3.33	0.896
Sales of space heating units - Electric Heat Pump (%)	9.66	20.3	25	38.9	62.1	80.4	88.2
Sales of space heating units - Electric Resistance (%)	13.5	21.8	20.6	17.6	12.4	8.21	6.44
Sales of space heating units - Fossil (%)	2.25	3.63	3.53	2.94	1.99	1.35	1.13
Sales of space heating units - Gas (%)	74.6	54.3	50.8	40.6	23.5	10.1	4.22
Sales of water heating units - Electric Heat Pump (%)	0	1.53	5.88	18.5	39	54	60.1
Sales of water heating units - Electric Resistance (%)	23.2	38.6	38.2	36.7	35.1	35	35.4

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 (%)	75.1	58	54.2	42.9	24.1	9.21	2.71
Sales of water heating units - Other (%)	1.72	1.82	1.82	1.82	1.8	1.79	1.78

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	80.1	162	553	1,721	2,514
Public EV charging plugs - DC Fast (1000 units)	0.256	0	0.253	0	1.17	0	3.2
Public EV charging plugs - L2 (1000 units)	0.619	0	6.09	0	28.1	0	76.9
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 (%)	1.45	1.88	2.04	1.61	1.02	0.524	0.225
Vehicle sales - Light-duty - EV (%)	2.01	4.96	12.4	26.8	49.4	72.7	87.8
Vehicle sales - Light-duty - gasoline (%)	91.4	86.9	78.7	65.5	45.1	24.2	10.7
Vehicle sales - Light-duty - hybrid (%)	4.96	5.74	6.41	5.78	4.28	2.5	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.377	0.32	0.242	0.17	0.094	0.044
Vehicle sales - Light-duty - other (%)	0.098	0.102	0.092	0.08	0.057	0.031	0.014
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)	89.2	89.2	88.5	87.3	84.9	81.8	79
Final energy use - Industry (PJ)	73.7	73.6	72.4	73.5	76.5	78.3	80
Final energy use - Residential (PJ)	94.5	92.7	91.9	90.1	85.9	79.9	74.4
Final energy use - Transportation (PJ)	291	276	258	242	229	214	195

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	7,460	8,285	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	3.34	13	18	32.6	57.8	78.9	88.5
Sales of space heating units - Electric Resistance (%)	3.3	3.43	3.51	3.82	4.64	5.8	6.5
Sales of space heating units - Fossil (%)	0.985	0.242	0.226	0.167	0.082	0.026	0.007
Sales of space heating units - Gas Furnace (%)	92.4	83.3	78.3	63.4	37.5	15.3	4.96
Sales of water heating units - Electric Heat Pump (%)	0.03	1.53	5.79	18.2	38.6	54.2	60.6
Sales of water heating units - Electric Resistance (%)	1.46	2.2	4.25	10.4	21	30.2	34.5
Sales of water heating units - Gas Furnace (%)	98.1	95.9	89.6	71	39.9	15.3	4.5
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.09	2.43	2.55	2.99	3.14

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	0	0	0	0	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	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.01	0.04	0.06	0.04	0.05
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	0.01	0.04	0.06	0.04	0.05
Cumulative - All (MMT)	0	0	0.01	0.05	0.11	0.15	0.2
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	0.01	0.05	0.11	0.15	0.2

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	51.1	102	102	102	102
Cumulative investment - All (million \$2018)	0	0	26.6	53.4	53.5	53.4	53.4
Cumulative investment - Spur (million \$2018)	0	0	26.6	53.4	53.5	53.4	53.4
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	51.1	102	102	102	102
Trunk (km)	0	0	0	0	0	0	0

Table 56: E-B+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-227
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	-1.61
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-229
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	-114
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	-0.807
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-115
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	789
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	2.48
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	791
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	160
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	1.24
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	162

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	186
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	593
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	1.27
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1.52
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	65.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	6,960
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3.05
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	126
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	319
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	258

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	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0.459
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	9.3
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	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.7
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0.69
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	13.5
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	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,986

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	3.21	3.39	0	0	0	0
Sales of cooking units - Electric Resistance (%)	65.9	65.9	65.9	65.9	65.9	65.9	65.9
Sales of cooking units - Gas (%)	34.1	34.1	34.1	34.1	34.1	34.1	34.1
Sales of space heating units - Electric Heat Pump (%)	8.46	27.8	28.5	29.6	30.6	31.8	33.4
Sales of space heating units - Electric Resistance (%)	13.8	20.2	19.9	19.6	18.9	17.9	16.3
Sales of space heating units - Fossil (%)	2.27	2.79	2.82	2.75	2.59	2.52	2.58
Sales of space heating units - Gas (%)	75.5	49.2	48.8	48.1	47.9	47.8	47.7
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	23.2	38.8	38.9	38.9	39	39	39
Sales of water heating units - Gas Furnace (%)	75.1	59.4	59.3	59.3	59.2	59.2	59.2
Sales of water heating units - Other (%)	1.72	1.82	1.82	1.82	1.81	1.81	1.81

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 (%)	1.45	1.88	2.17	2.02	1.81	1.69	1.6
Vehicle sales - Light-duty - EV (%)	3.92	6.06	6.87	8.47	10.3	11.8	13
Vehicle sales - Light-duty - gasoline (%)	89.6	86	83.7	81.7	79.6	77.6	76.1
Vehicle sales - Light-duty - hybrid (%)	4.79	5.62	6.85	7.41	7.95	8.48	8.86
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.373	0.34	0.3	0.296	0.296	0.306
Vehicle sales - Light-duty - other (%)	0.097	0.101	0.097	0.098	0.097	0.096	0.098
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)	89.2	90.9	92	92.1	92.8	95.6	100
Final energy use - Industry (PJ)	73.8	76.5	78.3	81.6	85.7	92	98.7
Final energy use - Residential (PJ)	94.5	93.4	95	97.3	101	105	108
Final energy use - Transportation (PJ)	291	280	269	263	267	277	288

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	7,365	7,706	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric Heat Pump (%)	3.34	23.9	63.4	77.1	78.7	78.8	78.8
Sales of space heating units - Electric Resistance (%)	3.3	5.04	10.6	16	20	20.6	20.7
Sales of space heating units - Fossil (%)	0.985	0.211	0.092	0.03	0.004	0	0
Sales of space heating units - Gas Furnace (%)	92.4	70.9	25.9	6.85	1.34	0.57	0.508
Sales of water heating units - Electric Heat Pump (%)	0.03	0.03	0.03	0.03	0.03	0.03	0.03

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 (%)	1.46	1.47	1.47	1.48	1.47	1.48	1.47
Sales of water heating units - Gas Furnace (%)	98.1	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.365	0.384	0.383	0.384	0.383	0.384	0.383

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	2.15	2.25	2.49	2.61	2.9	3.04

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	0.51	0	1.5	0.43
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.001	0	-0.003	-0.003
Business-as-usual carbon sink - Total (Mt CO2e/y)	0.509	0	1.5	0.428
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,579
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	10,254
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	4,703
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	2.49
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4.57
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	186
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	593
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	2,495
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	791
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	3,666
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	1,806
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	1.27
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1.52
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	65.1
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	44.9
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	841
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,185
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	6,960

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	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	3,254
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	1.86
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	3.05
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	126
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	319
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	1,668
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	258
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	2,398
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	0.918
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	17.7
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	16.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	827
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	3,612
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	129
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	919
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	0.459
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	9.3
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	2.92
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	500
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,649
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	194
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	90.7

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	1,658
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	0.69
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	13.5
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	21.1
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,008
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,986

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	80.3	47.4	25.5	19.5	18.1	17
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	47.8	32.2	34.9	32.9	50.9	46.9
Monetary damages from air pollution - Transportation (million 2019\$)	0	480	521	561	604	648	695
Premature deaths from air pollution - Coal (deaths)	0	9.01	5.31	2.87	2.18	2.03	1.91
Premature deaths from air pollution - Natural Gas (deaths)	0	5.4	3.64	3.95	3.71	5.74	5.29
Premature deaths from air pollution - Transportation (deaths)	0	54	58.6	63.1	67.9	72.9	78.1