

Net-Zero America - Louisiana state report

Larson et al. 2020

February 2021

These data underlie graphs and tables presented in the Princeton Net-Zero America study (E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, interim report, Princeton University, Princeton, NJ, December 15, 2020. Report available at <https://netzeroamerica.princeton.edu>.)

Notes

- These data are a subset of all data from the study available at <https://netzeroamerica.princeton.edu>.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one “no new policies” reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not state-level results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- Some results are not model outputs, but rather they are limits that apply across all scenarios (e.g., maximum carbon storage potential in agricultural soils).

List of Tables

1	E+ scenario - PILLAR 1: Efficiency/Electrification - Residential	4
2	E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	4
3	E+ scenario - PILLAR 1: Efficiency/Electrification - Overview	4
4	E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	4
5	E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	5
6	E+ scenario - PILLAR 2: Clean Electricity - Generating capacity	5
7	E+ scenario - PILLAR 2: Clean Electricity - Generation	5
8	E+ scenario - PILLAR 3: Clean fuels - Bioenergy	5
9	E+ scenario - PILLAR 4: CCUS - CO2 capture	6
10	E+ scenario - PILLAR 4: CCUS - CO2 storage	6
11	E+ scenario - PILLAR 4: CCUS - CO2 pipelines	6
12	E+ scenario - PILLAR 6: Land sinks - Agriculture	6
13	E+ scenario - PILLAR 6: Land sinks - Forests	7
14	E+ scenario - IMPACTS - Health	9
15	E+ scenario - IMPACTS - Jobs	9
16	E+ scenario - IMPACTS - Fossil fuel industries	10
17	E- scenario - PILLAR 1: Efficiency/Electrification - Residential	10

18	E- scenario - PILLAR 1: Efficiency/Electrification - Transportation	10
19	E- scenario - PILLAR 1: Efficiency/Electrification - Overview	11
20	E- scenario - PILLAR 1: Efficiency/Electrification - Commercial	11
21	E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	11
22	E- scenario - PILLAR 6: Land sinks - Agriculture	11
23	E- scenario - PILLAR 6: Land sinks - Forests	12
24	E- scenario - IMPACTS - Health	14
25	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential	14
26	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	15
27	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview	15
28	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	15
29	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	16
30	E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity	16
31	E+RE+ scenario - PILLAR 2: Clean Electricity - Generation	16
32	E+RE+ scenario - PILLAR 6: Land sinks - Agriculture	16
33	E+RE+ scenario - PILLAR 6: Land sinks - Forests	17
34	E+RE+ scenario - IMPACTS - Health	19
35	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential	19
36	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation	19
37	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview	20
38	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial	20
39	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	20
40	E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity	20
41	E+RE- scenario - PILLAR 2: Clean Electricity - Generation	20
42	E+RE- scenario - PILLAR 6: Land sinks - Agriculture	20
43	E+RE- scenario - PILLAR 6: Land sinks - Forests	21
44	E+RE- scenario - IMPACTS - Health	23
45	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential	23
46	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	24
47	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview	24
48	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	24
49	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	24
50	E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity	25
51	E-B+ scenario - PILLAR 2: Clean Electricity - Generation	25
52	E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy	25
53	E-B+ scenario - PILLAR 4: CCUS - CO2 capture	25
54	E-B+ scenario - PILLAR 4: CCUS - CO2 storage	25
55	E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines	25
56	E-B+ scenario - PILLAR 6: Land sinks - Agriculture	26
57	E-B+ scenario - PILLAR 6: Land sinks - Forests	27
58	REF scenario - PILLAR 1: Efficiency/Electrification - Residential	29

59	REF scenario - PILLAR 1: Efficiency/Electrification - Transportation	29
60	REF scenario - PILLAR 1: Efficiency/Electrification - Overview	29
61	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial	29
62	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	30
63	REF scenario - PILLAR 6: Land sinks - Forests	30
64	REF scenario - IMPACTS - Health	32

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	3.78	4.86	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.6	73.7	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.4	26.3	4.49	0.226	0	0	0
Sales of space heating units - Electric Heat Pump (%)	15	30.5	75.4	85.4	85.9	85.7	85.7
Sales of space heating units - Electric Resistance (%)	44.7	43.2	18.2	12.6	12.3	12.5	12.5
Sales of space heating units - Fossil (%)	2.28	3.27	1.44	1.03	1.01	0.993	0.989
Sales of space heating units - Gas (%)	38	23	5.01	0.994	0.822	0.801	0.798
Sales of water heating units - Electric Heat Pump (%)	0	12	63.6	75.1	75.6	75.6	75.6
Sales of water heating units - Electric Resistance (%)	56.5	60.4	29.9	23	22.7	22.7	22.7
Sales of water heating units - Gas Furnace (%)	41.3	25.8	4.84	0.202	0	0	0
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.71	1.71	1.72	1.72

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	747	1,909	3,103	4,697	5,116	4,875
Public EV charging plugs - DC Fast (1000 units)	0.067	0	1.34	0	5.93	0	9.61
Public EV charging plugs - L2 (1000 units)	0.204	0	32.1	0	143	0	231
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 (%)	1.7	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.4	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.3	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.92	4.18	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.348	0.215	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	127	128	123	117	112	111	112
Final energy use - Industry (PJ)	1,932	2,153	2,273	2,317	2,383	2,435	2,505
Final energy use - Residential (PJ)	142	136	128	117	108	103	102
Final energy use - Transportation (PJ)	598	567	515	454	397	363	350

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	16,472	19,203	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	6.12	26.1	76.9	91.1	92.2	92.2	92.2
Sales of space heating units - Electric Resistance (%)	5.02	4.5	4.79	6.09	6.39	6.41	6.42
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	88.9	69.4	18.3	2.84	1.39	1.35	1.34
Sales of water heating units - Electric Heat Pump (%)	0.147	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	4.15	8.12	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	93.7	79.3	15	0.631	0	0	0
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	5.94	6.22	10.4	11.1	8.07	8.36

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	4.01	0	1.27	0	0
Capital invested - Offshore Wind - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	12.5	1.23	0.476	0	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 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	4,506	4,506	5,927	5,927	5,927
OffshoreWind - Base land use assumptions (GWh)	0	316	0	316	315	0	587
OffshoreWind - Constrained land use assumptions (GWh)	0	316	0	316	315	0	587
Solar - Base land use assumptions (GWh)	4,154	13,823	1,354	1,620	633	0	0
Solar - Constrained land use assumptions (GWh)	4,549	15,294	1,525	1,232	461	0	696
Wind - Base land use assumptions (GWh)	0	0	0	0	0	1,119	724
Wind - Constrained land use assumptions (GWh)	0	0	0	0	23,852	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	0	178	338	1,053	1,053	1,053
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	3,683	2,872	12,973	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	3	16	16	16
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	4	4	5	5	5
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	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	4.5	8.25	24.6	24.7	25.1
Annual - BECCS (MMT)	0	0	4.46	8.14	24.5	24.6	24.6
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0.03	0.11	0.12	0.13	0.58
Cumulative - All (MMT)	0	0	4.5	12.8	37.4	62.1	87.2
Cumulative - BECCS (MMT)	0	0	4.46	12.6	37.1	61.7	86.2
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0.03	0.14	0.26	0.39	0.97

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	12.1	41.4	75	121	163
Injection wells (wells)	0	0	10	41	72	122	150
Resource characterization, appraisal, permitting costs (million \$2020)	0	47.3	1,162	1,837	1,837	1,837	1,837
Wells and facilities construction costs (million \$2020)	0	0	312	1,215	2,166	3,621	4,496

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	1,158	2,112	2,735	2,824	3,406
Cumulative investment - All (million \$2018)	0	0	5,319	8,747	9,320	9,421	9,749
Cumulative investment - Spur (million \$2018)	0	0	211	512	1,085	1,187	1,515
Cumulative investment - Trunk (million \$2018)	0	0	5,108	8,234	8,234	8,234	8,234
Spur (km)	0	0	337	760	1,383	1,472	2,054
Trunk (km)	0	0	821	1,352	1,352	1,352	1,352

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	-181
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,416
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-5,665
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-181
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,814
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-3,029
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,563
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,760
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3

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	813
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.7
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	948

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	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,962
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,460
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	296
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	24,865
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	8,921

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	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	63.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	711
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	42.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	182
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,069
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	61.4

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	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,633

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	253	0.266	0.23	0.147	0.088	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	147	87.1	48.5	42.1	22.2	11.7
Monetary damages from air pollution - Transportation (million 2019\$)	0	716	671	513	298	138	57.1
Premature deaths from air pollution - Coal (deaths)	0	28.3	0.03	0.026	0.017	0.01	0
Premature deaths from air pollution - Natural Gas (deaths)	0	16.6	9.84	5.48	4.76	2.51	1.32
Premature deaths from air pollution - Transportation (deaths)	0	80.6	75.5	57.7	33.5	15.5	6.42

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	150	173	482	787	1,871	1,526	1,257
By economic sector - Construction (jobs)	12,626	18,631	15,168	15,055	13,369	11,175	10,662
By economic sector - Manufacturing (jobs)	16,193	26,861	30,395	37,234	35,031	27,836	32,792
By economic sector - Mining (jobs)	29,707	25,601	19,924	14,818	9,645	6,203	3,458
By economic sector - Other (jobs)	654	1,833	950	1,134	1,222	1,186	1,381
By economic sector - Pipeline (jobs)	2,155	2,177	2,517	1,992	1,289	926	708
By economic sector - Professional (jobs)	9,218	11,016	8,780	8,765	9,077	7,722	6,909
By economic sector - Trade (jobs)	9,036	9,894	7,912	7,265	6,336	5,172	4,355
By economic sector - Utilities (jobs)	14,040	14,952	15,134	15,450	14,244	11,051	10,132
By education level - All sectors - Associates degree or some college (jobs)	27,757	33,558	30,800	31,406	28,149	22,292	22,233
By education level - All sectors - Bachelors degree (jobs)	22,811	25,587	22,892	22,506	19,790	15,480	14,799
By education level - All sectors - Doctoral degree (jobs)	770	839	694	649	585	465	411
By education level - All sectors - High school diploma or less (jobs)	36,947	45,133	41,625	42,885	39,098	31,064	30,972
By education level - All sectors - Masters or professional degree (jobs)	5,495	6,021	5,248	5,054	4,463	3,497	3,240
By resource sector - Biomass (jobs)	623	744	1,328	2,242	5,633	5,567	5,367
By resource sector - CO2 (jobs)	0	47.4	5,826	4,378	1,433	1,842	2,235
By resource sector - Coal (jobs)	1,396	641	105	8.25	7.08	6.3	5.52
By resource sector - Grid (jobs)	9,332	11,976	11,411	16,175	17,208	14,746	15,191
By resource sector - Natural Gas (jobs)	44,770	41,897	32,991	25,333	20,464	13,078	7,450
By resource sector - Nuclear (jobs)	1,147	1,128	1,110	1,093	634	0	0
By resource sector - Oil (jobs)	28,990	27,520	24,381	21,256	15,488	11,575	7,349
By resource sector - Solar (jobs)	6,024	19,783	13,691	18,105	18,417	16,667	22,253
By resource sector - Wind (jobs)	1,498	7,403	10,415	13,910	12,801	9,318	11,805
Median wages - Annual - All (\$2019 per job)	59,825	59,061	59,662	59,502	59,590	59,990	59,446
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	14,888	17,739	16,190	16,333	14,527	11,464	11,259
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	5,851	6,827	6,059	5,873	5,149	4,077	3,790
On-Site or In-Plant Training - Total jobs - None (jobs)	15,176	18,076	16,377	16,611	14,993	11,849	11,759

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)	692	850	788	804	726	580	572
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	57,173	67,646	61,847	62,880	56,689	44,828	44,274
On-the-Job Training - All sectors - 1 to 4 years (jobs)	19,135	22,732	20,707	20,807	18,453	14,546	14,251
On-the-Job Training - All sectors - 4 to 10 years (jobs)	5,334	6,317	5,586	5,433	4,790	3,808	3,557
On-the-Job Training - All sectors - None (jobs)	5,255	6,137	5,435	5,419	4,832	3,824	3,753
On-the-Job Training - All sectors - Over 10 years (jobs)	915	1,143	1,052	1,086	962	758	782
On-the-Job Training - All sectors - Up to 1 year (jobs)	63,140	74,809	68,481	69,757	63,046	49,863	49,311
Related work experience - All sectors - 1 to 4 years (jobs)	34,937	40,840	37,108	37,279	33,304	26,247	25,533
Related work experience - All sectors - 4 to 10 years (jobs)	22,349	26,179	23,770	23,804	21,123	16,642	16,237
Related work experience - All sectors - None (jobs)	12,988	15,504	14,191	14,397	13,034	10,339	10,161
Related work experience - All sectors - Over 10 years (jobs)	6,361	7,464	6,847	6,927	6,124	4,803	4,773
Related work experience - All sectors - Up to 1 year (jobs)	17,143	21,151	19,344	20,094	18,498	14,767	14,949
Wage income - All (million \$2019)	5,611	6,564	6,042	6,099	5,487	4,367	4,260

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	1,322	1,342	1,131	907	683	430	298
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	27,326
Natural gas production - Annual (tcf)	3,062	3,393	3,208	2,794	2,362	1,873	1,455
Oil consumption - Annual (million bbls)	181	176	158	129	102	80	58.8
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	3,942
Oil production - Annual (million bbls)	80.9	87.4	87.7	87.6	69.4	56.4	37.5

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	3.73	4.58	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.5	67.4	70.4	78.5	89.8	96.7	99.1
Sales of cooking units - Gas (%)	33.5	32.6	29.6	21.5	10.2	3.31	0.889
Sales of space heating units - Electric Heat Pump (%)	15	21.9	27	41.8	64.3	78.9	84
Sales of space heating units - Electric Resistance (%)	44.7	48	45.1	36.7	24.2	16.2	13.4
Sales of space heating units - Fossil (%)	2.28	3.62	3.47	2.83	1.88	1.28	1.07
Sales of space heating units - Gas (%)	38	26.5	24.5	18.7	9.62	3.59	1.53
Sales of water heating units - Electric Heat Pump (%)	0	2.06	7.93	24.8	50.7	67.6	73.5
Sales of water heating units - Electric Resistance (%)	56.5	66.3	63	52.9	37.5	27.4	23.9
Sales of water heating units - Gas Furnace (%)	41.3	29.9	27.3	20.5	10.1	3.2	0.831
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.73	1.74	1.73	1.72

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	120	254	856	2,700	3,931
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.404	0	2.19	0	6.15
Public EV charging plugs - L2 (1000 units)	0.204	0	9.71	0	52.7	0	148
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 (%)	1.71	2.1	2.09	1.67	1.08	0.557	0.238
Vehicle sales - Light-duty - EV (%)	1.71	4.29	11	24.5	46.9	71.1	87.2
Vehicle sales - Light-duty - gasoline (%)	92.3	88.2	80.9	68.3	47.8	25.9	11.4
Vehicle sales - Light-duty - hybrid (%)	4.05	4.89	5.54	5.12	3.91	2.35	1.15
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.385	0.335	0.259	0.186	0.104	0.048
Vehicle sales - Light-duty - other (%)	0.11	0.113	0.104	0.091	0.066	0.037	0.017
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)	127	128	127	126	123	121	119
Final energy use - Industry (PJ)	1,932	2,153	2,275	2,325	2,395	2,445	2,512
Final energy use - Residential (PJ)	142	137	134	131	124	116	110
Final energy use - Transportation (PJ)	599	570	531	500	477	451	421

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	16,461	19,126	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	6.12	16.4	22.3	39	65.1	83.1	89.8
Sales of space heating units - Electric Resistance (%)	5.02	4.5	4.54	4.7	5.12	5.78	6.22
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	79.1	73.2	56.3	29.8	11.1	4.02
Sales of water heating units - Electric Heat Pump (%)	0.147	1.96	7.14	22.1	44.9	59.9	65.1
Sales of water heating units - Electric Resistance (%)	4.15	4.5	6.61	12.8	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	93.7	91.7	84.4	63.3	31	9.9	2.58
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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	4.71	4.85	6.22	6.5	9.04	9.59

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	-181
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,416
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-5,665

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	-181
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)	0	0	-2,814
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-3,029
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,563
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,760
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	813
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.7
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	948

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	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,962

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	4,460
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	296
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	24,865
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	8,921
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	63.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	711
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	42.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	182
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,069
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	61.4
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,633

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	253	0.266	0.23	0.147	0.088	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	141	73.5	33.7	14.6	7.16	6.75
Monetary damages from air pollution - Transportation (million 2019\$)	0	727	735	719	651	521	360
Premature deaths from air pollution - Coal (deaths)	0	28.3	0.03	0.026	0.017	0.01	0
Premature deaths from air pollution - Natural Gas (deaths)	0	16	8.3	3.8	1.65	0.809	0.762
Premature deaths from air pollution - Transportation (deaths)	0	81.8	82.7	80.9	73.2	58.6	40.5

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	3.78	4.86	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.6	73.7	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.4	26.3	4.49	0.226	0	0	0
Sales of space heating units - Electric Heat Pump (%)	15	30.5	75.4	85.4	85.9	85.7	85.7
Sales of space heating units - Electric Resistance (%)	44.7	43.2	18.2	12.6	12.3	12.5	12.5
Sales of space heating units - Fossil (%)	2.28	3.27	1.44	1.03	1.01	0.993	0.989
Sales of space heating units - Gas (%)	38	23	5.01	0.994	0.822	0.801	0.798
Sales of water heating units - Electric Heat Pump (%)	0	12	63.6	75.1	75.6	75.6	75.6

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 (%)	56.5	60.4	29.9	23	22.7	22.7	22.7
Sales of water heating units - Gas Furnace (%)	41.3	25.8	4.84	0.202	0	0	0
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.71	1.71	1.72	1.72

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	747	1,909	3,103	4,697	5,116	4,875
Public EV charging plugs - DC Fast (1000 units)	0.067	0	1.34	0	5.93	0	9.61
Public EV charging plugs - L2 (1000 units)	0.204	0	32.1	0	143	0	231
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 (%)	1.7	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.4	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.3	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.92	4.18	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.348	0.215	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	127	128	123	117	112	111	112
Final energy use - Industry (PJ)	1,932	2,153	2,273	2,317	2,383	2,435	2,505
Final energy use - Residential (PJ)	142	136	128	117	108	103	102
Final energy use - Transportation (PJ)	598	567	515	454	397	363	350

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	16,472	19,203	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	6.12	26.1	76.9	91.1	92.2	92.2	92.2
Sales of space heating units - Electric Resistance (%)	5.02	4.5	4.79	6.09	6.39	6.41	6.42
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	69.4	18.3	2.84	1.39	1.35	1.34
Sales of water heating units - Electric Heat Pump (%)	0.147	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	4.15	8.12	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	93.7	79.3	15	0.631	0	0	0
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	5.94	6.22	10.4	11.1	8.07	8.36

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	0.255	0.217	0	0.31	0	3.13
Capital invested - Solar PV - Base (billion \$2018)	0	5	0.207	0.17	0.14	0.476	0
Capital invested - Wind - Base (billion \$2018)	0	0	0	0	0.397	0.388	26.1

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	316	316	0	620	0	8,759
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	1,534
Solar - Base land use assumptions (GWh)	6,488	7,147	331	295	258	928	0
Solar - Constrained land use assumptions (GWh)	4,130	7,335	1,711	258	0	0	2,106
Wind - Base land use assumptions (GWh)	0	0	0	0	917	926	62,588
Wind - Constrained land use assumptions (GWh)	0	0	0	2,842	21,011	0	5,093

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	-181
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,416
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-5,665
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-181
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,814
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-3,029
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,563
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,760
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	813
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.7
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	948

Table 33: *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	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,962
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,460
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	296
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	24,865
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	8,921
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	63.5

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	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	711
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	42.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	182
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,069
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	61.4
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,633

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	253	0.266	0.23	0.147	0.088	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	141	83.8	38.2	26.8	8.46	4.41
Monetary damages from air pollution - Transportation (million 2019\$)	0	716	671	513	298	138	57.1
Premature deaths from air pollution - Coal (deaths)	0	28.3	0.03	0.026	0.017	0.01	0
Premature deaths from air pollution - Natural Gas (deaths)	0	15.9	9.46	4.32	3.03	0.956	0.499
Premature deaths from air pollution - Transportation (deaths)	0	80.6	75.5	57.7	33.5	15.5	6.42

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	3.78	4.86	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.6	73.7	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.4	26.3	4.49	0.226	0	0	0
Sales of space heating units - Electric Heat Pump (%)	15	30.5	75.4	85.4	85.9	85.7	85.7
Sales of space heating units - Electric Resistance (%)	44.7	43.2	18.2	12.6	12.3	12.5	12.5
Sales of space heating units - Fossil (%)	2.28	3.27	1.44	1.03	1.01	0.993	0.989
Sales of space heating units - Gas (%)	38	23	5.01	0.994	0.822	0.801	0.798
Sales of water heating units - Electric Heat Pump (%)	0	12	63.6	75.1	75.6	75.6	75.6
Sales of water heating units - Electric Resistance (%)	56.5	60.4	29.9	23	22.7	22.7	22.7
Sales of water heating units - Gas Furnace (%)	41.3	25.8	4.84	0.202	0	0	0
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.71	1.71	1.72	1.72

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	747	1,909	3,103	4,697	5,116	4,875
Public EV charging plugs - DC Fast (1000 units)	0.067	0	1.34	0	5.93	0	9.61
Public EV charging plugs - L2 (1000 units)	0.204	0	32.1	0	143	0	231
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 (%)	1.7	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.4	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.3	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.92	4.18	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.348	0.215	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	127	128	123	117	112	111	112
Final energy use - Industry (PJ)	1,932	2,153	2,273	2,317	2,383	2,435	2,505
Final energy use - Residential (PJ)	142	136	128	117	108	103	102
Final energy use - Transportation (PJ)	598	567	515	454	397	363	350

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	16,472	19,203	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	44.4	79.2	86.1	86.5	86.5	86.5
Sales of cooking units - Gas (%)	69.9	55.6	20.8	13.9	13.5	13.5	13.5
Sales of space heating units - Electric Heat Pump (%)	6.12	26.1	76.9	91.1	92.2	92.2	92.2
Sales of space heating units - Electric Resistance (%)	5.02	4.5	4.79	6.09	6.39	6.41	6.42
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	69.4	18.3	2.84	1.39	1.35	1.34
Sales of water heating units - Electric Heat Pump (%)	0.147	10.7	56.3	66.5	66.9	66.9	66.9
Sales of water heating units - Electric Resistance (%)	4.15	8.12	26.9	31.1	31.3	31.3	31.3
Sales of water heating units - Gas Furnace (%)	93.7	79.3	15	0.631	0	0	0
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)	0	5.94	6.22	10.4	11.1	8.07	8.36

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	0.255	0	0	0.156	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	6.52	0.356	0.17	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	5.33	0.495	0.403	0	0.151	0
Capital invested - Wind - Constrained (billion \$2018)	0	0	0	0	0	0	1.07

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	316	0	0	316	0	0
Solar - Base land use assumptions (GWh)	11,065	9,298	567	295	0	0	0
Solar - Constrained land use assumptions (GWh)	4,300	7,617	794	701	0	293	0
Wind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	2,390

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	-181
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-5,416
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-67.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-5,665
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-181

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	-2,814
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)	0	0	-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)	0	0	-3,029
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,563
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,760
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	73.3
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	813
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	61.7
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	948

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	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	1,962
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	4,460

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	296
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	24,865
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)	0	0	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	8,921
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	63.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	711
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	42.3

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	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	182
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,069
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	61.4
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,633

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	253	0.266	0.23	0.147	0.088	0.003
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	157	95.2	107	88.7	37.2	9.73
Monetary damages from air pollution - Transportation (million 2019\$)	0	716	671	513	298	138	57.1
Premature deaths from air pollution - Coal (deaths)	0	28.3	0.03	0.026	0.017	0.01	0
Premature deaths from air pollution - Natural Gas (deaths)	0	17.7	10.7	12.1	10	4.21	1.1
Premature deaths from air pollution - Transportation (deaths)	0	80.6	75.5	57.7	33.5	15.5	6.42

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	3.73	4.58	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.5	67.4	70.4	78.5	89.8	96.7	99.1
Sales of cooking units - Gas (%)	33.5	32.6	29.6	21.5	10.2	3.31	0.889
Sales of space heating units - Electric Heat Pump (%)	15	21.9	27	41.8	64.3	78.9	84
Sales of space heating units - Electric Resistance (%)	44.7	48	45.1	36.7	24.2	16.2	13.4
Sales of space heating units - Fossil (%)	2.28	3.62	3.47	2.83	1.88	1.28	1.07
Sales of space heating units - Gas (%)	38	26.5	24.5	18.7	9.62	3.59	1.53
Sales of water heating units - Electric Heat Pump (%)	0	2.06	7.93	24.8	50.7	67.6	73.5
Sales of water heating units - Electric Resistance (%)	56.5	66.3	63	52.9	37.5	27.4	23.9

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 (%)	41.3	29.9	27.3	20.5	10.1	3.2	0.831
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.73	1.74	1.73	1.72

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	120	254	856	2,700	3,931
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.404	0	2.19	0	6.15
Public EV charging plugs - L2 (1000 units)	0.204	0	9.71	0	52.7	0	148
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 (%)	1.71	2.1	2.09	1.67	1.08	0.557	0.238
Vehicle sales - Light-duty - EV (%)	1.71	4.29	11	24.5	46.9	71.1	87.2
Vehicle sales - Light-duty - gasoline (%)	92.3	88.2	80.9	68.3	47.8	25.9	11.4
Vehicle sales - Light-duty - hybrid (%)	4.05	4.89	5.54	5.12	3.91	2.35	1.15
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.385	0.335	0.259	0.186	0.104	0.048
Vehicle sales - Light-duty - other (%)	0.11	0.113	0.104	0.091	0.066	0.037	0.017
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)	127	128	127	126	123	121	119
Final energy use - Industry (PJ)	1,932	2,153	2,275	2,325	2,395	2,445	2,512
Final energy use - Residential (PJ)	142	137	134	131	124	116	110
Final energy use - Transportation (PJ)	599	570	531	500	477	451	421

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	16,461	19,126	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	34.2	39	52	70.1	81.2	85
Sales of cooking units - Gas (%)	69.9	65.8	61	48	29.9	18.8	15
Sales of space heating units - Electric Heat Pump (%)	6.12	16.4	22.3	39	65.1	83.1	89.8
Sales of space heating units - Electric Resistance (%)	5.02	4.5	4.54	4.7	5.12	5.78	6.22
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	79.1	73.2	56.3	29.8	11.1	4.02
Sales of water heating units - Electric Heat Pump (%)	0.147	1.96	7.14	22.1	44.9	59.9	65.1
Sales of water heating units - Electric Resistance (%)	4.15	4.5	6.61	12.8	22.2	28.4	30.5
Sales of water heating units - Gas Furnace (%)	93.7	91.7	84.4	63.3	31	9.9	2.58
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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	4.71	4.85	6.22	6.5	9.04	9.59

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	10.5	12.5	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	11,774	25,838	25,838	25,838

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	799	2,743	2,743	2,743
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	0	0	10,894	24,876	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	1	16	16	16
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	9	20	20	20
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	13.4	44.5	44.5	44.5
Annual - BECCS (MMT)	0	0	0	13.3	44.4	44.4	44.3
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0.14	0.11	0.09	0.17
Cumulative - All (MMT)	0	0	0	13.4	57.9	102	147
Cumulative - BECCS (MMT)	0	0	0	13.3	57.6	102	146
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0.14	0.25	0.34	0.51

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	19.4	87.8	173	240	252
Injection wells (wells)	0	0	16	65	116	194	240
Resource characterization, appraisal, permitting costs (million \$2020)	0	47.3	1,958	3,115	3,115	3,115	3,115
Wells and facilities construction costs (million \$2020)	0	0	499	1,946	3,468	5,799	7,199

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	845	2,391	3,748	3,748	4,168
Cumulative investment - All (million \$2018)	0	0	5,578	10,341	14,944	14,944	15,240
Cumulative investment - Spur (million \$2018)	0	0	12.7	714	1,786	1,786	2,082
Cumulative investment - Trunk (million \$2018)	0	0	5,565	9,626	13,158	13,158	13,158
Spur (km)	0	0	23.9	934	1,822	1,822	2,242
Trunk (km)	0	0	821	1,456	1,926	1,926	1,926

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	-527
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-4,958
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	-59.9
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-5,545
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-527
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-2,572
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	-29.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-3,129
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	217
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,538
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	56.5
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	240
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	109
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	4,161
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	217
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	744
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	56.5
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	240
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	54.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,312

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	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	1,962
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	4,460
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	296
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	24,865
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	8,921
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	63.5

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	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	711
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	42.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	182
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	1,069
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	61.4
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,633

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	3.65	3.76	0	0	0	0
Sales of cooking units - Electric Resistance (%)	66.2	66.2	66.2	66.2	66.2	66.2	66.2
Sales of cooking units - Gas (%)	33.8	33.8	33.8	33.8	33.8	33.8	33.8
Sales of space heating units - Electric Heat Pump (%)	12.3	40.8	42	44	45.9	48.4	52.1
Sales of space heating units - Electric Resistance (%)	46.3	37.2	36.6	35.6	34.3	32	28.2
Sales of space heating units - Fossil (%)	2.33	2.13	2.16	2.14	2.1	2.11	2.11
Sales of space heating units - Gas (%)	39.1	19.9	19.2	18.2	17.7	17.5	17.6
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	56.5	67.6	67.7	67.7	67.5	67.5	67.5
Sales of water heating units - Gas Furnace (%)	41.3	30.7	30.5	30.6	30.8	30.7	30.8
Sales of water heating units - Other (%)	2.21	1.75	1.73	1.74	1.75	1.75	1.76

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 (%)	1.71	2.1	2.21	2.06	1.86	1.73	1.65
Vehicle sales - Light-duty - EV (%)	3.05	4.94	5.66	6.92	8.47	9.91	11.1
Vehicle sales - Light-duty - gasoline (%)	91.1	87.7	85.8	84.1	82.2	80.2	78.6
Vehicle sales - Light-duty - hybrid (%)	3.94	4.81	5.91	6.48	7.09	7.74	8.29
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.382	0.355	0.318	0.316	0.318	0.329
Vehicle sales - Light-duty - other (%)	0.109	0.113	0.11	0.11	0.11	0.109	0.112
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)	127	130	131	133	135	141	150
Final energy use - Industry (PJ)	1,933	2,162	2,297	2,357	2,441	2,510	2,595
Final energy use - Residential (PJ)	142	137	138	141	145	151	156
Final energy use - Transportation (PJ)	599	570	535	514	514	526	543

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	16,112	16,910	0	0	0	0
Sales of cooking units - Electric Resistance (%)	30.1	32.3	32.3	32.3	32.3	32.3	32.3
Sales of cooking units - Gas (%)	69.9	67.7	67.7	67.7	67.7	67.7	67.7
Sales of space heating units - Electric Heat Pump (%)	6.12	28.9	70.9	79.1	79.5	79.5	79.5
Sales of space heating units - Electric Resistance (%)	5.02	6.38	12.2	15.9	18.7	19.1	19.1
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	64.7	17	5	1.82	1.39	1.34
Sales of water heating units - Electric Heat Pump (%)	0.147	0.132	0.129	0.132	0.131	0.129	0.129

Table 61: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	4.15	3.75	3.71	3.72	3.75	3.73	3.74
Sales of water heating units - Gas Furnace (%)	93.7	94.3	94.3	94.3	94.3	94.3	94.3
Sales of water heating units - Other (%)	1.99	1.82	1.81	1.82	1.83	1.82	1.83

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	6.34	6.66	9.85	10.5	8.17	8.47

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO ₂ e/y)	-31.8	0	-11.5	-9.34
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO ₂ e/y)	-3.64	0	-6.07	-6.39
Business-as-usual carbon sink - Total (Mt CO ₂ e/y)	-35.4	0	-17.6	-15.7
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	0	388
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	0	37,585
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)	0	0	0	1,388
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)	0	0	0	7,036
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)	0	0	0	3,857
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	0	13,381
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	0	846
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)	0	0	0	1,337
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)	0	0	0	5,571
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)	0	0	0	3,779
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	0	195
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	0	12,212
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)	0	0	0	231
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)	0	0	0	2,703
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)	0	0	0	1,962
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)	0	0	0	4,460
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)	0	0	0	296
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)	0	0	0	669
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)	0	0	0	422
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)	0	0	0	1,274
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)	0	0	0	292
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)	0	0	0	24,865

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	810
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	4,869
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	2,876
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	8,921
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	571
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	1,003
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	2,997
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	2,527
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	63.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	188
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	3,588
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	1,421
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	80.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	88.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	158
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,253
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	6,840
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	31.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	176
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,375
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	711
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	42.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	44.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	27.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	758
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	3,165
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	47.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	182

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	2,481
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	1,069
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	61.4
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	66.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	198
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,527
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,633

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	1,350	808	419	335	302	300
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	161	168	189	148	144	124
Monetary damages from air pollution - Transportation (million 2019\$)	0	727	747	767	791	816	841
Premature deaths from air pollution - Coal (deaths)	0	152	90.6	47	37.6	33.9	33.7
Premature deaths from air pollution - Natural Gas (deaths)	0	18.2	19	21.4	16.7	16.3	14.1
Premature deaths from air pollution - Transportation (deaths)	0	81.8	84	86.3	89	91.8	94.6