Net-Zero America - tennessee state report

Larson et al. 2020

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

Notes

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

List of Tables

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 . . . 5
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 . . . 15
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 . . . 16
34 E+RE+ scenario - IMPACTS - Health . . . 18
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 . . . 19
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 . . . 24
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	5.23	5.68	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0
Sales of space heating units - Electric Heat Pump (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165	0	2.15	0	9.36	0	15.1
Public EV charging plugs - L2 (1000 units)	0.888	0	51.7	0	225	0	363
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 (%)	1.55	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.92	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Transportation (PJ)	679	622	545	451	367	315	293

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	19,412	22,037	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	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 (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.81	4.94	6.83	7.17	5.85	5.99

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	3.78	0
Capital invested - Solar PV - Base (billion $2018)	0	0.364	0.667	1.41	2.88	6.84	11
Capital invested - Solar PV - Constrained (billion $2018)	0	0.173	0	1.86	2.57	9.47	7
Capital invested - Wind - Base (billion $2018)	0	0.069	0.052	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	0	0	0	4,245	4,245
Solar - Base land use assumptions (GWh)	538	517	1,060	2,417	5,226	12,990	22,023
Solar - Constrained land use assumptions (GWh)	282	0	293	4,856	5,444	10,756	13,520
Wind - Base land use assumptions (GWh)	106	139	116	0	0	0	0
Wind - Constrained land use assumptions (GWh)	106	0	0	0	0	0	255

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	170	170	506	506
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	3,213	0	6,799	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	3	7	7
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	2	2
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	5.99	5.7	17.2	16.5
Annual - BECCS (MMT)	0	0	0	4.13	4.13	12.5	12.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	1.86	1.57	4.69	4.06
Cumulative - All (MMT)	0	0	0	5.99	11.7	28.9	45.4
Cumulative - BECCS (MMT)	0	0	0	4.13	8.26	20.7	33.2
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	1.86	3.43	8.12	12.2

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0.88	1.81	2.58	3.73
Injection wells (wells)	0	0	1	2	4	7	8
Resource characterization, appraisal, permitting costs (million $2020)	0	25.4	71.2	91.5	91.5	91.5	91.5
Wells and facilities construction costs (million $2020)	0	0	16.9	66	118	197	244

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	181	832	1,089	1,872	1,662
Cumulative investment - All (million $2018)	0	0	1,110	2,685	2,984	3,656	3,492
Cumulative investment - Spur (million $2018)	0	0	0	464	763	1,435	1,271
Cumulative investment - Trunk (million $2018)	0	0	1,110	2,221	2,221	2,221	2,221
Spur (km)	0	0	0	470	727	1,511	1,301
Trunk (km)	0	0	181	362	362	362	362

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	-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,739
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,097
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,141
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	965

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,176

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,289
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,839
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	626

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

Item	2020	2025	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	218
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	109
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	46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	75.6

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,532

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	682	0.896	0.87	0.639	0.432	0.035
Monetary damages from air pollution - Natural Gas (million 2019$)	0	231	165	93.7	75.3	30.8	12.1
Monetary damages from air pollution - Transportation (million 2019$)	0	1,540	1,435	1,091	632	291	118
Premature deaths from air pollution - Coal (deaths)	0	76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Natural Gas (deaths)	0	26.1	18.6	10.6	8.51	3.48	1.37
Premature deaths from air pollution - Transportation (deaths)	0	173	161	123	71.1	32.7	13.3

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	438	446	511	765	539	791	630
By economic sector - Construction (jobs)	4,712	4,928	5,282	6,728	7,188	9,183	13,635
By economic sector - Manufacturing (jobs)	4,146	8,493	10,165	13,466	12,832	10,500	13,560
By economic sector - Mining (jobs)	3,073	2,237	1,603	1,043	637	388	238
By economic sector - Other (jobs)	319	336	393	622	971	1,757	3,311
By economic sector - Pipeline (jobs)	466	452	517	487	296	258	237
By economic sector - Professional (jobs)	2,854	2,680	2,460	3,173	3,387	4,784	6,907
By economic sector - Trade (jobs)	2,800	2,315	2,009	2,093	2,174	2,915	4,617
By economic sector - Utilities (jobs)	7,557	7,809	7,736	9,463	8,714	7,834	9,365
By education level - All sectors - Associates degree or some college (jobs)	7,925	9,090	9,483	11,834	11,609	12,123	16,800
By education level - All sectors - Bachelors degree (jobs)	5,841	6,373	6,380	7,650	7,345	7,571	10,227
By education level - All sectors - Doctoral degree (jobs)	189	185	175	206	205	247	344
By education level - All sectors - High school diploma or less (jobs)	11,019	12,589	13,206	16,436	15,922	16,684	22,696
By education level - All sectors - Masters or professional degree (jobs)	1,391	1,460	1,431	1,713	1,658	1,786	2,433
By resource sector - Biomass (jobs)	1,150	1,166	1,223	1,948	1,486	2,903	2,752
By resource sector - CO2 (jobs)	0	13.5	1,134	1,618	735	1,111	1,373
By resource sector - Coal (jobs)	1,987	519	20.5	17.8	15.6	14.1	12.5
By resource sector - Grid (jobs)	6,947	8,096	8,072	11,427	11,624	12,058	15,882
By resource sector - Natural Gas (jobs)	4,057	4,373	3,586	3,247	2,992	1,666	1,554
By resource sector - Nuclear (jobs)	2,555	2,514	2,474	2,435	1,914	956	349
By resource sector - Oil (jobs)	6,549	5,546	4,342	3,023	1,949	1,189	650
By resource sector - Solar (jobs)	2,459	4,257	5,307	8,129	10,534	14,614	25,062
By resource sector - Wind (jobs)	660	3,212	4,519	5,995	5,488	3,900	4,864
Median wages - Annual - All ($2019 per job)	56,367	55,958	55,914	55,961	56,362	56,704	56,970
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	4,161	4,704	4,882	6,048	5,908	6,169	8,492
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	1,657	1,750	1,779	2,182	2,152	2,370	3,310
On-Site or In-Plant Training - Total jobs - None (jobs)	4,243	4,817	4,982	6,159	6,000	6,318	8,666
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	207	237	247	311	305	323	448

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	16,096	18,189	18,786	23,139	22,373	23,231	31,585
On-the-Job Training - All sectors - 1 to 4 years (jobs)	5,322	6,004	6,226	7,715	7,545	7,885	10,868
On-the-Job Training - All sectors - 4 to 10 years (jobs)	1,567	1,653	1,689	2,093	2,083	2,328	3,281
On-the-Job Training - All sectors - None (jobs)	1,471	1,614	1,643	1,994	1,944	2,077	2,876
On-the-Job Training - All sectors - Over 10 years (jobs)	246	301	321	399	389	394	542
On-the-Job Training - All sectors - Up to 1 year (jobs)	17,757	20,125	20,797	25,639	24,778	25,726	34,932
Related work experience - All sectors - 1 to 4 years (jobs)	9,580	10,664	10,940	13,433	13,036	13,630	18,607
Related work experience - All sectors - 4 to 10 years (jobs)	6,106	6,833	7,017	8,616	8,377	8,719	11,940
Related work experience - All sectors - None (jobs)	3,775	4,244	4,394	5,438	5,279	5,574	7,638
Related work experience - All sectors - Over 10 years (jobs)	1,667	1,936	2,007	2,467	2,384	2,396	3,245
Related work experience - All sectors - Up to 1 year (jobs)	5,236	6,019	6,318	7,885	7,662	8,093	11,071
Wage income - All (million $2019)	1,486	1,662	1,715	2,118	2,071	2,178	2,991

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	299	303	256	205	154	97.1	67.4
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	6,175
Natural gas production - Annual (tcf)	3.65	4.04	3.82	3.33	2.81	2.23	1.73
Oil consumption - Annual (million bbls)	133	123	105	78.9	54.7	35.5	20.6
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	2,449
Oil production - Annual (million bbls)	0.252	0.272	0.273	0.273	0.216	0.176	0.117

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	5.17	5.41	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.1	83.5	85.1	89.2	94.8	98.3	99.6
Sales of cooking units - Gas (%)	16.9	16.5	14.9	10.8	5.17	1.67	0.449
Sales of space heating units - Electric Heat Pump (%)	32.2	41.6	45.3	56	72.3	82.8	86.5
Sales of space heating units - Electric Resistance (%)	31.3	33.1	31	25.2	16.6	11.1	9.21
Sales of space heating units - Fossil (%)	4.13	5	4.74	3.81	2.44	1.57	1.28
Sales of space heating units - Gas (%)	32.4	20.3	18.9	14.9	8.67	4.49	3.04
Sales of water heating units - Electric Heat Pump (%)	0	1.56	6	18.8	38.4	51.1	55.6
Sales of water heating units - Electric Resistance (%)	68.9	78.9	75.9	67	53.3	44.5	41.4
Sales of water heating units - Gas Furnace (%)	27.4	17	15.5	11.7	5.76	1.83	0.477
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.56	2.54	2.54

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	180	376	1,271	3,991	5,817
Public EV charging plugs - DC Fast (1000 units)	0.165	0	0.677	0	3.48	0	9.69
Public EV charging plugs - L2 (1000 units)	0.888	0	16.3	0	83.7	0	233
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

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

Item	2020	2025	2030	2035	2040	2045	2050
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.9	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.7	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.59	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.38	0.326	0.249	0.177	0.098	0.046
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
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)	171	171	169	166	161	156	153
Final energy use - Industry (PJ)	755	838	889	910	921	912	909
Final energy use - Residential (PJ)	260	244	232	219	204	187	173
Final energy use - Transportation (PJ)	680	628	570	525	490	449	400

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	19,401	22,003	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric Heat Pump (%)	9.56	21.7	26.9	42.4	66.6	83.3	89.7
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.65	4.78	5.23	5.91	6.33
Sales of space heating units - Fossil (%)	0	3.27	3.09	2.34	1.17	0.379	0.099
Sales of space heating units - Gas Furnace (%)	85.6	70.4	65.3	50.5	27	10.4	3.89
Sales of water heating units - Electric Heat Pump (%)	0.155	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	5.74	6.48	8.39	14.4	23.5	29.5	31.6
Sales of water heating units - Gas Furnace (%)	92.5	90	83	62.2	30.4	9.74	2.53
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.14	4.18	4.77	4.88	5.83	6.04

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	-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,739
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-274

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,097
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,141
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,176

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	2,278

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,289
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,839
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	218
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	109
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	46.4

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,532

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	682	0.896	0.87	0.639	0.432	0.035
Monetary damages from air pollution - Natural Gas (million 2019$)	0	175	109	44.9	18.5	6.58	4.2
Monetary damages from air pollution - Transportation (million 2019$)	0	1,565	1,579	1,538	1,387	1,106	761
Premature deaths from air pollution - Coal (deaths)	0	76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Natural Gas (deaths)	0	19.8	12.3	5.08	2.09	0.743	0.475
Premature deaths from air pollution - Transportation (deaths)	0	176	178	173	156	124	85.5

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	5.23	5.68	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0
Sales of space heating units - Electric Heat Pump (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165	0	2.15	0	9.36	0	15.1
Public EV charging plugs - L2 (1000 units)	0.888	0	51.7	0	225	0	363
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 (%)	1.55	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.92	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Transportation (PJ)	679	622	545	451	367	315	293

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	19,412	22,037	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	0	0	0
Sales of space heating units - Gas Furnace (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.81	4.94	6.83	7.17	5.85	5.99

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	1.82	5.34	15	16.4	37.2
Capital invested - Wind - Base (billion $2018)	0	0.069	0.052	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	355	0	2,871	9,024	26,849	31,008	74,393
Solar - Constrained land use assumptions (GWh)	501	0	1,591	8,838	22,244	30,754	59,291
Wind - Base land use assumptions (GWh)	106	139	116	0	0	0	0
Wind - Constrained land use assumptions (GWh)	106	0	0	0	0	0	255

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	-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,739
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,097
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,141
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,176

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	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,178

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

Item	2020	2025	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,289
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,839
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	218

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

Item	2020	2025	2050
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	109
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	46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,532

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	682	0.896	0.87	0.639	0.432	0.035
Monetary damages from air pollution - Natural Gas (million 2019$)	0	188	134	69.9	43.8	12.3	4.63
Monetary damages from air pollution - Transportation (million 2019$)	0	1,540	1,435	1,091	632	291	118

Table 34: *E+RE+ scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Coal (deaths)	0	76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Natural Gas (deaths)	0	21.2	15.1	7.9	4.95	1.39	0.523
Premature deaths from air pollution - Transportation (deaths)	0	173	161	123	71.1	32.7	13.3

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	5.23	5.68	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0
Sales of space heating units - Electric Heat Pump (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165	0	2.15	0	9.36	0	15.1
Public EV charging plugs - L2 (1000 units)	0.888	0	51.7	0	225	0	363
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 (%)	1.55	1.81	1.26	0.402	0.074	0.013	0
Vehicle sales - Light-duty - EV (%)	3.92	15.2	46.5	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.064	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	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)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Transportation (PJ)	679	622	545	451	367	315	293

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	19,412	22,037	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Sales of space heating units - Electric Heat Pump (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	0	0	0
Sales of space heating units - Gas Furnace (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.81	4.94	6.83	7.17	5.85	5.99

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	1.03	1.06	0.107
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0	0.233	0.639	1.71	0
Capital invested - Wind - Base (billion $2018)	0	0.069	0	0	0.046	0	0
Capital invested - Wind - Constrained (billion $2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,029	0	0	1,871	2,014	219
Solar - Constrained land use assumptions (GWh)	501	0	401	1,150	3,257	0
Wind - Base land use assumptions (GWh)	106	139	0	116	0	0
Wind - Constrained land use assumptions (GWh)	106	0	0	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,739
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,097
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112

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

Item	2020	2025	2050
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,141
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,176

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,289

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

Item	2020	2025	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,839
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	218
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	109
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	46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,436

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,532

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	682	0.896	0.87	0.639	0.432	0.035
Monetary damages from air pollution - Natural Gas (million 2019$)	0	214	151	156	120	41.1	13.4
Monetary damages from air pollution - Transportation (million 2019$)	0	1,540	1,435	1,091	632	291	118
Premature deaths from air pollution - Coal (deaths)	0	76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Natural Gas (deaths)	0	24.1	17	17.6	13.5	4.64	1.51
Premature deaths from air pollution - Transportation (deaths)	0	173	161	123	71.1	32.7	13.3

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	5.17	5.41	0	0	0	0
Sales of cooking units - Electric Resistance (%)	83.1	83.5	85.1	89.2	94.8	98.3	99.6
Sales of cooking units - Gas (%)	16.9	16.5	14.9	10.8	5.17	1.67	0.449
Sales of space heating units - Electric Heat Pump (%)	32.2	41.6	45.3	56	72.3	82.8	86.5
Sales of space heating units - Electric Resistance (%)	31.3	33.1	31	25.2	16.6	11.1	9.21
Sales of space heating units - Fossil (%)	4.13	5	4.74	3.81	2.44	1.57	1.28
Sales of space heating units - Gas (%)	32.4	20.3	18.9	14.9	8.67	4.49	3.04
Sales of water heating units - Electric Heat Pump (%)	0	1.56	6	18.8	38.4	51.1	55.6
Sales of water heating units - Electric Resistance (%)	68.9	78.9	75.9	67	53.3	44.5	41.4
Sales of water heating units - Gas Furnace (%)	27.4	17	15.5	11.7	5.76	1.83	0.477
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.56	2.54	2.54

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	180	376	1,271	3,991	5,817
Public EV charging plugs - DC Fast (1000 units)	0.165	0	0.677	0	3.48	0	9.69
Public EV charging plugs - L2 (1000 units)	0.888	0	16.3	0	83.7	0	233
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.9	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.7	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.59	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.38	0.326	0.249	0.177	0.098	0.046
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
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)	171	171	169	166	161	156	153
Final energy use - Industry (PJ)	755	838	889	910	921	912	909
Final energy use - Residential (PJ)	260	244	232	219	204	187	173
Final energy use - Transportation (PJ)	680	628	570	525	490	449	400

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	19,401	22,003	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Sales of space heating units - Electric Heat Pump (%)	9.56	21.7	26.9	42.4	66.6	83.3	89.7
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.65	4.78	5.23	5.91	6.33
Sales of space heating units - Fossil (%)	0	3.27	3.09	2.34	1.17	0.379	0.099
Sales of space heating units - Gas Furnace (%)	85.6	70.4	65.3	50.5	27	10.4	3.89
Sales of water heating units - Electric Heat Pump (%)	0.155	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	5.74	6.48	8.39	14.4	23.5	29.5	31.6
Sales of water heating units - Gas Furnace (%)	92.5	90	83	62.2	30.4	9.74	2.53
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.14	4.18	4.77	4.88	5.83	6.04

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

Table 50: *E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.046	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	2.97	0.004	6.62	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	45.5	45.5	45.5	45.5
Biomass w/ccu power plant (GWh)	0	0	3,332	3,337	10,762	10,762	10,762

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	214	575	1,886	2,174	2,174
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	2,724	4,018	15,288	3,181	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	4	15	18	18
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	2	3	9	9	9
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 53: *E-B+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	3.3	8.41	27.6	31.7	31.7
Annual - BECCS (MMT)	0	0	3.3	8.41	27.6	31.7	31.7
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0.01
Cumulative - All (MMT)	0	0	3.3	11.7	39.3	71	103
Cumulative - BECCS (MMT)	0	0	3.3	11.7	39.3	71	103
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0.01

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0.92	3.21	7.13	9.85	10
Injection wells (wells)	0	0	2	7	12	20	24
Resource characterization, appraisal, permitting costs (million $2020)	0	25.4	112	173	173	173	173
Wells and facilities construction costs (million $2020)	0	0	50.8	198	353	590	732

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	499	1,390	2,745	2,186	2,944
Cumulative investment - All (million $2018)	0	0	1,603	3,872	6,641	6,309	6,854
Cumulative investment - Spur (million $2018)	0	0	310	1,287	2,763	2,431	2,976
Cumulative investment - Trunk (million $2018)	0	0	1,293	2,585	3,878	3,878	3,878
Spur (km)	0	0	318	1,029	2,203	1,644	2,401
Trunk (km)	0	0	181	362	543	543	543

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	-652
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,109
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	-97.8
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-3,859
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-652
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-1,638
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	-48.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-2,339
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	4,110
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	110
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	442
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	178
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	5,132
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	877
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	110
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	442
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	89
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	1,810

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	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,289
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,839
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	18.9

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	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	218
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	109
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	46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	4,532

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	5.15	4.97	0	0	0	0
Sales of cooking units - Electric Resistance (%)	82.9	82.9	82.9	82.9	82.9	82.9	82.9
Sales of cooking units - Gas (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Sales of space heating units - Electric Heat Pump (%)	30.6	53.8	54.6	55.9	57.2	58.9	61.6
Sales of space heating units - Electric Resistance (%)	32	27.2	26.7	25.9	24.9	23.3	20.6
Sales of space heating units - Fossil (%)	4.21	3.29	3.32	3.27	3.22	3.18	3.2
Sales of space heating units - Gas (%)	33.2	15.8	15.4	14.9	14.7	14.6	14.6
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	68.9	80	80.1	80	79.9	79.9	79.9
Sales of water heating units - Gas Furnace (%)	27.4	17.5	17.3	17.5	17.6	17.5	17.6
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.57	2.56	2.57

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 (%)	1.55	1.97	2.18	2.03	1.83	1.71	1.62
Vehicle sales - Light-duty - EV (%)	3.56	5.6	6.38	7.84	9.55	11.1	12.2
Vehicle sales - Light-duty - gasoline (%)	90.2	86.7	84.5	82.7	80.6	78.7	77.1
Vehicle sales - Light-duty - hybrid (%)	4.44	5.28	6.47	7.04	7.6	8.18	8.63
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.377	0.346	0.307	0.304	0.305	0.315
Vehicle sales - Light-duty - other (%)	0.102	0.106	0.102	0.103	0.102	0.101	0.104
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)	171	174	176	176	177	181	190
Final energy use - Industry (PJ)	755	847	903	938	959	961	976
Final energy use - Residential (PJ)	260	244	236	230	227	228	229
Final energy use - Transportation (PJ)	680	628	576	545	545	562	584

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	19,056	19,846	0	0	0	0
Sales of cooking units - Electric Resistance (%)	43.5	45.6	45.9	45.7	46	45.9	45.7
Sales of cooking units - Gas (%)	56.5	54.4	54.1	54.3	54	54.1	54.3
Sales of space heating units - Electric Heat Pump (%)	9.56	27.5	56.9	76.1	79	79.4	79.4
Sales of space heating units - Electric Resistance (%)	4.81	5.67	10	15.4	18.7	19.2	19.2
Sales of space heating units - Fossil (%)	0	2.93	1.3	0.192	0.019	0	0
Sales of space heating units - Gas Furnace (%)	85.6	63.9	31.8	8.33	2.28	1.48	1.43
Sales of water heating units - Electric Heat Pump (%)	0.155	0.153	0.147	0.149	0.149	0.146	0.148

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 (%)	5.74	5.75	5.58	5.66	5.62	5.56	5.61
Sales of water heating units - Gas Furnace (%)	92.5	92.5	92.7	92.6	92.7	92.7	92.7
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56

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	4.86	5	5.95	6.18	5.74	5.89

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-8.29	0	-10.7	-8.71
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.86	0	-3.1	-3.26
Business-as-usual carbon sink - Total (Mt CO2e/y)	-10.1	0	-13.8	-12
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	116
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	31,364
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	9,586
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	3,823
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	57.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	8,323
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,289
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	86.8
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	19,839

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	1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	2,556
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	218
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	88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,209
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	109
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	46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	286

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	2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	164
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	67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,532

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,429	1,663	1,315	1,135	1,069	1,059
Monetary damages from air pollution - Natural Gas (million 2019$)	0	190	205	222	260	220	209
Monetary damages from air pollution - Transportation (million 2019$)	0	1,564	1,601	1,639	1,685	1,732	1,780
Premature deaths from air pollution - Coal (deaths)	0	273	187	148	127	120	119
Premature deaths from air pollution - Natural Gas (deaths)	0	21.5	23.2	25.1	29.4	24.8	23.6
Premature deaths from air pollution - Transportation (deaths)	0	176	180	184	190	195	200