Net-Zero America - wyoming 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

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	0.195	0.209	0	0	0	0
Sales of cooking units - Electric Resistance (%)	38	51.2	91.7	99.6	100	100	100
Sales of cooking units - Gas (%)	62	48.8	8.35	0.42	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	12.5	35.2	82	92.9	94	93.9
Sales of space heating units - Electric Resistance (%)	9.04	15.7	12.6	5.87	4.27	4.11	4.16
Sales of space heating units - Fossil (%)	15.2	17.3	12.6	2.36	0.19	0.008	0
Sales of space heating units - Gas (%)	70.6	54.6	39.6	9.78	2.61	1.91	1.89
Sales of water heating units - Electric Heat Pump (%)	0	0.824	11.4	35.5	41	41.4	41.4
Sales of water heating units - Electric Resistance (%)	12.2	25.1	33.5	52.4	57.1	57.6	57.7
Sales of water heating units - Gas Furnace (%)	87.1	73.3	54.2	11.3	0.997	0.043	0
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.869	0.883	0.888	0.894

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	161	411	669	1,013	1,103	1,051
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.335	0	1.49	0	2.42
Public EV charging plugs - L2 (1000 units)	0.087	0	8.09	0	36.1	0	58.5
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 (%)	2.1	2.29	1.49	0.482	0.084	0.013	0
Vehicle sales - Light-duty - EV (%)	2.08	9.65	37.5	78.2	95.9	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.9	84.3	58.1	20.2	3.78	0.605	0
Vehicle sales - Light-duty - hybrid (%)	2.64	3.27	2.57	1.02	0.236	0.048	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.371	0.249	0.08	0.015	0.003	0
Vehicle sales - Light-duty - other (%)	0.126	0.123	0.087	0.031	0.006	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)	23.9	23.9	23.4	22.2	20.6	19.5	18.9
Final energy use - Industry (PJ)	91.2	95.3	94.6	94.5	96.9	97.8	98.7
Final energy use - Residential (PJ)	12.4	11.7	11.2	10	8.47	7.35	6.61
Final energy use - Transportation (PJ)	100	93.7	82.5	69.4	57.8	50.9	48.2

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	1,754	1,951	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.45	7.71	29.2	77.9	89.7	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.46	3.43	4.85	8.06	8.66	8.7	8.7
Sales of space heating units - Fossil (%)	0	0.209	0.04	0.002	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	97.1	88.6	66	14	1.67	0.543	0.493
Sales of water heating units - Electric Heat Pump (%)	0.014	0.99	13.4	41.7	48.6	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.674	2.42	14.8	42.9	49.7	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.2	96.2	71.5	15	1.33	0.057	0
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.475	0.492	0.982	1.06	0.888	0.932

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0.302
Capital invested - Wind - Base (billion $2018)	0	1.38	9.97	7.61	10.7	7.23	3.44
Capital invested - Wind - Constrained (billion $2018)	0	6.49	5.04	2.64	3.93	3.26	2.02

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	339
Wind - Base land use assumptions (GWh)	24,571	3,643	25,630	20,713	29,772	21,263	11,172
Wind - Constrained land use assumptions (GWh)	24,034	3,352	14,690	10,169	10,431	10,255	4,402

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	0	0	16.5
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	0	277
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	1
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	0	0	0	0.32
Annual - BECCS (MMT)	0	0	0	0	0	0	0.32
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0.32

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0.32
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	25.7	25.7	95.7	25.7	192
Cumulative investment - All (million $2018)	0	0	13.7	14.8	52.6	14.8	117
Cumulative investment - Spur (million $2018)	0	0	13.7	14.8	52.6	14.8	117
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	25.7	25.7	95.7	25.7	192
Trunk (km)	0	0	0	0	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-742
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-771
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-378
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-14.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-393
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	44.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,048
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	513
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	22.3

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	535

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	385
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,188
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,665
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	1,027

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

Item	2020	2025	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	54.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	9.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	7.99
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,309

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,709

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	28.6	0.02	0.02	0.015	0.009	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	6.15	3.96	2.86	2.7	1.79	0.853
Monetary damages from air pollution - Transportation (million 2019$)	0	23.8	21.5	15.8	8.75	3.79	1.38
Premature deaths from air pollution - Coal (deaths)	0	3.21	0.002	0.002	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.695	0.447	0.323	0.305	0.202	0.096
Premature deaths from air pollution - Transportation (deaths)	0	2.67	2.42	1.78	0.984	0.427	0.156

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	0	0	0	0	0	0	15.2
By economic sector - Construction (jobs)	5,579	6,007	8,230	9,850	11,769	12,143	11,338
By economic sector - Manufacturing (jobs)	6,687	6,304	7,764	8,870	8,022	6,909	6,810
By economic sector - Mining (jobs)	13,501	9,381	6,651	5,046	3,291	2,068	1,102
By economic sector - Other (jobs)	263	301	533	739	1,018	1,171	1,210
By economic sector - Pipeline (jobs)	706	730	663	582	452	328	218
By economic sector - Professional (jobs)	4,767	4,587	5,950	7,183	8,786	9,437	9,204
By economic sector - Trade (jobs)	9,935	5,530	4,608	5,011	5,494	5,659	5,396
By economic sector - Utilities (jobs)	5,052	4,537	5,685	7,196	9,489	10,097	9,660
By education level - All sectors - Associates degree or some college (jobs)	13,354	10,995	12,151	13,693	15,164	15,141	14,338
By education level - All sectors - Bachelors degree (jobs)	10,734	8,829	9,225	9,985	10,614	10,428	9,743
By education level - All sectors - Doctoral degree (jobs)	329	303	340	375	418	426	402
By education level - All sectors - High school diploma or less (jobs)	19,679	15,167	16,128	17,979	19,456	19,147	17,959
By education level - All sectors - Masters or professional degree (jobs)	2,394	2,082	2,242	2,447	2,668	2,669	2,510
By resource sector - Biomass (jobs)	0	0	0	0	0	0	65
By resource sector - CO2 (jobs)	0	0	0	14.6	17.8	18.1	99.9
By resource sector - Coal (jobs)	12,946	3,817	364	193	142	110	92.3
By resource sector - Grid (jobs)	4,436	4,061	7,284	10,871	15,254	16,972	16,762
By resource sector - Natural Gas (jobs)	11,300	10,721	8,701	6,672	5,462	3,800	2,339
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	12,187	11,814	10,701	9,641	7,043	5,296	3,313
By resource sector - Solar (jobs)	1,612	1,038	1,396	2,498	2,528	2,589	3,245
By resource sector - Wind (jobs)	4,008	5,926	11,639	14,590	17,873	19,026	19,036
Median wages - Annual - All ($2019 per job)	61,418	63,266	63,772	64,191	64,926	65,780	66,476
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	7,030	5,836	6,397	7,147	7,851	7,799	7,334
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	2,612	2,288	2,580	2,904	3,292	3,324	3,113
On-Site or In-Plant Training - Total jobs - None (jobs)	7,270	6,003	6,532	7,253	7,886	7,818	7,382
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	306	273	318	366	416	420	398
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	29,271	22,976	24,258	26,809	28,876	28,450	26,725
On-the-Job Training - All sectors - 1 to 4 years (jobs)	8,786	7,427	8,216	9,195	10,152	10,113	9,519

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 4 to 10 years (jobs)	2,381	2,103	2,423	2,764	3,187	3,245	3,055
On-the-Job Training - All sectors - None (jobs)	2,651	2,105	2,212	2,423	2,606	2,572	2,414
On-the-Job Training - All sectors - Over 10 years (jobs)	399	353	396	438	464	450	423
On-the-Job Training - All sectors - Up to 1 year (jobs)	32,273	25,389	26,837	29,660	31,912	31,431	29,542
Related work experience - All sectors - 1 to 4 years (jobs)	17,468	13,915	14,737	16,269	17,609	17,400	16,315
Related work experience - All sectors - 4 to 10 years (jobs)	10,582	8,770	9,502	10,538	11,499	11,408	10,721
Related work experience - All sectors - None (jobs)	6,327	5,155	5,582	6,223	6,809	6,756	6,357
Related work experience - All sectors - Over 10 years (jobs)	2,867	2,421	2,618	2,878	3,077	3,016	2,831
Related work experience - All sectors - Up to 1 year (jobs)	9,247	7,116	7,645	8,571	9,325	9,231	8,729
Wage income - All (million $2019)	2,855	2,365	2,556	2,855	3,137	3,145	2,989

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	125	127	107	86	64.7	40.7	28.3
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	2,590
Natural gas production - Annual (tcf)	1,735	1,923	1,818	1,583	1,339	1,062	825
Oil consumption - Annual (million bbls)	29.5	28.7	25.8	21.1	16.3	12.6	8.98
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	638
Oil production - Annual (million bbls)	105	114	114	114	90.5	73.5	48.9

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	0.194	0.206	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.8	39.4	45.1	60.1	81	93.9	98.3
Sales of cooking units - Gas (%)	62.2	60.6	54.9	39.9	19	6.14	1.65
Sales of space heating units - Electric Heat Pump (%)	5.11	10.8	12.2	17	27.9	41.4	49.7
Sales of space heating units - Electric Resistance (%)	9.04	15.9	15.6	15.1	13.8	11.8	10.6
Sales of space heating units - Fossil (%)	15.2	17.6	17.7	15.3	12	9.78	8.25
Sales of space heating units - Gas (%)	70.6	55.7	54.6	52.6	46.3	37	31.4
Sales of water heating units - Electric Heat Pump (%)	0	0.23	0.889	3.05	8.31	15.1	19.3
Sales of water heating units - Electric Resistance (%)	12.2	24.6	25.4	27.4	31.8	37.2	40.6
Sales of water heating units - Gas Furnace (%)	87.1	74.3	72.8	68.7	59	46.8	39.1
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.868	0.881	0.89	0.897

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	25.8	54.8	184	582	848
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.1	0	0.552	0	1.55
Public EV charging plugs - L2 (1000 units)	0.087	0	2.42	0	13.3	0	37.5
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 (%)	2.11	2.42	2.16	1.75	1.17	0.614	0.26

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.25	3.29	8.83	21	42.9	68.3	86.1
Vehicle sales - Light-duty - gasoline (%)	93.7	90.1	84.4	72.9	52.4	28.8	12.5
Vehicle sales - Light-duty - hybrid (%)	2.7	3.64	4.15	4.05	3.3	2.1	1.08
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.396	0.359	0.287	0.213	0.122	0.056
Vehicle sales - Light-duty - other (%)	0.127	0.13	0.123	0.109	0.081	0.046	0.021
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)	23.9	23.9	23.7	23.6	23.4	23.1	22.9
Final energy use - Industry (PJ)	91.2	95.4	95	95.9	99	99.6	100
Final energy use - Residential (PJ)	12.4	11.7	11.3	11.1	10.7	10.3	9.8
Final energy use - Transportation (PJ)	100	94.2	85.5	79.2	74.7	69.4	62.9

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	1,753	1,948	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	1.45	6.48	7.77	12	22.4	35.8	44.2
Sales of space heating units - Electric Resistance (%)	1.46	3.35	3.43	3.71	4.42	5.32	5.86
Sales of space heating units - Fossil (%)	0	0.246	0.238	0.208	0.166	0.139	0.129
Sales of space heating units - Gas Furnace (%)	97.1	89.9	88.6	84.1	73	58.7	49.8
Sales of water heating units - Electric Heat Pump (%)	0.014	0.298	1.07	3.62	9.83	17.9	23
Sales of water heating units - Electric Resistance (%)	0.674	1.73	2.5	5.04	11.2	19.3	24.3
Sales of water heating units - Gas Furnace (%)	99.2	97.6	96	91	78.6	62.4	52.4
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.375	0.38	0.515	0.536	0.847	0.903

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-742
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-771
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-378
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-14.5

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-393
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	44.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,048
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	513
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	22.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	535

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	385
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,188

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

Item	2020	2025	2050
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,665
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	1,027
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	54.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	9.4

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	7.99
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,309
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,709

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	28.6	0.02	0.02	0.015	0.009	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	6.25	3.48	2.29	1.39	0.762	0.565
Monetary damages from air pollution - Transportation (million 2019$)	0	24.1	23.5	22.2	19.3	14.8	9.75
Premature deaths from air pollution - Coal (deaths)	0	3.21	0.002	0.002	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.706	0.393	0.258	0.157	0.086	0.064
Premature deaths from air pollution - Transportation (deaths)	0	2.71	2.64	2.49	2.17	1.67	1.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	0.195	0.209	0	0	0	0
Sales of cooking units - Electric Resistance (%)	38	51.2	91.7	99.6	100	100	100
Sales of cooking units - Gas (%)	62	48.8	8.35	0.42	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	12.5	35.2	82	92.9	94	93.9
Sales of space heating units - Electric Resistance (%)	9.04	15.7	12.6	5.87	4.27	4.11	4.16
Sales of space heating units - Fossil (%)	15.2	17.3	12.6	2.36	0.19	0.008	0
Sales of space heating units - Gas (%)	70.6	54.6	39.6	9.78	2.61	1.91	1.89
Sales of water heating units - Electric Heat Pump (%)	0	0.824	11.4	35.5	41	41.4	41.4
Sales of water heating units - Electric Resistance (%)	12.2	25.1	33.5	52.4	57.1	57.6	57.7
Sales of water heating units - Gas Furnace (%)	87.1	73.3	54.2	11.3	0.997	0.043	0
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.869	0.883	0.888	0.894

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	161	411	669	1,013	1,103	1,051
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.335	0	1.49	0	2.42
Public EV charging plugs - L2 (1000 units)	0.087	0	8.09	0	36.1	0	58.5
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 (%)	2.1	2.29	1.49	0.482	0.084	0.013	0
Vehicle sales - Light-duty - EV (%)	2.08	9.65	37.5	78.2	95.9	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.9	84.3	58.1	20.2	3.78	0.605	0
Vehicle sales - Light-duty - hybrid (%)	2.64	3.27	2.57	1.02	0.236	0.048	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.371	0.249	0.08	0.015	0.003	0
Vehicle sales - Light-duty - other (%)	0.126	0.123	0.087	0.031	0.006	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)	23.9	23.9	23.4	22.2	20.6	19.5	18.9
Final energy use - Industry (PJ)	91.2	95.3	94.6	94.5	96.9	97.8	98.7
Final energy use - Residential (PJ)	12.4	11.7	11.2	10	8.47	7.35	6.61
Final energy use - Transportation (PJ)	100	93.7	82.5	69.4	57.8	50.9	48.2

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	1,754	1,951	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.45	7.71	29.2	77.9	89.7	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.46	3.43	4.85	8.06	8.66	8.7	8.7
Sales of space heating units - Fossil (%)	0	0.209	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	97.1	88.6	66	14	1.67	0.543	0.493
Sales of water heating units - Electric Heat Pump (%)	0.014	0.99	13.4	41.7	48.6	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.674	2.42	14.8	42.9	49.7	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.2	96.2	71.5	15	1.33	0.057	0
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.475	0.492	0.982	1.06	0.888	0.932

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	0	0	0	0	10.5
Capital invested - Wind - Base (billion $2018)	0	2.04	10.9	14.4	17.3	14	33.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	0	0	0	24,112
Solar - Constrained land use assumptions (GWh)	0	0	0	0	0	0	11,411
Wind - Base land use assumptions (GWh)	25,403	5,366	27,960	38,298	48,229	40,243	102,271
Wind - Constrained land use assumptions (GWh)	24,034	5,835	15,079	14,847	20,420	15,349	96,133

Table 32: *E+RE+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-742
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-771
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-378
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-14.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-393
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	44.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,048
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	513
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	22.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	535

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	385

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

Item	2020	2025	2050
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,188
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,665
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	1,027
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	54.2

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

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	9.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	7.99
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,309
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,709

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	28.6	0.02	0.02	0.015	0.009	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	5.58	3.29	1.66	1.36	0.746	0.458
Monetary damages from air pollution - Transportation (million 2019$)	0	23.8	21.5	15.8	8.75	3.79	1.38
Premature deaths from air pollution - Coal (deaths)	0	3.21	0.002	0.002	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.63	0.371	0.187	0.153	0.084	0.052
Premature deaths from air pollution - Transportation (deaths)	0	2.67	2.42	1.78	0.984	0.427	0.156

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	0.195	0.209	0	0	0	0
Sales of cooking units - Electric Resistance (%)	38	51.2	91.7	99.6	100	100	100
Sales of cooking units - Gas (%)	62	48.8	8.35	0.42	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	12.5	35.2	82	92.9	94	93.9
Sales of space heating units - Electric Resistance (%)	9.04	15.7	12.6	5.87	4.27	4.11	4.16
Sales of space heating units - Fossil (%)	15.2	17.3	12.6	2.36	0.19	0.008	0
Sales of space heating units - Gas (%)	70.6	54.6	39.6	9.78	2.61	1.91	1.89
Sales of water heating units - Electric Heat Pump (%)	0	0.824	11.4	35.5	41	41.4	41.4
Sales of water heating units - Electric Resistance (%)	12.2	25.1	33.5	52.4	57.1	57.6	57.7
Sales of water heating units - Gas Furnace (%)	87.1	73.3	54.2	11.3	0.997	0.043	0
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.869	0.883	0.888	0.894

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	161	411	669	1,013	1,103	1,051
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.335	0	1.49	0	2.42
Public EV charging plugs - L2 (1000 units)	0.087	0	8.09	0	36.1	0	58.5
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 (%)	2.1	2.29	1.49	0.482	0.084	0.013	0
Vehicle sales - Light-duty - EV (%)	2.08	9.65	37.5	78.2	95.9	99.3	100
Vehicle sales - Light-duty - gasoline (%)	92.9	84.3	58.1	20.2	3.78	0.605	0
Vehicle sales - Light-duty - hybrid (%)	2.64	3.27	2.57	1.02	0.236	0.048	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.371	0.249	0.08	0.015	0.003	0
Vehicle sales - Light-duty - other (%)	0.126	0.123	0.087	0.031	0.006	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)	23.9	23.9	23.4	22.2	20.6	19.5	18.9
Final energy use - Industry (PJ)	91.2	95.3	94.6	94.5	96.9	97.8	98.7
Final energy use - Residential (PJ)	12.4	11.7	11.2	10	8.47	7.35	6.61
Final energy use - Transportation (PJ)	100	93.7	82.5	69.4	57.8	50.9	48.2

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	1,754	1,951	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.45	7.71	29.2	77.9	89.7	90.8	90.8
Sales of space heating units - Electric Resistance (%)	1.46	3.43	4.85	8.06	8.66	8.7	8.7
Sales of space heating units - Fossil (%)	0	0.209	0.04	0.002	0	0	0

Table 38: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	97.1	88.6	66	14	1.67	0.543	0.493
Sales of water heating units - Electric Heat Pump (%)	0.014	0.99	13.4	41.7	48.6	49.2	49.2
Sales of water heating units - Electric Resistance (%)	0.674	2.42	14.8	42.9	49.7	50.4	50.4
Sales of water heating units - Gas Furnace (%)	99.2	96.2	71.5	15	1.33	0.057	0
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.475	0.492	0.982	1.06	0.888	0.932

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	0.836	0	0	0	0.603	0.481
Capital invested - Solar PV - Constrained (billion $2018)	0	0	0	0	0.499	0	0.303
Capital invested - Wind - Base (billion $2018)	0	1.53	4.64	5.2	8.26	6	0.933
Capital invested - Wind - Constrained (billion $2018)	0	1.25	3.92	2.37	4.03	2.15	0.51

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	1,350	0	0	0	1,327	1,122
Solar - Constrained land use assumptions (GWh)	0	0	0	0	1,031	0	701
Wind - Base land use assumptions (GWh)	25,403	3,930	12,358	13,954	23,713	17,697	3,084
Wind - Constrained land use assumptions (GWh)	24,034	2,958	9,894	6,324	11,109	6,130	1,536

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-742
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-771
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-378
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-14.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-393
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,003
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	44.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,048

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	513
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	22.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	535

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	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	385
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,188
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,665

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

Item	2020	2025	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	1,027
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	54.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	9.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	7.99

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

Item	2020	2025	2050
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,309
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,709

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	28.6	0.02	0.02	0.015	0.009	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	6.12	3.87	3.61	4.59	2.16	0.625
Monetary damages from air pollution - Transportation (million 2019$)	0	23.8	21.5	15.8	8.75	3.79	1.38
Premature deaths from air pollution - Coal (deaths)	0	3.21	0.002	0.002	0.002	0.001	0
Premature deaths from air pollution - Natural Gas (deaths)	0	0.691	0.437	0.408	0.519	0.244	0.071
Premature deaths from air pollution - Transportation (deaths)	0	2.67	2.42	1.78	0.984	0.427	0.156

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	0.194	0.206	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.8	39.4	45.1	60.1	81	93.9	98.3
Sales of cooking units - Gas (%)	62.2	60.6	54.9	39.9	19	6.14	1.65
Sales of space heating units - Electric Heat Pump (%)	5.11	10.8	12.2	17	27.9	41.4	49.7
Sales of space heating units - Electric Resistance (%)	9.04	15.9	15.6	15.1	13.8	11.8	10.6
Sales of space heating units - Fossil (%)	15.2	17.6	17.7	15.3	12	9.78	8.25
Sales of space heating units - Gas (%)	70.6	55.7	54.6	52.6	46.3	37	31.4
Sales of water heating units - Electric Heat Pump (%)	0	0.23	0.889	3.05	8.31	15.1	19.3
Sales of water heating units - Electric Resistance (%)	12.2	24.6	25.4	27.4	31.8	37.2	40.6
Sales of water heating units - Gas Furnace (%)	87.1	74.3	72.8	68.7	59	46.8	39.1
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.868	0.881	0.89	0.897

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	25.8	54.8	184	582	848
Public EV charging plugs - DC Fast (1000 units)	0.067	0	0.1	0	0.552	0	1.55
Public EV charging plugs - L2 (1000 units)	0.087	0	2.42	0	13.3	0	37.5
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 (%)	2.11	2.42	2.16	1.75	1.17	0.614	0.26

Table 46: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	1.25	3.29	8.83	21	42.9	68.3	86.1
Vehicle sales - Light-duty - gasoline (%)	93.7	90.1	84.4	72.9	52.4	28.8	12.5
Vehicle sales - Light-duty - hybrid (%)	2.7	3.64	4.15	4.05	3.3	2.1	1.08
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.396	0.359	0.287	0.213	0.122	0.056
Vehicle sales - Light-duty - other (%)	0.127	0.13	0.123	0.109	0.081	0.046	0.021
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)	23.9	23.9	23.7	23.6	23.4	23.1	22.9
Final energy use - Industry (PJ)	91.2	95.4	95	95.9	99	99.6	100
Final energy use - Residential (PJ)	12.4	11.7	11.3	11.1	10.7	10.3	9.8
Final energy use - Transportation (PJ)	100	94.2	85.5	79.2	74.7	69.4	62.9

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	1,753	1,948	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump (%)	1.45	6.48	7.77	12	22.4	35.8	44.2
Sales of space heating units - Electric Resistance (%)	1.46	3.35	3.43	3.71	4.42	5.32	5.86
Sales of space heating units - Fossil (%)	0	0.246	0.238	0.208	0.166	0.139	0.129
Sales of space heating units - Gas Furnace (%)	97.1	89.9	88.6	84.1	73	58.7	49.8
Sales of water heating units - Electric Heat Pump (%)	0.014	0.298	1.07	3.62	9.83	17.9	23
Sales of water heating units - Electric Resistance (%)	0.674	1.73	2.5	5.04	11.2	19.3	24.3
Sales of water heating units - Gas Furnace (%)	99.2	97.6	96	91	78.6	62.4	52.4
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.375	0.38	0.515	0.536	0.847	0.903

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0.68

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	763

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	0	0	47
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	0	624
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0.75
Annual - BECCS (MMT)	0	0	0	0	0	0	0.75
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0.75
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0.75
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	60.7	25.7	25.7	311	279
Cumulative investment - All (million $2018)	0	0	32.2	16.6	16.6	179	179
Cumulative investment - Spur (million $2018)	0	0	32.2	16.6	16.6	179	179
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	60.7	25.7	25.7	311	279
Trunk (km)	0	0	0	0	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-5.6
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-735
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	-28.3
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-769

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-5.6
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-375
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	-14.1
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-394
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	8.46
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	2,452
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	2.77
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	43.5
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	2,507
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	8.46
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	507
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	2.77
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	0
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	21.7
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	540

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	385

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

Item	2020	2025	2050
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,188
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,665
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	1,027
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	54.2

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

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	9.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	7.99
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,309
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	2,709

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	0.191	0.192	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.2	37.2	37.2	37.2	37.2	37.2	37.2
Sales of cooking units - Gas (%)	62.8	62.8	62.8	62.8	62.8	62.8	62.8
Sales of space heating units - Electric Heat Pump (%)	4.61	14.6	14.9	15.5	16.1	16.6	17.2
Sales of space heating units - Electric Resistance (%)	9.12	15.3	15.1	15.1	15.1	14.6	14
Sales of space heating units - Fossil (%)	15.3	16.2	16.5	15.3	14	14.2	14.2
Sales of space heating units - Gas (%)	70.9	53.8	53.4	54	54.8	54.6	54.5
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	12.2	24.4	24.7	25	25.4	25.6	25.8

Table 58: *REF scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	87.1	74.7	74.4	74.1	73.7	73.6	73.3
Sales of water heating units - Other (%)	0.718	0.834	0.853	0.868	0.881	0.89	0.897

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 (%)	2.11	2.42	2.28	2.12	1.93	1.81	1.72
Vehicle sales - Light-duty - EV (%)	1.75	3.29	3.74	4.44	5.48	6.62	7.7
Vehicle sales - Light-duty - gasoline (%)	93.3	90.1	89.1	88	86.4	84.6	82.8
Vehicle sales - Light-duty - hybrid (%)	2.65	3.61	4.4	5	5.66	6.46	7.32
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.396	0.379	0.345	0.349	0.355	0.367
Vehicle sales - Light-duty - other (%)	0.127	0.13	0.129	0.131	0.132	0.132	0.136
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)	23.8	24.3	24.8	24.8	24.8	25.4	26.5
Final energy use - Industry (PJ)	91.2	98	100	103	106	111	116
Final energy use - Residential (PJ)	12.4	11.8	11.6	11.6	11.6	11.8	12
Final energy use - Transportation (PJ)	100	94.3	86.2	81.7	81.7	84.2	87.4

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	1,732	1,819	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric Heat Pump (%)	1.45	13.4	45.3	72.5	77.4	78.1	78.1
Sales of space heating units - Electric Resistance (%)	1.46	4.34	9.12	16.3	20.7	21.4	21.4
Sales of space heating units - Fossil (%)	0	0.228	0.136	0.039	0.005	0	0
Sales of space heating units - Gas Furnace (%)	97.1	82	45.5	11.2	1.88	0.584	0.494
Sales of water heating units - Electric Heat Pump (%)	0.014	0.03	0.03	0.03	0.03	0.03	0.03
Sales of water heating units - Electric Resistance (%)	0.674	1.46	1.46	1.47	1.46	1.47	1.46
Sales of water heating units - Gas Furnace (%)	99.2	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.16	0.382	0.381	0.382	0.381	0.382	0.382

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	0.451	0.465	0.504	0.521	0.589	0.612

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	29	0	1.96	0.561
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.065	0	-0.136	-0.143
Business-as-usual carbon sink - Total (Mt CO2e/y)	28.9	0	1.82	0.418
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,948
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	13,225
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	691
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	2,406
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	28.8
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	240
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	385
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	2,376
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	1,909
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	3,241
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	976
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	4,670
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	115
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	924
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	14.7
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	80
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	135
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	1,188
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,092
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,462
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	8,947
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	403
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	1,665
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	21.5
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	160
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	260
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	1,782
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	1,027

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

Item	2020	2025	2030	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	2,167
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	319
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	93.6
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	1,227
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	10.6
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	36.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	54.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,074
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,972
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	159
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	87.9
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	470
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	5.31
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	19.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	9.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	650
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,480
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	239
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	90.8
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	848
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	7.99
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	27.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	68
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,309

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,709

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	57.2	33	17.9	14	12	11.6
Monetary damages from air pollution - Natural Gas (million 2019$)	0	6.77	6.47	6.36	4.46	4.22	3.11
Monetary damages from air pollution - Transportation (million 2019$)	0	24.1	23.9	23.6	23.5	23.2	23
Premature deaths from air pollution - Coal (deaths)	0	6.41	3.7	2.01	1.58	1.35	1.3
Premature deaths from air pollution - Natural Gas (deaths)	0	0.764	0.731	0.718	0.504	0.476	0.351
Premature deaths from air pollution - Transportation (deaths)	0	2.71	2.68	2.66	2.64	2.61	2.59