Net-Zero America - new mexico state report

Larson et al. 2020

February 2021

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

Notes

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

List of Tables

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	1.87	2.24	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.2	92.2	99.6	100	100	100
Sales of cooking units - Gas (%)	58.1	45.8	7.83	0.394	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	20.2	63.3	85.3	88.8	89.3	89
Sales of space heating units - Electric Resistance (%)	6.51	10.4	5.63	3.21	2.94	2.96	2.97
Sales of space heating units - Fossil (%)	10.2	14.7	10.2	7.32	6.18	5.78	6.11
Sales of space heating units - Gas (%)	78.2	54.7	20.9	4.15	2.05	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0	7.63	42.7	57.5	59.2	59.2	59.2
Sales of water heating units - Electric Resistance (%)	11.7	24.2	31.3	38.3	39.4	39.5	39.5
Sales of water heating units - Gas Furnace (%)	87.3	67	24.8	2.98	0.155	0	0
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

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	350	897	1,453	2,201	2,395	2,284
Public EV charging plugs - DC Fast (1000 units)	0.099	0	0.64	0	2.8	0	4.53
Public EV charging plugs - L2 (1000 units)	0.151	0	15.4	0	67.5	0	109
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 (%)	1.71	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.39	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.4	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.91	4.17	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.349	0.216	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	61.5	59.1	55.3	51.5	49.4	48.9
Final energy use - Industry (PJ)	35.8	36.3	35.9	36.6	38.7	39.4	40.1
Final energy use - Residential (PJ)	73.6	69.9	64.4	56.2	48.8	44.3	42
Final energy use - Transportation (PJ)	268	250	222	187	156	137	129

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	5,003	5,574	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 (%)	1.58	19.8	62.6	88.7	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	1.76	3.39	4.14	6.37	6.83	6.86	6.85
Sales of space heating units - Fossil (%)	0	0.199	0.038	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 (%)	96.7	76.6	33.3	4.92	0.721	0.496	0.493
Sales of water heating units - Electric Heat Pump (%)	0.016	7.95	44.7	60.9	62.8	62.9	62.9
Sales of water heating units - Electric Resistance (%)	0.796	4.99	22.9	34.8	36.6	36.7	36.7
Sales of water heating units - Gas Furnace (%)	99	86.7	32.1	3.86	0.201	0	0
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	1.12	1.17	2.25	2.43	2.16	2.28

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	0.01	0.021
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0.014	0.004
Capital invested - Solar PV - Base (billion $2018)	0	7.83	9.25	11.1	5.38	3.26	1.97
Capital invested - Solar PV - Constrained (billion $2018)	0	0.876	0	0	1.04	1.02	1.11
Capital invested - Wind - Base (billion $2018)	0	14.4	19	20.7	13.5	8.91	13.5
Capital invested - Wind - Constrained (billion $2018)	0	14.6	12.8	18.5	13.6	5.1	14.3

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	9.98	30.8
Biomass w/ccu power plant (GWh)	0	0	0	0	0	16	20.1
Solar - Base land use assumptions (GWh)	2,269	14,000	18,491	24,169	12,382	7,953	5,065
Solar - Constrained land use assumptions (GWh)	1,588	463	0	1,545	4,041	1,086	1,321
Wind - Base land use assumptions (GWh)	24,562	31,717	44,413	49,298	32,992	23,613	36,789
Wind - Constrained land use assumptions (GWh)	24,176	25,574	24,629	36,843	21,893	7,728	28,372

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	14.2	85.6	195
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	203	1,035	1,602
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	1	3	6
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0.26	1.57	3.58
Annual - BECCS (MMT)	0	0	0	0	0.26	1.57	3.58
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	0.26	1.83	5.41
Cumulative - BECCS (MMT)	0	0	0	0	0.26	1.83	5.41
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	3.52	5.42	10.3	13.1
Injection wells (wells)	0	0	0	4	6	12	14
Resource characterization, appraisal, permitting costs (million $2020)	0	5.15	92.7	147	147	147	147
Wells and facilities construction costs (million $2020)	0	0	28.4	111	197	330	410

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	35.9	681	1,245
Cumulative investment - All (million $2018)	0	0	0	0	20.2	379	709
Cumulative investment - Spur (million $2018)	0	0	0	0	20.2	379	709
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	35.9	681	1,245
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	-506
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-31.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-538
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	-261
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-277
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	691
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	48.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	739
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	358
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	24.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	382

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.92
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	34.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,065
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	68.9

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

Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	2.15
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	18.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	152
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	3.23
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	26.5

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,878

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	99.3	0.084	0.084	0.061	0.039	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	28.2	18.7	13.7	12.7	7.88	3.46
Monetary damages from air pollution - Transportation (million 2019$)	0	215	204	159	93.1	43	16.9
Premature deaths from air pollution - Coal (deaths)	0	11.1	0.009	0.009	0.007	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.19	2.12	1.55	1.43	0.89	0.391
Premature deaths from air pollution - Transportation (deaths)	0	24.2	23	17.8	10.5	4.84	1.9

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	1.46	1.68	3.41	1.3	20.1	94.9	178
By economic sector - Construction (jobs)	9,113	21,265	27,580	34,988	33,874	32,502	33,505
By economic sector - Manufacturing (jobs)	8,862	10,184	12,452	14,361	12,846	11,240	11,099
By economic sector - Mining (jobs)	14,801	12,759	10,124	7,932	5,181	3,363	1,824
By economic sector - Other (jobs)	544	2,099	3,112	4,344	4,297	4,329	4,834
By economic sector - Pipeline (jobs)	1,140	1,194	1,122	1,031	808	649	521
By economic sector - Professional (jobs)	5,801	11,806	15,764	20,749	21,352	21,511	23,142
By economic sector - Trade (jobs)	7,413	10,057	11,661	14,036	13,627	13,359	14,029
By economic sector - Utilities (jobs)	5,241	13,265	17,083	23,185	24,978	25,343	27,310
By education level - All sectors - Associates degree or some college (jobs)	15,243	25,056	30,537	37,788	37,021	35,777	37,351
By education level - All sectors - Bachelors degree (jobs)	12,775	18,410	21,446	25,657	24,722	23,672	24,391
By education level - All sectors - Doctoral degree (jobs)	433	679	822	1,009	991	967	1,011
By education level - All sectors - High school diploma or less (jobs)	21,461	33,988	40,785	49,725	47,948	45,869	47,332
By education level - All sectors - Masters or professional degree (jobs)	3,003	4,497	5,311	6,448	6,301	6,105	6,357
By resource sector - Biomass (jobs)	6.04	7.22	9.41	3.72	60.4	346	761
By resource sector - CO2 (jobs)	0	2.01	52.4	65.5	75.4	394	1,115
By resource sector - Coal (jobs)	1,734	742	121	10.2	7.55	5.87	4.93
By resource sector - Grid (jobs)	5,007	20,811	28,724	41,454	45,355	46,918	50,936
By resource sector - Natural Gas (jobs)	11,644	11,032	9,084	6,953	5,555	3,588	2,149
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	25,695	24,959	22,653	20,474	14,926	11,195	6,939
By resource sector - Solar (jobs)	3,984	11,105	15,166	20,050	16,842	15,307	16,591
By resource sector - Wind (jobs)	4,845	13,972	23,091	31,616	34,162	34,636	37,946
Median wages - Annual - All ($2019 per job)	59,775	58,972	59,066	59,477	60,349	61,243	62,042
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	8,217	13,295	16,045	19,702	19,196	18,478	19,179
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	3,192	5,570	6,808	8,453	8,310	8,051	8,381
On-Site or In-Plant Training - Total jobs - None (jobs)	8,583	13,402	16,097	19,642	19,035	18,292	18,998

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	372	664	825	1,037	1,028	1,001	1,049
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	32,552	49,699	59,127	71,792	69,414	66,569	68,834
On-the-Job Training - All sectors - 1 to 4 years (jobs)	10,435	17,067	20,655	25,428	24,838	23,946	24,898
On-the-Job Training - All sectors - 4 to 10 years (jobs)	2,904	5,321	6,592	8,270	8,178	7,955	8,322
On-the-Job Training - All sectors - None (jobs)	3,068	4,647	5,501	6,644	6,382	6,106	6,310
On-the-Job Training - All sectors - Over 10 years (jobs)	517	803	965	1,162	1,105	1,043	1,069
On-the-Job Training - All sectors - Up to 1 year (jobs)	35,991	54,792	65,188	79,121	76,481	73,340	75,844
Related work experience - All sectors - 1 to 4 years (jobs)	19,667	30,250	35,995	43,757	42,409	40,730	42,129
Related work experience - All sectors - 4 to 10 years (jobs)	12,390	19,445	23,287	28,431	27,660	26,611	27,594
Related work experience - All sectors - None (jobs)	7,322	11,670	14,033	17,192	16,719	16,098	16,713
Related work experience - All sectors - Over 10 years (jobs)	3,454	5,209	6,175	7,469	7,218	6,906	7,133
Related work experience - All sectors - Up to 1 year (jobs)	10,082	16,055	19,412	23,778	22,977	22,045	22,872
Wage income - All (million $2019)	3,163	4,873	5,842	7,175	7,061	6,884	7,225

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	207	210	177	142	107	67.3	46.7
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	4,279
Natural gas production - Annual (tcf)	1,498	1,660	1,569	1,367	1,156	917	712
Oil consumption - Annual (million bbls)	48.3	45.5	39.3	30	21.1	14.1	8.13
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	919
Oil production - Annual (million bbls)	298	323	324	323	256	208	139

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	1.86	2.24	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.7	43.2	48.5	62.6	82.2	94.2	98.5
Sales of cooking units - Gas (%)	58.3	56.8	51.5	37.4	17.8	5.75	1.55
Sales of space heating units - Electric Heat Pump (%)	5.11	12.8	17.7	32.4	57.3	77.2	85.4
Sales of space heating units - Electric Resistance (%)	6.51	11.2	10.6	9.06	6.48	4.32	3.36
Sales of space heating units - Fossil (%)	10.2	15.5	15.4	13.1	9.22	6.81	6.5
Sales of space heating units - Gas (%)	78.2	60.4	56.3	45.5	27	11.7	4.76
Sales of water heating units - Electric Heat Pump (%)	0	1.41	5.41	17.1	36.2	50.8	56.8
Sales of water heating units - Electric Resistance (%)	11.7	23.2	24.2	26.7	31.4	36	38.4
Sales of water heating units - Gas Furnace (%)	87.3	74.1	69.2	55	31.1	12	3.54
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

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	56.7	119	402	1,263	1,841
Public EV charging plugs - DC Fast (1000 units)	0.099	0	0.199	0	1.04	0	2.9
Public EV charging plugs - L2 (1000 units)	0.151	0	4.8	0	25.1	0	69.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.72	2.1	2.09	1.67	1.08	0.558	0.238
Vehicle sales - Light-duty - EV (%)	1.7	4.28	11	24.5	46.9	71.1	87.2
Vehicle sales - Light-duty - gasoline (%)	92.3	88.2	80.9	68.4	47.9	25.9	11.4
Vehicle sales - Light-duty - hybrid (%)	4.04	4.88	5.53	5.11	3.91	2.35	1.15
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.385	0.335	0.259	0.186	0.104	0.048
Vehicle sales - Light-duty - other (%)	0.11	0.113	0.104	0.091	0.066	0.037	0.017
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 19: *E- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	61.6	61.1	60.2	58.4	56.2	54.2
Final energy use - Industry (PJ)	35.8	36.3	36.1	37.2	39.6	40.4	41.1
Final energy use - Residential (PJ)	73.6	70.2	68	65.4	60.8	55.1	49.4
Final energy use - Transportation (PJ)	268	252	231	214	201	186	169

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	5,000	5,547	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 (%)	1.58	12.8	17.7	32.2	57.3	78.6	88.4
Sales of space heating units - Electric Resistance (%)	1.76	3.37	3.45	3.77	4.61	5.79	6.51
Sales of space heating units - Fossil (%)	0	0.23	0.214	0.159	0.078	0.025	0.007
Sales of space heating units - Gas Furnace (%)	96.7	83.6	78.7	63.9	38	15.6	5.05
Sales of water heating units - Electric Heat Pump (%)	0.016	1.51	5.7	18	38.2	53.7	60.3
Sales of water heating units - Electric Resistance (%)	0.796	2.19	4.23	10.3	21	30.4	34.7
Sales of water heating units - Gas Furnace (%)	99	95.9	89.7	71.3	40.4	15.6	4.61
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	0.866	0.891	1.24	1.3	1.97	2.11

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	-506
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-31.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-538

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-261
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-277
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	691
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	48.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	739
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	358
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	24.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	382

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.92

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	34.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,065
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	68.9
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	2.15
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	18.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	152
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	3.23
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	26.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,878

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	99.3	0.084	0.084	0.061	0.039	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	28.7	14.7	9.33	5.49	2.56	1.47
Monetary damages from air pollution - Transportation (million 2019$)	0	218	224	223	205	167	117
Premature deaths from air pollution - Coal (deaths)	0	11.1	0.009	0.009	0.007	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.24	1.65	1.05	0.62	0.289	0.166
Premature deaths from air pollution - Transportation (deaths)	0	24.5	25.2	25.1	23.1	18.8	13.1

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	1.87	2.24	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.2	92.2	99.6	100	100	100
Sales of cooking units - Gas (%)	58.1	45.8	7.83	0.394	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	20.2	63.3	85.3	88.8	89.3	89
Sales of space heating units - Electric Resistance (%)	6.51	10.4	5.63	3.21	2.94	2.96	2.97
Sales of space heating units - Fossil (%)	10.2	14.7	10.2	7.32	6.18	5.78	6.11
Sales of space heating units - Gas (%)	78.2	54.7	20.9	4.15	2.05	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0	7.63	42.7	57.5	59.2	59.2	59.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	11.7	24.2	31.3	38.3	39.4	39.5	39.5
Sales of water heating units - Gas Furnace (%)	87.3	67	24.8	2.98	0.155	0	0
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

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	350	897	1,453	2,201	2,395	2,284
Public EV charging plugs - DC Fast (1000 units)	0.099	0	0.64	0	2.8	0	4.53
Public EV charging plugs - L2 (1000 units)	0.151	0	15.4	0	67.5	0	109
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 (%)	1.71	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.39	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.4	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.91	4.17	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.349	0.216	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	61.5	59.1	55.3	51.5	49.4	48.9
Final energy use - Industry (PJ)	35.8	36.3	35.9	36.6	38.7	39.4	40.1
Final energy use - Residential (PJ)	73.6	69.9	64.4	56.2	48.8	44.3	42
Final energy use - Transportation (PJ)	268	250	222	187	156	137	129

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	5,003	5,574	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 (%)	1.58	19.8	62.6	88.7	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	1.76	3.39	4.14	6.37	6.83	6.86	6.85
Sales of space heating units - Fossil (%)	0	0.199	0.038	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	96.7	76.6	33.3	4.92	0.721	0.496	0.493
Sales of water heating units - Electric Heat Pump (%)	0.016	7.95	44.7	60.9	62.8	62.9	62.9
Sales of water heating units - Electric Resistance (%)	0.796	4.99	22.9	34.8	36.6	36.7	36.7
Sales of water heating units - Gas Furnace (%)	99	86.7	32.1	3.86	0.201	0	0
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	1.12	1.17	2.25	2.43	2.16	2.28

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	8.47	15.1	7.55	2.52	8.42	7.45
Capital invested - Wind - Base (billion $2018)	0	19.3	19.8	27.2	19.8	11.5	22.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,269	15,139	30,135	16,396	5,770	20,508	19,154
Solar - Constrained land use assumptions (GWh)	2,269	275	0	0	4,768	20,586	25,601
Wind - Base land use assumptions (GWh)	19,677	42,328	45,814	64,282	49,417	29,300	59,387
Wind - Constrained land use assumptions (GWh)	19,175	33,112	27,278	45,791	22,190	7,741	125,374

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	-506
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-31.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-538
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	-261
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-277
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	691
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	48.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	739
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	358
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	24.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	382

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	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.92
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	34.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,065
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	68.9
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	529

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

Item	2020	2025	2050
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	2.15
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	18.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	152
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	3.23
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	26.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,878

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	99.3	0.084	0.084	0.061	0.039	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	25.3	15	7.15	5.54	2.74	1.27
Monetary damages from air pollution - Transportation (million 2019$)	0	215	204	159	93.1	43	16.9
Premature deaths from air pollution - Coal (deaths)	0	11.1	0.009	0.009	0.007	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	2.86	1.69	0.808	0.626	0.31	0.144
Premature deaths from air pollution - Transportation (deaths)	0	24.2	23	17.8	10.5	4.84	1.9

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	1.87	2.24	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.9	54.2	92.2	99.6	100	100	100
Sales of cooking units - Gas (%)	58.1	45.8	7.83	0.394	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.11	20.2	63.3	85.3	88.8	89.3	89
Sales of space heating units - Electric Resistance (%)	6.51	10.4	5.63	3.21	2.94	2.96	2.97
Sales of space heating units - Fossil (%)	10.2	14.7	10.2	7.32	6.18	5.78	6.11
Sales of space heating units - Gas (%)	78.2	54.7	20.9	4.15	2.05	1.95	1.94
Sales of water heating units - Electric Heat Pump (%)	0	7.63	42.7	57.5	59.2	59.2	59.2
Sales of water heating units - Electric Resistance (%)	11.7	24.2	31.3	38.3	39.4	39.5	39.5
Sales of water heating units - Gas Furnace (%)	87.3	67	24.8	2.98	0.155	0	0
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

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	350	897	1,453	2,201	2,395	2,284
Public EV charging plugs - DC Fast (1000 units)	0.099	0	0.64	0	2.8	0	4.53
Public EV charging plugs - L2 (1000 units)	0.151	0	15.4	0	67.5	0	109
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 (%)	1.71	1.95	1.32	0.424	0.077	0.013	0
Vehicle sales - Light-duty - EV (%)	3.39	13.6	44	80.8	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.8	79.8	51.4	17.5	3.42	0.594	0
Vehicle sales - Light-duty - hybrid (%)	3.91	4.17	3.04	1.15	0.276	0.059	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.349	0.216	0.068	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.109	0.105	0.07	0.025	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	61.5	59.1	55.3	51.5	49.4	48.9
Final energy use - Industry (PJ)	35.8	36.3	35.9	36.6	38.7	39.4	40.1
Final energy use - Residential (PJ)	73.6	69.9	64.4	56.2	48.8	44.3	42
Final energy use - Transportation (PJ)	268	250	222	187	156	137	129

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	5,003	5,574	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 (%)	1.58	19.8	62.6	88.7	92.5	92.6	92.7
Sales of space heating units - Electric Resistance (%)	1.76	3.39	4.14	6.37	6.83	6.86	6.85
Sales of space heating units - Fossil (%)	0	0.199	0.038	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	96.7	76.6	33.3	4.92	0.721	0.496	0.493
Sales of water heating units - Electric Heat Pump (%)	0.016	7.95	44.7	60.9	62.8	62.9	62.9
Sales of water heating units - Electric Resistance (%)	0.796	4.99	22.9	34.8	36.6	36.7	36.7
Sales of water heating units - Gas Furnace (%)	99	86.7	32.1	3.86	0.201	0	0
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	1.12	1.17	2.25	2.43	2.16	2.28

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	12.8	9.98	9.31	5.41	3.1	0.516
Capital invested - Solar PV - Constrained (billion $2018)	0	0.154	0	0.56	0	0	0
Capital invested - Wind - Base (billion $2018)	0	8.91	9.12	16.6	9.93	5.4	11.8
Capital invested - Wind - Constrained (billion $2018)	0	9.36	7.91	10.9	7.51	6.07	11.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,269	22,994	19,969	20,219	12,458	7,560	1,325
Solar - Constrained land use assumptions (GWh)	2,269	275	0	1,233	0	0	0
Wind - Base land use assumptions (GWh)	13,439	19,599	22,241	41,764	25,262	14,169	32,451
Wind - Constrained land use assumptions (GWh)	13,392	18,866	17,026	22,163	15,030	11,929	23,740

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	-506
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-31.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-538
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-261
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-277
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	691
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	48.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	739
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	358
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	24.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	382

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	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.92
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	34.4

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

Item	2020	2025	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,065
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	68.9
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	529
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	2.15
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	18.3

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	152
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	3.23
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	26.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,878

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	99.3	0.084	0.084	0.061	0.039	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	28.9	18.4	16.9	19.1	9.21	2.75
Monetary damages from air pollution - Transportation (million 2019$)	0	215	204	159	93.1	43	16.9
Premature deaths from air pollution - Coal (deaths)	0	11.1	0.009	0.009	0.007	0.004	0
Premature deaths from air pollution - Natural Gas (deaths)	0	3.27	2.08	1.91	2.16	1.04	0.31
Premature deaths from air pollution - Transportation (deaths)	0	24.2	23	17.8	10.5	4.84	1.9

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	1.86	2.24	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.7	43.2	48.5	62.6	82.2	94.2	98.5
Sales of cooking units - Gas (%)	58.3	56.8	51.5	37.4	17.8	5.75	1.55
Sales of space heating units - Electric Heat Pump (%)	5.11	12.8	17.7	32.4	57.3	77.2	85.4
Sales of space heating units - Electric Resistance (%)	6.51	11.2	10.6	9.06	6.48	4.32	3.36
Sales of space heating units - Fossil (%)	10.2	15.5	15.4	13.1	9.22	6.81	6.5
Sales of space heating units - Gas (%)	78.2	60.4	56.3	45.5	27	11.7	4.76
Sales of water heating units - Electric Heat Pump (%)	0	1.41	5.41	17.1	36.2	50.8	56.8
Sales of water heating units - Electric Resistance (%)	11.7	23.2	24.2	26.7	31.4	36	38.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	87.3	74.1	69.2	55	31.1	12	3.54
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

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	56.7	119	402	1,263	1,841
Public EV charging plugs - DC Fast (1000 units)	0.099	0	0.199	0	1.04	0	2.9
Public EV charging plugs - L2 (1000 units)	0.151	0	4.8	0	25.1	0	69.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.72	2.1	2.09	1.67	1.08	0.558	0.238
Vehicle sales - Light-duty - EV (%)	1.7	4.28	11	24.5	46.9	71.1	87.2
Vehicle sales - Light-duty - gasoline (%)	92.3	88.2	80.9	68.4	47.9	25.9	11.4
Vehicle sales - Light-duty - hybrid (%)	4.04	4.88	5.53	5.11	3.91	2.35	1.15
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.385	0.335	0.259	0.186	0.104	0.048
Vehicle sales - Light-duty - other (%)	0.11	0.113	0.104	0.091	0.066	0.037	0.017
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 47: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	61.6	61.1	60.2	58.4	56.2	54.2
Final energy use - Industry (PJ)	35.8	36.3	36.1	37.2	39.6	40.4	41.1
Final energy use - Residential (PJ)	73.6	70.2	68	65.4	60.8	55.1	49.4
Final energy use - Transportation (PJ)	268	252	231	214	201	186	169

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	5,000	5,547	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 (%)	1.58	12.8	17.7	32.2	57.3	78.6	88.4
Sales of space heating units - Electric Resistance (%)	1.76	3.37	3.45	3.77	4.61	5.79	6.51
Sales of space heating units - Fossil (%)	0	0.23	0.214	0.159	0.078	0.025	0.007
Sales of space heating units - Gas Furnace (%)	96.7	83.6	78.7	63.9	38	15.6	5.05
Sales of water heating units - Electric Heat Pump (%)	0.016	1.51	5.7	18	38.2	53.7	60.3
Sales of water heating units - Electric Resistance (%)	0.796	2.19	4.23	10.3	21	30.4	34.7
Sales of water heating units - Gas Furnace (%)	99	95.9	89.7	71.3	40.4	15.6	4.61
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	0.866	0.891	1.24	1.3	1.97	2.11

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	0.058
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	1.59

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	57.5
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	1,784

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	59.9	173
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	683	1,529
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	1	1
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	0.88	2.68
Annual - BECCS (MMT)	0	0	0	0	0	0.88	2.68
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	0.88	3.56
Cumulative - BECCS (MMT)	0	0	0	0	0	0.88	3.56
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	1.85	6.42	11.9	15.8	16.7
Injection wells (wells)	0	0	2	6	10	16	20
Resource characterization, appraisal, permitting costs (million $2020)	0	5.15	127	204	204	204	204
Wells and facilities construction costs (million $2020)	0	0	40.3	157	280	468	581

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	0	9.01	200
Cumulative investment - All (million $2018)	0	0	0	0	0	6.22	152
Cumulative investment - Spur (million $2018)	0	0	0	0	0	6.22	152
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	9.01	200
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	-34.2
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-482
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	-29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-546
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-34.2
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-248
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	-14.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-297
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	37.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,615
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	3.18
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	44.5
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,700
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	37.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	338
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	3.18
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	22.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	401

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	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.92
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	34.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	19,065
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	68.9
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	529

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	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	2.15
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	18.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	152
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	3.23
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	26.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	6,878

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	1.8	1.89	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41.1	41.1	41.1	41.1	41.1	41.1	41.1
Sales of cooking units - Gas (%)	58.9	58.9	58.9	58.9	58.9	58.9	58.9
Sales of space heating units - Electric Heat Pump (%)	3.87	20.3	20.9	21.9	22.8	23.5	24.1
Sales of space heating units - Electric Resistance (%)	6.66	10.4	10.2	10.1	9.98	9.54	8.77
Sales of space heating units - Fossil (%)	10.3	13.6	13.9	13.5	12	11	11.9
Sales of space heating units - Gas (%)	79.2	55.7	55	54.5	55.3	55.9	55.2
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	11.7	23	23.1	23.2	23.3	23.3	23.4
Sales of water heating units - Gas Furnace (%)	87.3	75.8	75.7	75.6	75.5	75.4	75.4
Sales of water heating units - Other (%)	1.03	1.2	1.22	1.23	1.24	1.24	1.25

Table 59: *REF scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.119	0.138	0.16	0.186	0.216	0.25	0.29
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.71	2.1	2.21	2.06	1.86	1.73	1.65
Vehicle sales - Light-duty - EV (%)	3.04	4.93	5.65	6.91	8.45	9.89	11
Vehicle sales - Light-duty - gasoline (%)	91.1	87.7	85.8	84.1	82.2	80.2	78.6
Vehicle sales - Light-duty - hybrid (%)	3.93	4.8	5.9	6.47	7.08	7.73	8.29
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.382	0.355	0.318	0.316	0.318	0.329
Vehicle sales - Light-duty - other (%)	0.109	0.113	0.11	0.11	0.11	0.109	0.112
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

Table 60: *REF scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	61.7	62.9	63.8	63.9	64.3	66	69.1
Final energy use - Industry (PJ)	35.8	37.5	38.4	40	41.7	44.3	47
Final energy use - Residential (PJ)	73.6	70.7	70.1	70.3	71.2	72.7	74
Final energy use - Transportation (PJ)	268	252	233	221	221	228	236

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	4,936	5,160	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 (%)	1.58	19.9	53.5	75.1	78.5	78.8	78.8
Sales of space heating units - Electric Resistance (%)	1.76	4.5	9.3	15.8	20	20.6	20.7
Sales of space heating units - Fossil (%)	0	0.211	0.115	0.034	0.005	0	0
Sales of space heating units - Gas Furnace (%)	96.7	75.4	37.1	9.08	1.57	0.556	0.495
Sales of water heating units - Electric Heat Pump (%)	0.016	0.03	0.03	0.03	0.03	0.03	0.03

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	0.796	1.46	1.46	1.47	1.46	1.47	1.47
Sales of water heating units - Gas Furnace (%)	99	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.192	0.382	0.382	0.383	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	0.941	0.974	1.68	1.79	1.79	1.89

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-11.8	0	3.33	0.955
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.028	0	-0.058	-0.061
Business-as-usual carbon sink - Total (Mt CO2e/y)	-11.8	0	3.27	0.894
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	3,236
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	27,508
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,156
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	9,681
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	11.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	103
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	365
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	5,360
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	1,215
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	6,378
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,622
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	10,623
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	193
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	3,718
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	5.92
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	34.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	128
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	2,680
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	92.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	2,150
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	2,429
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	19,065

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	674
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	6,700
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	8.68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	68.9
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	247
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	4,020
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	654
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	4,264
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	529
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	157
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	4,937
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	4.29
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	34.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	354
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	34.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	2,114
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	8,165
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	265
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	147
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,891
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	2.15
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	18.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	177
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	5.99
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	1,279
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	3,786
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	397
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	152

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	3,414
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	3.23
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	26.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	266
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	43.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	2,576
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	6,878

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	185	107	48	36.9	33	31.3
Monetary damages from air pollution - Natural Gas (million 2019$)	0	31.8	34.1	35.4	27.3	28.4	24.4
Monetary damages from air pollution - Transportation (million 2019$)	0	218	228	238	250	262	274
Premature deaths from air pollution - Coal (deaths)	0	20.8	12	5.38	4.14	3.71	3.52
Premature deaths from air pollution - Natural Gas (deaths)	0	3.59	3.85	4	3.08	3.21	2.76
Premature deaths from air pollution - Transportation (deaths)	0	24.5	25.6	26.8	28.1	29.5	30.9