Net-Zero America - maryland 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	4.8	4.71	0	0	0	0
Sales of cooking units - Electric Resistance (%)	59.2	67.9	94.5	99.7	100	100	100
Sales of cooking units - Gas (%)	40.8	32.1	5.5	0.277	0	0	0
Sales of space heating units - Electric Heat Pump (%)	17.4	35.6	79.7	89.7	90.1	90.1	90.1
Sales of space heating units - Electric Resistance (%)	13.2	13.8	5.81	3.98	3.89	3.95	3.95
Sales of space heating units - Fossil (%)	14.3	18.9	5.51	2.51	2.38	2.35	2.35
Sales of space heating units - Gas (%)	55.1	31.6	8.99	3.84	3.61	3.62	3.62
Sales of water heating units - Electric Heat Pump (%)	0	9.19	48.7	57.6	58	58	58
Sales of water heating units - Electric Resistance (%)	35.7	51	42.2	40.3	40.2	40.2	40.2
Sales of water heating units - Gas Furnace (%)	59.5	36.5	7.04	0.317	0.002	0	0
Sales of water heating units - Other (%)	4.77	3.29	2.07	1.81	1.81	1.83	1.84

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	800	2,073	3,321	5,046	5,475	5,229
Public EV charging plugs - DC Fast (1000 units)	0.402	0	1.31	0	5.5	0	8.84
Public EV charging plugs - L2 (1000 units)	1.67	0	31.5	0	132	0	212
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 (%)	1.29	1.58	1.16	0.367	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.79	17.9	50.4	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.5	75	44.7	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.27	5.16	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.325	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.019	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	189	188	180	167	157	154	156
Final energy use - Industry (PJ)	130	132	132	141	151	159	167
Final energy use - Residential (PJ)	241	228	209	183	162	149	144
Final energy use - Transportation (PJ)	448	417	367	305	249	213	197

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	21,776	24,347	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.22	28.1	70.4	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	2.54	8.39	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Fossil (%)	11	4.19	0.8	0.034	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 (%)	84.3	59.3	18.3	3.58	1.9	1.86	1.85
Sales of water heating units - Electric Heat Pump (%)	0.097	10.5	54.4	64.3	64.7	64.8	64.7
Sales of water heating units - Electric Resistance (%)	2.5	10.8	28.3	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	93	74.5	14.3	0.646	0.003	0	0
Sales of water heating units - Other (%)	4.44	4.22	3.02	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.99	3.04	6	6.39	5.4	5.63

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Offshore Wind - Base (billion $2018)	0	0	0	0	0	6.33	14.7
Capital invested - Offshore Wind - Constrained (billion $2018)	0	0	0	0	0	1.46	19.1
Capital invested - Solar PV - Base (billion $2018)	0	4.41	2.06	2.19	1.12	1.28	0.169
Capital invested - Solar PV - Constrained (billion $2018)	0	2.9	0.138	0.35	0	1.23	1.46
Capital invested - Wind - Constrained (billion $2018)	0	0	0	0.457	3.71	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	19,084	53,030
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	19,084	53,030
Solar - Base land use assumptions (GWh)	1,524	6,122	3,207	3,739	1,993	2,352	345
Solar - Constrained land use assumptions (GWh)	845	6,139	947	2,025	1,017	2,336	1,070
Wind - Base land use assumptions (GWh)	786	0	0	0	0	0	0
Wind - Constrained land use assumptions (GWh)	786	0	0	263	8,465	1,221	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	0	0	222
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	0	4,833
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	4
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
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	3.32	3.42	9.75
Annual - BECCS (MMT)	0	0	0	0	0	0	6.21
Annual - Cement and lime (MMT)	0	0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	3.32	6.74	16.5
Cumulative - BECCS (MMT)	0	0	0	0	0	0	6.21
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	6.74	10.3
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	0	112	197	197	429
Cumulative investment - All (million $2018)	0	0	0	667	748	749	961
Cumulative investment - Spur (million $2018)	0	0	0	0	81.3	82.7	294
Cumulative investment - Trunk (million $2018)	0	0	0	667	667	667	667
Spur (km)	0	0	0	0	85.1	85.1	317
Trunk (km)	0	0	0	112	112	112	112

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	-595
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	-624
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	-313
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	-327
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	525
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	52.7

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

Item	2020	2025	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	578
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	276
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	26.4
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	302

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	18.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	1,480
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	183
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	642

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

Item	2020	2025	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	240
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	140
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	260
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	470

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	938

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	748	0.507	0.502	0.46	0.32	0.027
Monetary damages from air pollution - Natural Gas (million 2019$)	0	248	185	123	112	65.6	27.4
Monetary damages from air pollution - Transportation (million 2019$)	0	2,187	2,036	1,542	889	398	147
Premature deaths from air pollution - Coal (deaths)	0	83.9	0.057	0.056	0.052	0.036	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	28	20.9	13.9	12.6	7.41	3.09
Premature deaths from air pollution - Transportation (deaths)	0	246	229	173	100	44.8	16.5

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	43.2	49.8	101	38.7	30	22	324
By economic sector - Construction (jobs)	6,860	8,177	6,965	8,178	8,092	10,411	20,267
By economic sector - Manufacturing (jobs)	3,737	6,920	12,734	12,785	10,098	11,764	11,071
By economic sector - Mining (jobs)	1,822	1,387	923	589	350	190	100
By economic sector - Other (jobs)	909	1,195	1,055	1,308	1,398	1,767	3,128
By economic sector - Pipeline (jobs)	310	304	256	280	153	102	100
By economic sector - Professional (jobs)	2,924	3,366	2,915	3,203	3,313	4,882	11,061
By economic sector - Trade (jobs)	2,369	2,506	2,074	2,245	2,286	3,158	6,652
By economic sector - Utilities (jobs)	5,009	5,917	5,608	6,814	7,153	9,692	20,441
By education level - All sectors - Associates degree or some college (jobs)	7,521	9,450	10,362	11,399	10,661	13,643	23,749
By education level - All sectors - Bachelors degree (jobs)	4,928	5,984	6,519	6,921	6,349	8,182	14,417
By education level - All sectors - Doctoral degree (jobs)	169	193	180	190	181	248	507
By education level - All sectors - High school diploma or less (jobs)	10,195	12,803	14,136	15,396	14,236	18,005	30,863
By education level - All sectors - Masters or professional degree (jobs)	1,171	1,392	1,433	1,535	1,446	1,912	3,608
By resource sector - Biomass (jobs)	179	214	279	110	90.3	80.4	1,382
By resource sector - CO2 (jobs)	0	0	0	655	56	72.2	326
By resource sector - Coal (jobs)	1,453	803	212	0	0	0	0
By resource sector - Grid (jobs)	4,691	7,244	7,653	10,558	12,271	18,066	40,246
By resource sector - Natural Gas (jobs)	3,478	3,257	2,606	2,312	2,623	1,856	1,306
By resource sector - Nuclear (jobs)	938	923	908	527	0	0	0
By resource sector - Oil (jobs)	3,602	3,071	2,410	1,678	1,089	673	385
By resource sector - Solar (jobs)	9,525	14,155	17,961	19,117	15,493	15,638	16,688
By resource sector - Wind (jobs)	117	154	602	483	1,250	5,605	12,811
Median wages - Annual - All ($2019 per job)	62,708	62,912	63,005	63,816	64,974	66,381	68,724

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	3,916	4,871	5,255	5,779	5,410	6,920	12,158
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	1,630	1,945	1,876	2,126	2,070	2,689	5,108
On-Site or In-Plant Training - Total jobs - None (jobs)	3,919	4,886	5,387	5,806	5,343	6,819	11,768
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)	200	250	267	299	286	369	666
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	14,319	17,869	19,847	21,430	19,763	25,192	43,444
On-the-Job Training - All sectors - 1 to 4 years (jobs)	5,040	6,254	6,701	7,390	6,938	8,892	15,718
On-the-Job Training - All sectors - 4 to 10 years (jobs)	1,595	1,907	1,814	2,079	2,043	2,663	5,106
On-the-Job Training - All sectors - None (jobs)	1,335	1,634	1,749	1,880	1,734	2,213	3,862
On-the-Job Training - All sectors - Over 10 years (jobs)	246	316	366	389	346	430	681
On-the-Job Training - All sectors - Up to 1 year (jobs)	15,768	19,711	22,000	23,702	21,811	27,792	47,778
Related work experience - All sectors - 1 to 4 years (jobs)	8,626	10,646	11,563	12,549	11,667	14,937	26,208
Related work experience - All sectors - 4 to 10 years (jobs)	5,582	6,894	7,454	8,119	7,559	9,697	17,070
Related work experience - All sectors - None (jobs)	3,440	4,279	4,641	5,082	4,756	6,065	10,645
Related work experience - All sectors - Over 10 years (jobs)	1,485	1,876	2,138	2,297	2,094	2,666	4,500
Related work experience - All sectors - Up to 1 year (jobs)	4,851	6,127	6,835	7,394	6,797	8,625	14,720
Wage income - All (million $2019)	1,504	1,876	2,056	2,262	2,136	2,788	5,027

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	229	233	196	157	118	74.6	51.7
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	4,741
Natural gas production - Annual (tcf)	0.026	0.029	0.028	0.024	0.02	0.016	0.013
Oil consumption - Annual (million bbls)	73.9	69.1	59.1	44.6	31.1	20.6	12.5
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	1,382
Oil production - Annual (million bbls)	0	0	0	0	0	0	0

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	4.8	4.72	0	0	0	0
Sales of cooking units - Electric Resistance (%)	59	60.1	63.8	73.7	87.5	96	98.9
Sales of cooking units - Gas (%)	41	39.9	36.2	26.3	12.5	4.04	1.09
Sales of space heating units - Electric Heat Pump (%)	17.4	27.2	32.2	46.7	68.8	83.3	88.3
Sales of space heating units - Electric Resistance (%)	13.2	15.3	14.3	11.6	7.67	5.11	4.2
Sales of space heating units - Fossil (%)	14.3	21.5	20.1	15.7	8.92	4.46	2.92
Sales of space heating units - Gas (%)	55.1	36	33.4	26	14.6	7.13	4.52
Sales of water heating units - Electric Heat Pump (%)	0	1.58	6.08	19	38.9	51.9	56.4
Sales of water heating units - Electric Resistance (%)	35.7	52.7	51.6	48.7	44.3	41.5	40.5
Sales of water heating units - Gas Furnace (%)	59.5	42.2	38.9	29.2	14.4	4.62	1.21
Sales of water heating units - Other (%)	4.77	3.53	3.4	3	2.4	2.02	1.89

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	133	271	925	2,883	4,210
Public EV charging plugs - DC Fast (1000 units)	0.402	0	0.44	0	2.06	0	5.66
Public EV charging plugs - L2 (1000 units)	1.67	0	10.6	0	49.6	0	136
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 (%)	1.3	1.76	2.01	1.59	0.995	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.19	5.36	13.2	28	50.7	73.5	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.2	77.5	63.9	43.6	23.3	10.3
Vehicle sales - Light-duty - hybrid (%)	5.48	6.24	6.9	6.15	4.48	2.57	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.373	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.092	0.095	0.085	0.073	0.052	0.028	0.013
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)	189	189	186	183	177	171	167
Final energy use - Industry (PJ)	130	132	133	143	154	162	170
Final energy use - Residential (PJ)	241	229	222	214	200	183	167
Final energy use - Transportation (PJ)	449	421	386	356	331	302	268

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	21,752	24,163	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	2.22	20.1	24.9	38.9	61	76.7	82.8
Sales of space heating units - Electric Resistance (%)	2.54	8.05	8.31	9.13	10.6	12	12.8
Sales of space heating units - Fossil (%)	11	4.85	4.51	3.43	1.69	0.531	0.139
Sales of space heating units - Gas Furnace (%)	84.3	67	62.3	48.5	26.7	10.8	4.34
Sales of water heating units - Electric Heat Pump (%)	0.097	2.03	7.02	21.4	43.5	57.9	63
Sales of water heating units - Electric Resistance (%)	2.5	7.39	9.34	15.1	24	29.8	31.8
Sales of water heating units - Gas Furnace (%)	93	86.1	79.2	59.6	29.2	9.38	2.45
Sales of water heating units - Other (%)	4.44	4.46	4.4	3.91	3.31	2.91	2.76

Table 21: *E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.54	2.53	3.68	3.81	5.55	5.88

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

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-595
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	-624
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	-313
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	-327
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	525
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	52.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	578
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	276
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	26.4
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	302

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	18.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	1,480

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

Item	2020	2025	2050
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	183
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	642
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	240
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	140

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	260
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	938

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	748	0.507	0.502	0.46	0.32	0.027
Monetary damages from air pollution - Natural Gas (million 2019$)	0	248	162	73.2	34.7	11.7	7.64
Monetary damages from air pollution - Transportation (million 2019$)	0	2,231	2,262	2,199	1,975	1,567	1,069
Premature deaths from air pollution - Coal (deaths)	0	83.9	0.057	0.056	0.052	0.036	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	28	18.3	8.27	3.91	1.32	0.863
Premature deaths from air pollution - Transportation (deaths)	0	251	254	247	222	176	120

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	4.8	4.71	0	0	0	0
Sales of cooking units - Electric Resistance (%)	59.2	67.9	94.5	99.7	100	100	100
Sales of cooking units - Gas (%)	40.8	32.1	5.5	0.277	0	0	0
Sales of space heating units - Electric Heat Pump (%)	17.4	35.6	79.7	89.7	90.1	90.1	90.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Resistance (%)	13.2	13.8	5.81	3.98	3.89	3.95	3.95
Sales of space heating units - Fossil (%)	14.3	18.9	5.51	2.51	2.38	2.35	2.35
Sales of space heating units - Gas (%)	55.1	31.6	8.99	3.84	3.61	3.62	3.62
Sales of water heating units - Electric Heat Pump (%)	0	9.19	48.7	57.6	58	58	58
Sales of water heating units - Electric Resistance (%)	35.7	51	42.2	40.3	40.2	40.2	40.2
Sales of water heating units - Gas Furnace (%)	59.5	36.5	7.04	0.317	0.002	0	0
Sales of water heating units - Other (%)	4.77	3.29	2.07	1.81	1.81	1.83	1.84

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	800	2,073	3,321	5,046	5,475	5,229
Public EV charging plugs - DC Fast (1000 units)	0.402	0	1.31	0	5.5	0	8.84
Public EV charging plugs - L2 (1000 units)	1.67	0	31.5	0	132	0	212
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 (%)	1.29	1.58	1.16	0.367	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.79	17.9	50.4	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.5	75	44.7	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.27	5.16	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.325	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.019	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	189	188	180	167	157	154	156
Final energy use - Industry (PJ)	130	132	132	141	151	159	167
Final energy use - Residential (PJ)	241	228	209	183	162	149	144
Final energy use - Transportation (PJ)	448	417	367	305	249	213	197

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	21,776	24,347	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.22	28.1	70.4	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	2.54	8.39	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Fossil (%)	11	4.19	0.8	0.034	0	0	0
Sales of space heating units - Gas Furnace (%)	84.3	59.3	18.3	3.58	1.9	1.86	1.85
Sales of water heating units - Electric Heat Pump (%)	0.097	10.5	54.4	64.3	64.7	64.8	64.7
Sales of water heating units - Electric Resistance (%)	2.5	10.8	28.3	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	93	74.5	14.3	0.646	0.003	0	0

Table 28: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	4.44	4.22	3.02	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.99	3.04	6	6.39	5.4	5.63

Table 30: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion $2018)	0	0	0	0	1.71	17.2	3.59
Capital invested - Solar PV - Base (billion $2018)	0	4.53	0.414	2.16	2.49	3.65	14.9
Capital invested - Wind - Base (billion $2018)	0	0	0	0	0	2.43	6.5

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	4,268	54,657	13,188
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	4,276	0	67,845
Solar - Base land use assumptions (GWh)	1,833	6,232	655	3,541	4,173	6,377	29,914
Solar - Constrained land use assumptions (GWh)	2,449	3,162	3,022	4,628	2,879	475	36,372
Wind - Base land use assumptions (GWh)	786	0	0	0	0	4,164	9,643
Wind - Constrained land use assumptions (GWh)	786	0	0	5,492	4,458	0	0

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	-595
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	-624
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	-313
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	-327
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	525
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	52.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	578
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	276

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	26.4
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	302

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	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	18.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	1,480
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	183
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	642
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	240

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

Item	2020	2025	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	140
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	260
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	3.08

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	938

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	748	0.507	0.502	0.46	0.32	0.027
Monetary damages from air pollution - Natural Gas (million 2019$)	0	228	159	98.9	69.7	24.4	4.65
Monetary damages from air pollution - Transportation (million 2019$)	0	2,187	2,036	1,542	889	398	147
Premature deaths from air pollution - Coal (deaths)	0	83.9	0.057	0.056	0.052	0.036	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	25.7	18	11.2	7.87	2.76	0.525
Premature deaths from air pollution - Transportation (deaths)	0	246	229	173	100	44.8	16.5

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	4.8	4.71	0	0	0	0
Sales of cooking units - Electric Resistance (%)	59.2	67.9	94.5	99.7	100	100	100
Sales of cooking units - Gas (%)	40.8	32.1	5.5	0.277	0	0	0
Sales of space heating units - Electric Heat Pump (%)	17.4	35.6	79.7	89.7	90.1	90.1	90.1
Sales of space heating units - Electric Resistance (%)	13.2	13.8	5.81	3.98	3.89	3.95	3.95
Sales of space heating units - Fossil (%)	14.3	18.9	5.51	2.51	2.38	2.35	2.35
Sales of space heating units - Gas (%)	55.1	31.6	8.99	3.84	3.61	3.62	3.62
Sales of water heating units - Electric Heat Pump (%)	0	9.19	48.7	57.6	58	58	58
Sales of water heating units - Electric Resistance (%)	35.7	51	42.2	40.3	40.2	40.2	40.2
Sales of water heating units - Gas Furnace (%)	59.5	36.5	7.04	0.317	0.002	0	0
Sales of water heating units - Other (%)	4.77	3.29	2.07	1.81	1.81	1.83	1.84

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	800	2,073	3,321	5,046	5,475	5,229
Public EV charging plugs - DC Fast (1000 units)	0.402	0	1.31	0	5.5	0	8.84
Public EV charging plugs - L2 (1000 units)	1.67	0	31.5	0	132	0	212
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 (%)	1.29	1.58	1.16	0.367	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.79	17.9	50.4	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.5	75	44.7	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.27	5.16	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.325	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.019	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0

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

Item	2020	2025	2030	2035	2040	2045	2050
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)	189	188	180	167	157	154	156
Final energy use - Industry (PJ)	130	132	132	141	151	159	167
Final energy use - Residential (PJ)	241	228	209	183	162	149	144
Final energy use - Transportation (PJ)	448	417	367	305	249	213	197

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	21,776	24,347	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	2.22	28.1	70.4	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	2.54	8.39	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Fossil (%)	11	4.19	0.8	0.034	0	0	0
Sales of space heating units - Gas Furnace (%)	84.3	59.3	18.3	3.58	1.9	1.86	1.85
Sales of water heating units - Electric Heat Pump (%)	0.097	10.5	54.4	64.3	64.7	64.8	64.7
Sales of water heating units - Electric Resistance (%)	2.5	10.8	28.3	32.3	32.5	32.5	32.5
Sales of water heating units - Gas Furnace (%)	93	74.5	14.3	0.646	0.003	0	0
Sales of water heating units - Other (%)	4.44	4.22	3.02	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.99	3.04	6	6.39	5.4	5.63

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Constrained (billion $2018)	0	0	0	0	0	0.383	0.427
Capital invested - Solar PV - Base (billion $2018)	0	1.12	0.84	0.53	0.29	0	0
Capital invested - Solar PV - Constrained (billion $2018)	0	1.2	1.38	0.17	0.879	0.198	0
Capital invested - Wind - Base (billion $2018)	0	0	0	0	0	0	0
Capital invested - Wind - Constrained (billion $2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	1,098	1,388
Solar - Base land use assumptions (GWh)	1,078	1,541	1,311	891	525	0	0
Solar - Constrained land use assumptions (GWh)	1,345	1,662	2,107	293	1,561	369	0
Wind - Base land use assumptions (GWh)	786	0	0	0	0	0	0
Wind - Constrained land use assumptions (GWh)	786	0	0	0	0	0	0

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-595
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	-624
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	-313
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	-327
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	525
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	52.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	578
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	276
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	26.4
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	302

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	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	18.8

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

Item	2020	2025	2050
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	1,480
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	183
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	642
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	240
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	3.08

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	140
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	260
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	470
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	938

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	748	0.507	0.502	0.46	0.32	0.027
Monetary damages from air pollution - Natural Gas (million 2019$)	0	202	159	206	157	54.8	16.7
Monetary damages from air pollution - Transportation (million 2019$)	0	2,187	2,036	1,542	889	398	147
Premature deaths from air pollution - Coal (deaths)	0	83.9	0.057	0.056	0.052	0.036	0.003
Premature deaths from air pollution - Natural Gas (deaths)	0	22.9	18	23.2	17.7	6.19	1.89
Premature deaths from air pollution - Transportation (deaths)	0	246	229	173	100	44.8	16.5

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	4.8	4.72	0	0	0	0
Sales of cooking units - Electric Resistance (%)	59	60.1	63.8	73.7	87.5	96	98.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Gas (%)	41	39.9	36.2	26.3	12.5	4.04	1.09
Sales of space heating units - Electric Heat Pump (%)	17.4	27.2	32.2	46.7	68.8	83.3	88.3
Sales of space heating units - Electric Resistance (%)	13.2	15.3	14.3	11.6	7.67	5.11	4.2
Sales of space heating units - Fossil (%)	14.3	21.5	20.1	15.7	8.92	4.46	2.92
Sales of space heating units - Gas (%)	55.1	36	33.4	26	14.6	7.13	4.52
Sales of water heating units - Electric Heat Pump (%)	0	1.58	6.08	19	38.9	51.9	56.4
Sales of water heating units - Electric Resistance (%)	35.7	52.7	51.6	48.7	44.3	41.5	40.5
Sales of water heating units - Gas Furnace (%)	59.5	42.2	38.9	29.2	14.4	4.62	1.21
Sales of water heating units - Other (%)	4.77	3.53	3.4	3	2.4	2.02	1.89

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	133	271	925	2,883	4,210
Public EV charging plugs - DC Fast (1000 units)	0.402	0	0.44	0	2.06	0	5.66
Public EV charging plugs - L2 (1000 units)	1.67	0	10.6	0	49.6	0	136
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 (%)	1.3	1.76	2.01	1.59	0.995	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.19	5.36	13.2	28	50.7	73.5	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.2	77.5	63.9	43.6	23.3	10.3
Vehicle sales - Light-duty - hybrid (%)	5.48	6.24	6.9	6.15	4.48	2.57	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.373	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.092	0.095	0.085	0.073	0.052	0.028	0.013
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)	189	189	186	183	177	171	167
Final energy use - Industry (PJ)	130	132	133	143	154	162	170
Final energy use - Residential (PJ)	241	229	222	214	200	183	167
Final energy use - Transportation (PJ)	449	421	386	356	331	302	268

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	21,752	24,163	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump (%)	2.22	20.1	24.9	38.9	61	76.7	82.8
Sales of space heating units - Electric Resistance (%)	2.54	8.05	8.31	9.13	10.6	12	12.8
Sales of space heating units - Fossil (%)	11	4.85	4.51	3.43	1.69	0.531	0.139
Sales of space heating units - Gas Furnace (%)	84.3	67	62.3	48.5	26.7	10.8	4.34
Sales of water heating units - Electric Heat Pump (%)	0.097	2.03	7.02	21.4	43.5	57.9	63

Table 48: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	2.5	7.39	9.34	15.1	24	29.8	31.8
Sales of water heating units - Gas Furnace (%)	93	86.1	79.2	59.6	29.2	9.38	2.45
Sales of water heating units - Other (%)	4.44	4.46	4.4	3.91	3.31	2.91	2.76

Table 49: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.54	2.53	3.68	3.81	5.55	5.88

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

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

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0	0	0	0	0	476
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	0	5,252
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	6
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	3.32	3.42	3.53
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	3.32	3.42	3.53
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	3.32	6.74	10.3
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	6.74	10.3
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	0	112	197	197	257
Cumulative investment - All (million $2018)	0	0	0	667	748	749	820
Cumulative investment - Spur (million $2018)	0	0	0	0	81.3	82.7	153
Cumulative investment - Trunk (million $2018)	0	0	0	667	667	667	667
Spur (km)	0	0	0	0	85.1	85.1	145
Trunk (km)	0	0	0	112	112	112	112

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	-140
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-526
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	-25.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-691
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-140
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-276
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	-12.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-429
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	66.5
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,142
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	24.8
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	15.5
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	45.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,295
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	66.5

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	243
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	24.8
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	15.5
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	22.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	372

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	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	18.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	1,480
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	183
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	642

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

Item	2020	2025	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	240
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	140
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	260
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	470

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	3.08
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	938

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	4.7	4.34	0	0	0	0
Sales of cooking units - Electric Resistance (%)	58.7	58.7	58.7	58.7	58.7	58.7	58.7
Sales of cooking units - Gas (%)	41.3	41.3	41.3	41.3	41.3	41.3	41.3
Sales of space heating units - Electric Heat Pump (%)	15	40.3	41.5	42.8	43.7	44.6	45.9
Sales of space heating units - Electric Resistance (%)	13.7	12.7	12.4	12	11.7	10.8	9.45
Sales of space heating units - Fossil (%)	14.7	16.1	7.71	4.03	3.79	3.76	3.81
Sales of space heating units - Gas (%)	56.6	31	38.4	41.1	40.8	40.8	40.9
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	35.7	53	53	52.9	52.9	52.8	52.8
Sales of water heating units - Gas Furnace (%)	59.5	43.4	43.4	43.5	43.5	43.6	43.6
Sales of water heating units - Other (%)	4.77	3.57	3.58	3.59	3.6	3.6	3.61

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 (%)	1.29	1.75	2.14	2	1.79	1.66	1.58
Vehicle sales - Light-duty - EV (%)	4.42	6.72	7.55	9.34	11.3	12.8	14.1
Vehicle sales - Light-duty - gasoline (%)	88.8	85	82.5	80.4	78.1	76.3	74.8
Vehicle sales - Light-duty - hybrid (%)	5.29	6.1	7.38	7.93	8.43	8.88	9.17
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.367	0.331	0.29	0.286	0.285	0.294
Vehicle sales - Light-duty - other (%)	0.09	0.094	0.09	0.091	0.09	0.088	0.091
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)	189	191	193	193	194	199	210
Final energy use - Industry (PJ)	130	136	143	150	159	169	180
Final energy use - Residential (PJ)	241	228	225	225	227	233	239

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	449	422	391	372	373	384	398

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	21,455	22,311	0	0	0	0
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric Heat Pump (%)	2.22	24.1	48.5	68.5	71.8	72.2	72.1
Sales of space heating units - Electric Resistance (%)	2.54	8.78	12.8	20.1	25.2	25.9	26
Sales of space heating units - Fossil (%)	11	4.72	3.48	1.49	0.219	0.018	0
Sales of space heating units - Gas Furnace (%)	84.3	62.4	35.2	9.92	2.85	1.92	1.85
Sales of water heating units - Electric Heat Pump (%)	0.097	0.269	0.266	0.268	0.269	0.268	0.269
Sales of water heating units - Electric Resistance (%)	2.5	6.69	6.63	6.64	6.67	6.65	6.66
Sales of water heating units - Gas Furnace (%)	93	88.5	88.5	88.6	88.5	88.5	88.6
Sales of water heating units - Other (%)	4.44	4.5	4.6	4.5	4.54	4.55	4.51

Table 62: *REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	2.72	2.74	4.82	5.09	5.1	5.33

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-4.41	0	-2.14	-1.92
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.235	0	-0.423	-0.44
Business-as-usual carbon sink - Total (Mt CO2e/y)	-4.65	0	-2.57	-2.36
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	37.6
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	5,324
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,101
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	1,332
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	140
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	864
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	356
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	62.1
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	886
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	546
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	18.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	1,480
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	183

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

Item	2020	2025	2030	2050
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	511
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	71.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	288
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	125
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	31.1
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	67.1
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	184
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	28.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	3,401
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	642
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	922
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	104
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	576
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	240
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	46.6
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	365
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	6.15
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	149
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	679
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	51.5
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	33.8
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	4.11
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	25.2
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	181
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,130
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	3.08
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	140
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	260

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	25.8
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	17.8
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	2.05
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	4.36
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	110
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	563
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	4.61
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	144
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	470
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	38.8
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	25.8
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	3.08
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	31.5
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	221
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	938

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	1,951	1,226	1,147	1,115	1,094	1,003
Monetary damages from air pollution - Natural Gas (million 2019$)	0	199	221	262	277	254	245
Monetary damages from air pollution - Transportation (million 2019$)	0	2,223	2,284	2,337	2,400	2,459	2,517
Premature deaths from air pollution - Coal (deaths)	0	219	138	129	125	123	113
Premature deaths from air pollution - Natural Gas (deaths)	0	22.4	24.9	29.7	31.3	28.6	27.7
Premature deaths from air pollution - Transportation (deaths)	0	250	257	263	270	277	283