Net-Zero America - utah 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	2.76	3.21	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.1	50.5	91.5	99.6	100	100	100
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric Heat Pump (%)	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Sales of space heating units - Electric Resistance (%)	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric Heat Pump (%)	0	1.51	15.7	41.6	46.2	46.5	46.5
Sales of water heating units - Electric Resistance (%)	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Sales of water heating units - Gas Furnace (%)	92.3	82	57.3	9.09	0.535	0	0
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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	449	1,171	1,866	2,839	3,076	2,940
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.748	0	3.07	0	4.93
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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	7,533	8,381	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 (%)	0.749	8.98	33.5	81.9	90.4	91	91
Sales of space heating units - Electric Resistance (%)	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.72	1.81	3.2	3.44	3.67	3.91

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	0.003	0.029	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	0.377
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	0	0	0.525
Capital invested - Solar PV - Constrained (billion $2018)	0	1.09	0	0	2.18	2.6	1.2
Capital invested - Wind - Base (billion $2018)	0	0.251	7.55	5.67	2.22	1.04	3.24
Capital invested - Wind - Constrained (billion $2018)	0	0.199	7.9	6.7	0.918	0.419	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	4.9	61.8	61.8	61.8	61.8	61.8
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	423
Solar - Base land use assumptions (GWh)	2,042	0	0	0	0	0	1,245
Solar - Constrained land use assumptions (GWh)	2,037	0	0	0	15,608	2,359	2,413
Wind - Base land use assumptions (GWh)	1,617	508	16,025	12,502	4,938	2,416	8,258
Wind - Constrained land use assumptions (GWh)	3,563	2,082	15,525	9,625	2,054	823	5,491

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)	0	0.333	3.78	4.99	5.18	5.22	26.6
Conversion capital investment - Cumulative 5-yr (million $2018)	0	2.83	32.3	18.6	2.91	0.542	346
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	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	0.4
Annual - BECCS (MMT)	0	0	0	0	0	0	0.4
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	0.4
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0.4
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	0	0	22.6
Cumulative investment - All (million $2018)	0	0	0	0	0	0	13.5
Cumulative investment - Spur (million $2018)	0	0	0	0	0	0	13.5
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	22.6
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	-360
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-376
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	-184
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-7.84
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-192
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	646
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	24.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	670
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	329
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	12.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	341

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.38
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	9.92
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	12,667
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	19.8

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	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	231
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.95
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	16.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	2.93
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	24.1

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	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,034

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	159	0.184	0.184	0.164	0.108	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	38.7	29.3	22	19.4	15.2	11.3
Monetary damages from air pollution - Transportation (million 2019$)	0	745	724	572	341	160	64.3
Premature deaths from air pollution - Coal (deaths)	0	17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.37	3.31	2.48	2.19	1.72	1.28
Premature deaths from air pollution - Transportation (deaths)	0	83.8	81.5	64.3	38.3	18	7.23

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	3.65	4.2	10.7	10.8	9.3	7.45	25
By economic sector - Construction (jobs)	5,728	4,630	7,652	8,842	8,198	7,716	9,218
By economic sector - Manufacturing (jobs)	4,316	4,247	5,979	6,951	6,077	5,186	5,480
By economic sector - Mining (jobs)	6,520	4,907	3,453	2,594	1,720	1,121	655
By economic sector - Other (jobs)	655	445	717	909	968	1,034	1,668
By economic sector - Pipeline (jobs)	397	401	356	302	229	161	108
By economic sector - Professional (jobs)	3,120	2,672	4,371	5,247	5,088	4,956	6,002
By economic sector - Trade (jobs)	3,364	2,730	3,174	3,505	3,276	3,138	3,829
By economic sector - Utilities (jobs)	3,792	3,947	7,062	7,742	6,905	6,562	6,858
By education level - All sectors - Associates degree or some college (jobs)	8,367	7,240	10,231	11,371	10,292	9,532	10,866
By education level - All sectors - Bachelors degree (jobs)	5,989	5,270	6,970	7,584	6,784	6,213	6,963
By education level - All sectors - Doctoral degree (jobs)	202	174	239	267	247	232	272
By education level - All sectors - High school diploma or less (jobs)	11,926	10,055	13,651	15,035	13,477	12,356	13,984
By education level - All sectors - Masters or professional degree (jobs)	1,414	1,243	1,684	1,846	1,670	1,547	1,759
By resource sector - Biomass (jobs)	15.1	18	29.5	30.7	28	27.2	107
By resource sector - CO2 (jobs)	0	0	0	0	0	0	29.4
By resource sector - Coal (jobs)	4,431	2,670	1,040	529	460	414	367
By resource sector - Grid (jobs)	4,054	4,799	11,712	13,605	12,053	11,417	12,440
By resource sector - Natural Gas (jobs)	5,205	4,855	4,123	3,305	2,617	2,125	1,300
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	7,307	6,802	5,928	5,041	3,591	2,603	1,588
By resource sector - Solar (jobs)	6,180	3,444	3,627	4,869	5,150	5,442	9,230
By resource sector - Wind (jobs)	705	1,395	6,316	8,723	8,572	7,853	8,782
Median wages - Annual - All ($2019 per job)	56,613	58,060	58,319	58,637	59,219	59,958	60,200
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	4,439	3,831	5,342	5,897	5,310	4,898	5,541
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	1,744	1,511	2,176	2,407	2,184	2,036	2,316
On-Site or In-Plant Training - Total jobs - None (jobs)	4,421	3,814	5,258	5,822	5,259	4,849	5,547

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)	207	185	275	309	281	262	298
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	17,085	14,643	19,724	21,668	19,436	17,836	20,143
On-the-Job Training - All sectors - 1 to 4 years (jobs)	5,651	4,888	6,870	7,592	6,847	6,325	7,159
On-the-Job Training - All sectors - 4 to 10 years (jobs)	1,659	1,427	2,102	2,341	2,136	2,001	2,295
On-the-Job Training - All sectors - None (jobs)	1,540	1,313	1,756	1,928	1,736	1,599	1,840
On-the-Job Training - All sectors - Over 10 years (jobs)	267	229	316	351	315	287	327
On-the-Job Training - All sectors - Up to 1 year (jobs)	18,780	16,125	21,731	23,891	21,437	19,668	22,223
Related work experience - All sectors - 1 to 4 years (jobs)	10,259	8,827	11,924	13,081	11,745	10,800	12,185
Related work experience - All sectors - 4 to 10 years (jobs)	6,391	5,564	7,686	8,466	7,621	7,022	7,925
Related work experience - All sectors - None (jobs)	3,891	3,368	4,658	5,134	4,624	4,267	4,852
Related work experience - All sectors - Over 10 years (jobs)	1,743	1,527	2,084	2,288	2,047	1,870	2,092
Related work experience - All sectors - Up to 1 year (jobs)	5,613	4,696	6,424	7,134	6,434	5,921	6,789
Wage income - All (million $2019)	1,579	1,393	1,912	2,117	1,923	1,792	2,038

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	186	189	159	128	96	60.4	41.9
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	3,842
Natural gas production - Annual (tcf)	314	348	329	287	242	192	149
Oil consumption - Annual (million bbls)	57	53.1	45.7	34.9	24.7	16.6	10
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	1,076
Oil production - Annual (million bbls)	44.4	48	48.2	48.1	38.1	31	20.6

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	2.75	3.16	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.9	38.5	44.3	59.5	80.7	93.8	98.3
Sales of cooking units - Gas (%)	63.1	61.5	55.7	40.5	19.3	6.23	1.68
Sales of space heating units - Electric Heat Pump (%)	3.03	8.14	10.8	19.7	39.7	63.6	77.1
Sales of space heating units - Electric Resistance (%)	3.81	7.45	7.24	6.69	5.41	3.74	2.75
Sales of space heating units - Fossil (%)	3.57	9.27	9.34	9.11	8.39	7.66	7.61
Sales of space heating units - Gas (%)	89.6	75.1	72.6	64.6	46.5	25	12.6
Sales of water heating units - Electric Heat Pump (%)	0	0.562	2.11	7.14	18.6	32.3	40.2
Sales of water heating units - Electric Resistance (%)	7.01	15.2	16.4	20.2	29.3	40.6	47.3
Sales of water heating units - Gas Furnace (%)	92.3	83.4	80.7	71.9	51.3	26.3	11.8
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.783	0.781	0.778

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	76.1	152	522	1,618	2,366
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.26	0	1.16	0	3.16
Public EV charging plugs - L2 (1000 units)	1.07	0	6.25	0	27.9	0	75.9
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.8	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.8	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.58	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.38	0.326	0.249	0.177	0.098	0.046
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	103	102	99.5	96.4	92.8
Final energy use - Industry (PJ)	86.5	89.4	90.4	97.9	112	117	124
Final energy use - Residential (PJ)	126	122	121	118	114	105	94.6
Final energy use - Transportation (PJ)	304	292	270	253	241	225	207

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	7,532	8,365	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 (%)	0.749	7.59	10.3	19	39.5	64.5	79
Sales of space heating units - Electric Resistance (%)	0.855	3.35	3.5	4.01	5.26	6.85	7.79
Sales of space heating units - Fossil (%)	0	0.241	0.225	0.172	0.092	0.04	0.021
Sales of space heating units - Gas Furnace (%)	98.4	88.8	86	76.8	55.2	28.6	13.2
Sales of water heating units - Electric Heat Pump (%)	0.008	0.63	2.29	7.68	20	34.8	43.4
Sales of water heating units - Electric Resistance (%)	0.41	2	3.48	8.38	19.9	34.2	42.5
Sales of water heating units - Gas Furnace (%)	99.5	97	93.8	83.6	59.7	30.6	13.7
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.43	1.48	1.97	2.07	2.75	2.92

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	-360
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-376

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	-184
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-7.84
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-192
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	646
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	24.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	670
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	329
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	12.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	341

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.38

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	9.92
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	12,667
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	19.8
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	231
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.95
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	16.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	2.93
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	24.1
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,034

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	159	0.184	0.184	0.164	0.108	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	42.4	21.4	14.8	8.7	4.13	4.98
Monetary damages from air pollution - Transportation (million 2019$)	0	757	796	806	751	617	436
Premature deaths from air pollution - Coal (deaths)	0	17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.79	2.42	1.68	0.983	0.467	0.563
Premature deaths from air pollution - Transportation (deaths)	0	85.1	89.6	90.6	84.5	69.4	49.1

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	2.76	3.21	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.1	50.5	91.5	99.6	100	100	100
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric Heat Pump (%)	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Sales of space heating units - Electric Resistance (%)	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric Heat Pump (%)	0	1.51	15.7	41.6	46.2	46.5	46.5

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 (%)	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Sales of water heating units - Gas Furnace (%)	92.3	82	57.3	9.09	0.535	0	0
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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	449	1,171	1,866	2,839	3,076	2,940
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.748	0	3.07	0	4.93
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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	7,533	8,381	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 (%)	0.749	8.98	33.5	81.9	90.4	91	91
Sales of space heating units - Electric Resistance (%)	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.72	1.81	3.2	3.44	3.67	3.91

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	0	0	0	0	7.15
Capital invested - Wind - Base (billion $2018)	0	0.668	8.7	6.39	4.89	2.47	3.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,042	0	0	0	0	0	16,142
Solar - Constrained land use assumptions (GWh)	2,042	0	0	10,834	4,539	4,837	15,788
Wind - Base land use assumptions (GWh)	1,617	1,331	18,362	13,914	10,844	5,461	7,656
Wind - Constrained land use assumptions (GWh)	3,563	4,044	17,306	8,018	4,733	1,601	4,423

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	-360
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-376
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	-184
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-7.84
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-192
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	646
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	24.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	670
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	329
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	12.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	341

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.38
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	9.92
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	12,667
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	19.8
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	231

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	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.95
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	16.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	2.93
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	24.1
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,034

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	159	0.184	0.184	0.164	0.108	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	37.2	22.7	13	9.6	4.39	3.47
Monetary damages from air pollution - Transportation (million 2019$)	0	745	724	572	341	160	64.3
Premature deaths from air pollution - Coal (deaths)	0	17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.2	2.57	1.46	1.08	0.496	0.392
Premature deaths from air pollution - Transportation (deaths)	0	83.8	81.5	64.3	38.3	18	7.23

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	2.76	3.21	0	0	0	0
Sales of cooking units - Electric Resistance (%)	37.1	50.5	91.5	99.6	100	100	100
Sales of cooking units - Gas (%)	62.9	49.5	8.47	0.426	0	0	0
Sales of space heating units - Electric Heat Pump (%)	3.03	9.9	34.8	79.5	87.6	88.4	88.2
Sales of space heating units - Electric Resistance (%)	3.81	7.35	5.69	2.51	1.97	1.95	1.97
Sales of space heating units - Fossil (%)	3.57	9.24	8.91	8.06	7.57	7.25	7.38
Sales of space heating units - Gas (%)	89.6	73.5	50.6	9.98	2.86	2.43	2.43
Sales of water heating units - Electric Heat Pump (%)	0	1.51	15.7	41.6	46.2	46.5	46.5
Sales of water heating units - Electric Resistance (%)	7.01	15.7	26.3	48.5	52.5	52.7	52.7
Sales of water heating units - Gas Furnace (%)	92.3	82	57.3	9.09	0.535	0	0
Sales of water heating units - Other (%)	0.642	0.79	0.79	0.787	0.779	0.778	0.778

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	449	1,171	1,866	2,839	3,076	2,940
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.748	0	3.07	0	4.93
Public EV charging plugs - L2 (1000 units)	1.07	0	18	0	73.9	0	119
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.55	1.82	1.26	0.402	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.91	15.2	46.4	81.8	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.9	78	48.8	16.5	3.29	0.59	0
Vehicle sales - Light-duty - hybrid (%)	4.42	4.54	3.21	1.19	0.291	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.34	0.203	0.063	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.102	0.098	0.064	0.022	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	101	94.8	87.6	82.5	80.3
Final energy use - Industry (PJ)	86.5	89.3	90.2	96.9	111	116	122
Final energy use - Residential (PJ)	126	122	118	106	90.4	79.2	72.3
Final energy use - Transportation (PJ)	304	290	260	223	188	168	161

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	7,533	8,381	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 (%)	0.749	8.98	33.5	81.9	90.4	91	91
Sales of space heating units - Electric Resistance (%)	0.855	3.41	4.83	7.94	8.5	8.54	8.55
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	98.4	87.4	61.6	10.2	1.06	0.491	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	1.61	16.7	45	50	50.3	50.3
Sales of water heating units - Electric Resistance (%)	0.41	2.69	16.3	44.1	49	49.3	49.3
Sales of water heating units - Gas Furnace (%)	99.5	95.3	66.6	10.6	0.622	0	0
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.72	1.81	3.2	3.44	3.67	3.91

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	1.57	1.01	0.394	0.559	0.839	0
Capital invested - Solar PV - Constrained (billion $2018)	0	0.463	0	0	2.75	2.17	0
Capital invested - Wind - Base (billion $2018)	0	0.149	2.14	4.88	3.54	1.7	1.52
Capital invested - Wind - Constrained (billion $2018)	0	0.838	1.8	5.5	3.35	1.73	0.966

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	5,120	2,460	1,785	705	1,131	1,794	0
Solar - Constrained land use assumptions (GWh)	2,203	711	0	0	5,780	4,885	0
Wind - Base land use assumptions (GWh)	1,617	299	4,612	11,071	8,101	4,054	3,958
Wind - Constrained land use assumptions (GWh)	3,189	1,614	3,784	11,406	6,636	3,524	2,049

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	-360
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-15.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-376
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	-184
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-7.84
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-192
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	646
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	24.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	670
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	329
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	12.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	341

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.38
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	9.92

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	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	12,667
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	19.8
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	231
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.95
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	16.6

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	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	2.93
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	24.1
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,034

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	159	0.184	0.184	0.164	0.108	0
Monetary damages from air pollution - Natural Gas (million 2019$)	0	41.6	28.2	24.9	28.7	21.3	6.71
Monetary damages from air pollution - Transportation (million 2019$)	0	745	724	572	341	160	64.3
Premature deaths from air pollution - Coal (deaths)	0	17.8	0.021	0.021	0.018	0.012	0
Premature deaths from air pollution - Natural Gas (deaths)	0	4.69	3.19	2.81	3.24	2.4	0.758
Premature deaths from air pollution - Transportation (deaths)	0	83.8	81.5	64.3	38.3	18	7.23

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	2.75	3.16	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.9	38.5	44.3	59.5	80.7	93.8	98.3
Sales of cooking units - Gas (%)	63.1	61.5	55.7	40.5	19.3	6.23	1.68
Sales of space heating units - Electric Heat Pump (%)	3.03	8.14	10.8	19.7	39.7	63.6	77.1
Sales of space heating units - Electric Resistance (%)	3.81	7.45	7.24	6.69	5.41	3.74	2.75
Sales of space heating units - Fossil (%)	3.57	9.27	9.34	9.11	8.39	7.66	7.61
Sales of space heating units - Gas (%)	89.6	75.1	72.6	64.6	46.5	25	12.6
Sales of water heating units - Electric Heat Pump (%)	0	0.562	2.11	7.14	18.6	32.3	40.2
Sales of water heating units - Electric Resistance (%)	7.01	15.2	16.4	20.2	29.3	40.6	47.3

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 (%)	92.3	83.4	80.7	71.9	51.3	26.3	11.8
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.783	0.781	0.778

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	76.1	152	522	1,618	2,366
Public EV charging plugs - DC Fast (1000 units)	0.174	0	0.26	0	1.16	0	3.16
Public EV charging plugs - L2 (1000 units)	1.07	0	6.25	0	27.9	0	75.9
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 (%)	1.56	1.97	2.06	1.64	1.05	0.537	0.23
Vehicle sales - Light-duty - EV (%)	1.89	4.68	11.8	25.9	48.4	72	87.6
Vehicle sales - Light-duty - gasoline (%)	91.8	87.5	79.6	66.7	46.2	24.9	11
Vehicle sales - Light-duty - hybrid (%)	4.58	5.39	6.05	5.51	4.13	2.44	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.38	0.326	0.249	0.177	0.098	0.046
Vehicle sales - Light-duty - other (%)	0.103	0.106	0.097	0.084	0.061	0.033	0.015
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	103	103	102	99.5	96.4	92.8
Final energy use - Industry (PJ)	86.5	89.4	90.4	97.9	112	117	124
Final energy use - Residential (PJ)	126	122	121	118	114	105	94.6
Final energy use - Transportation (PJ)	304	292	270	253	241	225	207

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	7,532	8,365	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 (%)	0.749	7.59	10.3	19	39.5	64.5	79
Sales of space heating units - Electric Resistance (%)	0.855	3.35	3.5	4.01	5.26	6.85	7.79
Sales of space heating units - Fossil (%)	0	0.241	0.225	0.172	0.092	0.04	0.021
Sales of space heating units - Gas Furnace (%)	98.4	88.8	86	76.8	55.2	28.6	13.2
Sales of water heating units - Electric Heat Pump (%)	0.008	0.63	2.29	7.68	20	34.8	43.4
Sales of water heating units - Electric Resistance (%)	0.41	2	3.48	8.38	19.9	34.2	42.5
Sales of water heating units - Gas Furnace (%)	99.5	97	93.8	83.6	59.7	30.6	13.7
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.43	1.48	1.97	2.07	2.75	2.92

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	0
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	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	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

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

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	0	0	0	0
Cumulative investment - All (million $2018)	0	0	0	0	0	0	0
Cumulative investment - Spur (million $2018)	0	0	0	0	0	0	0
Cumulative investment - Trunk (million $2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	0
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	0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-360
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	-15.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-376
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	-184
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	-7.84
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-192
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	1,595
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	0.002
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	1.05
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	24.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	1,620
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	329
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	0.002
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	1.05
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	12.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	342

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	5.38
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	9.92
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	12,667
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	19.8
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	231

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	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	1.95
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	16.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	110
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	2.93
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	24.1
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	5,034

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	2.68	2.8	0	0	0	0
Sales of cooking units - Electric Resistance (%)	36.3	36.3	36.3	36.3	36.3	36.3	36.3
Sales of cooking units - Gas (%)	63.7	63.7	63.7	63.7	63.7	63.7	63.7
Sales of space heating units - Electric Heat Pump (%)	2.42	11.3	11.7	12.3	12.7	13	13.3
Sales of space heating units - Electric Resistance (%)	3.86	7.17	7.1	7.05	7.03	6.83	6.47
Sales of space heating units - Fossil (%)	3.61	9.13	9.24	9.18	8.79	8.45	8.65
Sales of space heating units - Gas (%)	90.1	72.4	72	71.5	71.5	71.7	71.5
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	7.01	14.8	14.8	14.8	14.9	14.9	14.9
Sales of water heating units - Gas Furnace (%)	92.3	84.4	84.4	84.4	84.4	84.4	84.3
Sales of water heating units - Other (%)	0.642	0.79	0.789	0.787	0.784	0.782	0.78

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 (%)	1.56	1.97	2.18	2.03	1.83	1.71	1.62
Vehicle sales - Light-duty - EV (%)	3.56	5.59	6.37	7.84	9.55	11	12.2
Vehicle sales - Light-duty - gasoline (%)	90.2	86.7	84.5	82.7	80.6	78.7	77.1
Vehicle sales - Light-duty - hybrid (%)	4.44	5.28	6.46	7.03	7.6	8.18	8.63
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.377	0.346	0.307	0.304	0.305	0.316
Vehicle sales - Light-duty - other (%)	0.102	0.106	0.102	0.103	0.102	0.101	0.104
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	103	105	107	106	106	108	113
Final energy use - Industry (PJ)	86.4	92	95.3	99.3	105	112	121
Final energy use - Residential (PJ)	126	123	123	125	127	130	132
Final energy use - Transportation (PJ)	304	294	276	267	271	282	297

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	7,440	7,806	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 (%)	0.749	14.6	48.1	74.1	78.4	78.8	78.8
Sales of space heating units - Electric Resistance (%)	0.855	4.29	8.82	15.6	19.9	20.6	20.7
Sales of space heating units - Fossil (%)	0	0.225	0.13	0.037	0.005	0	0
Sales of space heating units - Gas Furnace (%)	98.4	80.9	43	10.2	1.68	0.552	0.49
Sales of water heating units - Electric Heat Pump (%)	0.008	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 (%)	0.41	1.46	1.46	1.47	1.46	1.47	1.46
Sales of water heating units - Gas Furnace (%)	99.5	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.1	0.381	0.381	0.382	0.381	0.381	0.381

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	1.54	1.6	1.88	1.97	2.43	2.57

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-0.72	0	2.42	0.695
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.008	0	-0.017	-0.018
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.728	0	2.41	0.677
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,412
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	18,580
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	838
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	7,600
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	10.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	29.8
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	332
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	2,378
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	1,329
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	4,651
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	707
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	6,755
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	140
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	2,919
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	5.38
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	9.92
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	116
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	1,189
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	101
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,568
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	1,060
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	12,667

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	489
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	5,260
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	7.89
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	19.8
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	224
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	1,783
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	715
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	3,109
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	231
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	113
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	3,876
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	3.9
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	31.5
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	157
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	37.8
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	1,542
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,992
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	116
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	106
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,485
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	1.95
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	16.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	78.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	6.55
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	933
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,743
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	173
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	110

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	0	2,680
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	2.93
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	24.1
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	118
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	47.3
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	1,879
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	5,034

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	204	156	74.9	60.2	56.5	53.2
Monetary damages from air pollution - Natural Gas (million 2019$)	0	36.9	33.8	56.3	38.8	54.1	51.1
Monetary damages from air pollution - Transportation (million 2019$)	0	757	808	859	914	969	1,026
Premature deaths from air pollution - Coal (deaths)	0	22.9	17.5	8.4	6.75	6.34	5.97
Premature deaths from air pollution - Natural Gas (deaths)	0	4.17	3.81	6.36	4.38	6.11	5.78
Premature deaths from air pollution - Transportation (deaths)	0	85.1	90.8	96.6	103	109	115