Net-Zero America - indiana 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	5.74	7.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.6	74.5	95.6	99.8	100	100	100
Sales of cooking units - Gas (%)	32.4	25.5	4.36	0.22	0	0	0
Sales of space heating units - Electric Heat Pump (%)	7.14	16.5	45.4	84.9	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	18.1	24.2	17.6	8.04	6.29	6.24	6.46
Sales of space heating units - Fossil (%)	6.08	9.3	6.1	2.21	1.58	1.53	1.49
Sales of space heating units - Gas (%)	68.7	49.9	30.9	4.83	0.406	0.132	0.133
Sales of water heating units - Electric Heat Pump (%)	0	2.32	17.1	34.9	37.8	38	38.1
Sales of water heating units - Electric Resistance (%)	39.3	55.4	55.8	60.8	61.7	61.8	61.7
Sales of water heating units - Gas Furnace (%)	60.6	42.1	26.8	4.14	0.241	0	0
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.203	0.201	0.202	0.203

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,189	3,044	4,939	7,479	8,143	7,762
Public EV charging plugs - DC Fast (1000 units)	0.168	0	2.17	0	9.57	0	15.5
Public EV charging plugs - L2 (1000 units)	0.43	0	52.1	0	230	0	372
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 (%)	1.59	1.85	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.342	0.206	0.064	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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)	190	187	179	166	151	140	135
Final energy use - Industry (PJ)	680	692	706	721	751	767	776
Final energy use - Residential (PJ)	311	288	267	232	196	169	152
Final energy use - Transportation (PJ)	652	610	534	441	358	306	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,994	21,829	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	2.05	9.66	38.6	81.8	89.2	89.7	89.7
Sales of space heating units - Electric Resistance (%)	6.04	3.52	5.22	9.16	9.92	9.96	9.94
Sales of space heating units - Fossil (%)	3.02	2.32	0.438	0.019	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 (%)	88.9	84.5	55.7	9.03	0.86	0.359	0.36
Sales of water heating units - Electric Heat Pump (%)	0.622	3.21	22.6	47.9	52.2	52.5	52.5
Sales of water heating units - Electric Resistance (%)	5.71	4.94	19	42.9	47.1	47.4	47.4
Sales of water heating units - Gas Furnace (%)	93.3	91.7	58.2	8.97	0.524	0	0
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.81	4.97	8.01	8.51	7.33	7.63

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	0.006	0.021	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0.909	0
Capital invested - Solar PV - Base (billion $2018)	0	0.952	13.2	19.6	8.1	2.03	2.42
Capital invested - Solar PV - Constrained (billion $2018)	0	1.79	15.2	20	8.27	4.43	1.1
Capital invested - Wind - Base (billion $2018)	0	0	28.7	19.6	12.6	0.095	0
Capital invested - Wind - Constrained (billion $2018)	0	0	9.95	0	0	0	7.78

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	6.38	27.4	27.4
Biomass w/ccu power plant (GWh)	0	0	0	0	0	1,020	1,020
Solar - Base land use assumptions (GWh)	245	1,279	19,828	31,904	13,870	3,677	4,552
Solar - Constrained land use assumptions (GWh)	36.1	3,257	31,198	30,308	12,835	3,367	1,578
Wind - Base land use assumptions (GWh)	12,511	0	69,770	47,656	30,422	219	0
Wind - Constrained land use assumptions (GWh)	12,511	0	21,947	0	0	0	9,557

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	531	2,880	2,928
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	0	7,842	34,786	704
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	1	2	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	9	46	47
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	2	2
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	1	2	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	1.08	11.5	59.5	60.5
Annual - BECCS (MMT)	0	0	0	0	10.1	54.7	55.6
Annual - Cement and lime (MMT)	0	0	0	0	0	3.42	3.53
Annual - NGCC (MMT)	0	0	0	1.08	1.43	1.45	1.36
Cumulative - All (MMT)	0	0	0	1.08	12.6	72.1	133
Cumulative - BECCS (MMT)	0	0	0	0	10.1	64.7	120
Cumulative - Cement and lime (MMT)	0	0	0	0	0	3.42	6.95
Cumulative - NGCC (MMT)	0	0	0	1.08	2.51	3.96	5.32

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	1.1	1.76	3.61	6.02	7.46
Injection wells (wells)	0	0	1	4	8	13	16
Resource characterization, appraisal, permitting costs (million $2020)	0	50.6	142	182	182	182	182
Wells and facilities construction costs (million $2020)	0	0	33.7	131	234	391	485

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	499	758	788	2,397	2,712
Cumulative investment - All (million $2018)	0	0	2,413	2,617	2,670	4,365	4,596
Cumulative investment - Spur (million $2018)	0	0	57.6	249	302	1,997	2,228
Cumulative investment - Trunk (million $2018)	0	0	2,355	2,368	2,368	2,368	2,368
Spur (km)	0	0	34.3	292	321	1,930	2,245
Trunk (km)	0	0	465	467	467	467	467

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	-1,845
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-7,474
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-234
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-9,552
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,845
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,936
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-117
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,898
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,995
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	425
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	5,228
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808

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	2,104
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	213
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,124

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	85.6
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	611
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,255
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,223

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	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	12.7
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	31
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	100
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	256
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	46.6
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	145

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	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	1,936

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	828	1.01	0.998	0.872	0.634	0.056
Monetary damages from air pollution - Natural Gas (million 2019$)	0	203	153	103	88.6	48	19.9
Monetary damages from air pollution - Transportation (million 2019$)	0	1,813	1,690	1,283	740	339	136
Premature deaths from air pollution - Coal (deaths)	0	92.9	0.113	0.112	0.098	0.071	0.006
Premature deaths from air pollution - Natural Gas (deaths)	0	22.9	17.2	11.6	10	5.42	2.25
Premature deaths from air pollution - Transportation (deaths)	0	204	190	144	83.2	38.1	15.3

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	2,021	2,024	2,048	1,949	1,792	3,432	2,767
By economic sector - Construction (jobs)	8,214	8,136	25,157	36,051	33,704	29,553	28,716
By economic sector - Manufacturing (jobs)	6,388	10,527	13,063	17,489	16,961	14,999	17,931
By economic sector - Mining (jobs)	6,383	3,873	2,301	1,595	1,045	704	486
By economic sector - Other (jobs)	515	572	3,173	5,274	4,739	4,029	4,326
By economic sector - Pipeline (jobs)	760	751	905	535	409	381	291
By economic sector - Professional (jobs)	5,374	4,717	13,008	19,560	20,564	21,999	21,593
By economic sector - Trade (jobs)	5,810	4,346	8,197	11,831	11,692	11,188	11,331
By economic sector - Utilities (jobs)	11,392	9,913	17,094	25,225	27,186	25,731	25,200
By education level - All sectors - Associates degree or some college (jobs)	13,989	13,562	26,706	38,008	37,704	35,117	35,463
By education level - All sectors - Bachelors degree (jobs)	9,427	9,014	16,787	23,650	23,751	22,963	23,140
By education level - All sectors - Doctoral degree (jobs)	299	273	629	907	924	948	935
By education level - All sectors - High school diploma or less (jobs)	20,902	19,913	36,668	51,006	49,683	47,037	47,162
By education level - All sectors - Masters or professional degree (jobs)	2,242	2,096	4,156	5,938	6,031	5,950	5,942
By resource sector - Biomass (jobs)	4,911	4,782	4,683	4,346	4,688	12,609	12,142
By resource sector - CO2 (jobs)	0	26.8	2,275	376	439	1,369	1,311
By resource sector - Coal (jobs)	9,662	4,776	1,153	227	191	168	148
By resource sector - Grid (jobs)	12,826	10,883	24,844	43,681	48,041	46,064	46,682
By resource sector - Natural Gas (jobs)	7,578	7,694	6,136	5,869	5,252	3,344	2,042
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	7,005	6,069	4,885	3,582	2,434	1,622	998
By resource sector - Solar (jobs)	2,177	4,858	19,592	30,562	23,628	17,533	20,963
By resource sector - Wind (jobs)	2,700	5,769	21,376	30,866	33,420	29,305	28,356
Median wages - Annual - All ($2019 per job)	56,418	56,477	57,177	58,000	59,270	60,370	61,031
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	7,299	7,007	13,782	19,527	19,321	17,988	18,078
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	2,937	2,728	5,859	8,316	8,215	7,608	7,519
On-Site or In-Plant Training - Total jobs - None (jobs)	7,273	7,125	13,838	19,505	19,290	18,426	18,533

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)	382	375	752	1,067	1,057	981	984
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	28,968	27,623	50,713	71,093	70,209	67,012	67,527
On-the-Job Training - All sectors - 1 to 4 years (jobs)	9,252	8,896	17,748	25,196	24,979	23,201	23,295
On-the-Job Training - All sectors - 4 to 10 years (jobs)	2,821	2,609	5,792	8,270	8,169	7,537	7,438
On-the-Job Training - All sectors - None (jobs)	2,511	2,402	4,634	6,510	6,363	6,047	6,097
On-the-Job Training - All sectors - Over 10 years (jobs)	401	426	845	1,175	1,130	1,024	1,044
On-the-Job Training - All sectors - Up to 1 year (jobs)	31,873	30,525	55,925	78,358	77,451	74,205	74,768
Related work experience - All sectors - 1 to 4 years (jobs)	16,798	15,860	30,032	42,402	42,159	40,127	40,307
Related work experience - All sectors - 4 to 10 years (jobs)	10,441	10,041	19,539	27,638	27,490	25,888	26,035
Related work experience - All sectors - None (jobs)	6,854	6,587	12,383	17,356	17,095	16,244	16,290
Related work experience - All sectors - Over 10 years (jobs)	2,764	2,744	5,136	7,247	7,202	6,749	6,859
Related work experience - All sectors - Up to 1 year (jobs)	10,000	9,626	17,855	24,867	24,146	23,007	23,152
Wage income - All (million $2019)	2,644	2,534	4,857	6,932	7,000	6,763	6,875

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	651	661	557	447	336	212	147
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	13,461
Natural gas production - Annual (tcf)	5.57	6.17	5.83	5.08	4.3	3.41	2.65
Oil consumption - Annual (million bbls)	133	125	109	84.3	61.1	42.8	28
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	2,596
Oil production - Annual (million bbls)	2.02	2.18	2.19	2.19	1.73	1.41	0.937

Table 17: *E- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	5.71	7.71	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.5	68.3	71.3	79.1	90.1	96.8	99.1
Sales of cooking units - Gas (%)	32.5	31.7	28.7	20.9	9.94	3.21	0.863
Sales of space heating units - Electric Heat Pump (%)	7.14	13.6	16.9	27.4	49.2	73	86
Sales of space heating units - Electric Resistance (%)	18.1	24.8	24	21.6	16.2	10.6	7.72
Sales of space heating units - Fossil (%)	6.08	9.67	9.33	8.18	5.9	3.46	2.13
Sales of space heating units - Gas (%)	68.7	51.9	49.7	42.9	28.7	12.9	4.2
Sales of water heating units - Electric Heat Pump (%)	0	0.608	2.31	7.59	18.2	29.3	35.3
Sales of water heating units - Electric Resistance (%)	39.3	55.7	55.6	55.8	57.2	59.4	61
Sales of water heating units - Gas Furnace (%)	60.6	43.5	41.9	36.4	24.4	11	3.54
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.204	0.204	0.204	0.204

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	192	404	1,364	4,297	6,258
Public EV charging plugs - DC Fast (1000 units)	0.168	0	0.662	0	3.54	0	9.92
Public EV charging plugs - L2 (1000 units)	0.43	0	15.9	0	85.2	0	238
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 (%)	1.6	2	2.06	1.64	1.05	0.542	0.232
Vehicle sales - Light-duty - EV (%)	1.85	4.59	11.7	25.5	48	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.6	79.9	67.1	46.6	25.1	11.1
Vehicle sales - Light-duty - hybrid (%)	4.46	5.27	5.93	5.42	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.381	0.328	0.251	0.179	0.099	0.046
Vehicle sales - Light-duty - other (%)	0.105	0.108	0.098	0.086	0.062	0.034	0.016
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)	190	187	183	179	172	164	155
Final energy use - Industry (PJ)	680	693	708	728	762	777	784
Final energy use - Residential (PJ)	311	289	273	257	238	214	188
Final energy use - Transportation (PJ)	653	615	559	514	480	439	392

Table 20: *E- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,992	21,841	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric Heat Pump (%)	2.05	6.96	10.3	20.9	43.5	68.9	83
Sales of space heating units - Electric Resistance (%)	6.04	3.45	3.62	4.3	5.98	8.09	9.31
Sales of space heating units - Fossil (%)	3.02	2.68	2.47	1.87	0.951	0.308	0.081
Sales of space heating units - Gas Furnace (%)	88.9	86.9	83.6	72.9	49.6	22.7	7.57
Sales of water heating units - Electric Heat Pump (%)	0.622	1.14	3.37	10.3	24.6	40.1	48.5
Sales of water heating units - Electric Resistance (%)	5.71	3.86	5.44	10.7	22.3	35.9	43.7
Sales of water heating units - Gas Furnace (%)	93.3	94.8	91	78.8	52.9	23.8	7.64
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.04	4.11	5.15	5.33	7.04	7.41

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	-1,845
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-7,474
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-234
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-9,552

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	-1,845
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,936
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-117
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,898
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,995
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	425
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	5,228
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,104
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	213
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,124

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	85.6

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	611
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,255
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,223
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	12.7
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	31
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	100
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	256
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	46.6
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	145
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	1,936

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	828	1.01	0.998	0.872	0.634	0.056
Monetary damages from air pollution - Natural Gas (million 2019$)	0	213	138	58.5	27	9.16	6.15
Monetary damages from air pollution - Transportation (million 2019$)	0	1,843	1,859	1,807	1,625	1,292	887
Premature deaths from air pollution - Coal (deaths)	0	92.9	0.113	0.112	0.098	0.071	0.006
Premature deaths from air pollution - Natural Gas (deaths)	0	24.1	15.6	6.61	3.05	1.03	0.695
Premature deaths from air pollution - Transportation (deaths)	0	207	209	203	183	145	99.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	5.74	7.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.6	74.5	95.6	99.8	100	100	100
Sales of cooking units - Gas (%)	32.4	25.5	4.36	0.22	0	0	0
Sales of space heating units - Electric Heat Pump (%)	7.14	16.5	45.4	84.9	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	18.1	24.2	17.6	8.04	6.29	6.24	6.46
Sales of space heating units - Fossil (%)	6.08	9.3	6.1	2.21	1.58	1.53	1.49
Sales of space heating units - Gas (%)	68.7	49.9	30.9	4.83	0.406	0.132	0.133
Sales of water heating units - Electric Heat Pump (%)	0	2.32	17.1	34.9	37.8	38	38.1

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 (%)	39.3	55.4	55.8	60.8	61.7	61.8	61.7
Sales of water heating units - Gas Furnace (%)	60.6	42.1	26.8	4.14	0.241	0	0
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.203	0.201	0.202	0.203

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,189	3,044	4,939	7,479	8,143	7,762
Public EV charging plugs - DC Fast (1000 units)	0.168	0	2.17	0	9.57	0	15.5
Public EV charging plugs - L2 (1000 units)	0.43	0	52.1	0	230	0	372
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 (%)	1.59	1.85	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.342	0.206	0.064	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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)	190	187	179	166	151	140	135
Final energy use - Industry (PJ)	680	692	706	721	751	767	776
Final energy use - Residential (PJ)	311	288	267	232	196	169	152
Final energy use - Transportation (PJ)	652	610	534	441	358	306	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,994	21,829	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	2.05	9.66	38.6	81.8	89.2	89.7	89.7
Sales of space heating units - Electric Resistance (%)	6.04	3.52	5.22	9.16	9.92	9.96	9.94
Sales of space heating units - Fossil (%)	3.02	2.32	0.438	0.019	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	84.5	55.7	9.03	0.86	0.359	0.36
Sales of water heating units - Electric Heat Pump (%)	0.622	3.21	22.6	47.9	52.2	52.5	52.5
Sales of water heating units - Electric Resistance (%)	5.71	4.94	19	42.9	47.1	47.4	47.4
Sales of water heating units - Gas Furnace (%)	93.3	91.7	58.2	8.97	0.524	0	0
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.81	4.97	8.01	8.51	7.33	7.63

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	6.9	19.5	15.4	2.85	5.57	54.9
Capital invested - Wind - Base (billion $2018)	0	0	36.8	24.1	1.13	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	245	9,278	29,360	25,060	4,791	9,692	106,429
Solar - Constrained land use assumptions (GWh)	245	11,719	16,065	11,874	4,989	3,681	140,455
Wind - Base land use assumptions (GWh)	12,511	0	88,473	57,025	2,570	0	0
Wind - Constrained land use assumptions (GWh)	12,511	0	21,947	0	0	0	143,283

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	-1,845
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-7,474
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-234
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-9,552
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,845
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,936
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-117
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,898
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,995
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	425
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	5,228
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,104
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	213
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,124

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	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	85.6
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	611
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,255
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,223
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	12.7

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	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	31
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	100
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	256
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	46.6
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	145
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	1,936

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	828	1.01	0.998	0.872	0.634	0.056
Monetary damages from air pollution - Natural Gas (million 2019$)	0	209	143	83.1	57.1	19.7	5.12
Monetary damages from air pollution - Transportation (million 2019$)	0	1,813	1,690	1,283	740	339	136
Premature deaths from air pollution - Coal (deaths)	0	92.9	0.113	0.112	0.098	0.071	0.006
Premature deaths from air pollution - Natural Gas (deaths)	0	23.7	16.1	9.39	6.45	2.23	0.578
Premature deaths from air pollution - Transportation (deaths)	0	204	190	144	83.2	38.1	15.3

Table 35: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	5.74	7.82	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.6	74.5	95.6	99.8	100	100	100
Sales of cooking units - Gas (%)	32.4	25.5	4.36	0.22	0	0	0
Sales of space heating units - Electric Heat Pump (%)	7.14	16.5	45.4	84.9	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	18.1	24.2	17.6	8.04	6.29	6.24	6.46
Sales of space heating units - Fossil (%)	6.08	9.3	6.1	2.21	1.58	1.53	1.49
Sales of space heating units - Gas (%)	68.7	49.9	30.9	4.83	0.406	0.132	0.133
Sales of water heating units - Electric Heat Pump (%)	0	2.32	17.1	34.9	37.8	38	38.1
Sales of water heating units - Electric Resistance (%)	39.3	55.4	55.8	60.8	61.7	61.8	61.7
Sales of water heating units - Gas Furnace (%)	60.6	42.1	26.8	4.14	0.241	0	0
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.203	0.201	0.202	0.203

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)	0	1,189	3,044	4,939	7,479	8,143	7,762
Public EV charging plugs - DC Fast (1000 units)	0.168	0	2.17	0	9.57	0	15.5
Public EV charging plugs - L2 (1000 units)	0.43	0	52.1	0	230	0	372
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 (%)	1.59	1.85	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.79	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.8	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.3	4.45	3.17	1.18	0.287	0.063	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.342	0.206	0.064	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	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)	190	187	179	166	151	140	135
Final energy use - Industry (PJ)	680	692	706	721	751	767	776
Final energy use - Residential (PJ)	311	288	267	232	196	169	152
Final energy use - Transportation (PJ)	652	610	534	441	358	306	285

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,994	21,829	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	2.05	9.66	38.6	81.8	89.2	89.7	89.7
Sales of space heating units - Electric Resistance (%)	6.04	3.52	5.22	9.16	9.92	9.96	9.94
Sales of space heating units - Fossil (%)	3.02	2.32	0.438	0.019	0	0	0
Sales of space heating units - Gas Furnace (%)	88.9	84.5	55.7	9.03	0.86	0.359	0.36
Sales of water heating units - Electric Heat Pump (%)	0.622	3.21	22.6	47.9	52.2	52.5	52.5
Sales of water heating units - Electric Resistance (%)	5.71	4.94	19	42.9	47.1	47.4	47.4
Sales of water heating units - Gas Furnace (%)	93.3	91.7	58.2	8.97	0.524	0	0
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.81	4.97	8.01	8.51	7.33	7.63

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)	0	0	2.53	5.35	4.05	2.84	0.454
Capital invested - Solar PV - Constrained (billion $2018)	0	0	3.23	5.34	3.48	4.56	0.08
Capital invested - Wind - Base (billion $2018)	0	0.955	10.4	0	2.02	0.645	0.849
Capital invested - Wind - Constrained (billion $2018)	0	0	2.48	0	1.74	0.35	0.394

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	245	0	3,769	8,731	7,022	5,183	870
Solar - Constrained land use assumptions (GWh)	245	0	4,836	8,692	6,008	8,353	155
Wind - Base land use assumptions (GWh)	12,511	2,180	25,818	0	5,506	1,848	2,559
Wind - Constrained land use assumptions (GWh)	12,511	0	5,689	0	4,401	937	1,089

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	-1,845
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-7,474
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-234
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-9,552
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-1,845

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	-3,936
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)	0	0	-117
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,898
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	3,995
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	425
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	5,228
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	808
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	2,104
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	213
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,124

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	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	85.6
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	611

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	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,255
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,223
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	12.7
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	31
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	100

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	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	256
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	46.6
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	145
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	1,936

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	828	1.01	0.998	0.872	0.634	0.056
Monetary damages from air pollution - Natural Gas (million 2019$)	0	188	118	140	102	35.3	11.2
Monetary damages from air pollution - Transportation (million 2019$)	0	1,813	1,690	1,283	740	339	136
Premature deaths from air pollution - Coal (deaths)	0	92.9	0.113	0.112	0.098	0.071	0.006
Premature deaths from air pollution - Natural Gas (deaths)	0	21.2	13.3	15.8	11.6	3.99	1.26
Premature deaths from air pollution - Transportation (deaths)	0	204	190	144	83.2	38.1	15.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	5.71	7.71	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.5	68.3	71.3	79.1	90.1	96.8	99.1
Sales of cooking units - Gas (%)	32.5	31.7	28.7	20.9	9.94	3.21	0.863
Sales of space heating units - Electric Heat Pump (%)	7.14	13.6	16.9	27.4	49.2	73	86
Sales of space heating units - Electric Resistance (%)	18.1	24.8	24	21.6	16.2	10.6	7.72
Sales of space heating units - Fossil (%)	6.08	9.67	9.33	8.18	5.9	3.46	2.13
Sales of space heating units - Gas (%)	68.7	51.9	49.7	42.9	28.7	12.9	4.2
Sales of water heating units - Electric Heat Pump (%)	0	0.608	2.31	7.59	18.2	29.3	35.3
Sales of water heating units - Electric Resistance (%)	39.3	55.7	55.6	55.8	57.2	59.4	61

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 (%)	60.6	43.5	41.9	36.4	24.4	11	3.54
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.204	0.204	0.204	0.204

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	192	404	1,364	4,297	6,258
Public EV charging plugs - DC Fast (1000 units)	0.168	0	0.662	0	3.54	0	9.92
Public EV charging plugs - L2 (1000 units)	0.43	0	15.9	0	85.2	0	238
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 (%)	1.6	2	2.06	1.64	1.05	0.542	0.232
Vehicle sales - Light-duty - EV (%)	1.85	4.59	11.7	25.5	48	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.6	79.9	67.1	46.6	25.1	11.1
Vehicle sales - Light-duty - hybrid (%)	4.46	5.27	5.93	5.42	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.381	0.328	0.251	0.179	0.099	0.046
Vehicle sales - Light-duty - other (%)	0.105	0.108	0.098	0.086	0.062	0.034	0.016
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)	190	187	183	179	172	164	155
Final energy use - Industry (PJ)	680	693	708	728	762	777	784
Final energy use - Residential (PJ)	311	289	273	257	238	214	188
Final energy use - Transportation (PJ)	653	615	559	514	480	439	392

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,992	21,841	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric Heat Pump (%)	2.05	6.96	10.3	20.9	43.5	68.9	83
Sales of space heating units - Electric Resistance (%)	6.04	3.45	3.62	4.3	5.98	8.09	9.31
Sales of space heating units - Fossil (%)	3.02	2.68	2.47	1.87	0.951	0.308	0.081
Sales of space heating units - Gas Furnace (%)	88.9	86.9	83.6	72.9	49.6	22.7	7.57
Sales of water heating units - Electric Heat Pump (%)	0.622	1.14	3.37	10.3	24.6	40.1	48.5
Sales of water heating units - Electric Resistance (%)	5.71	3.86	5.44	10.7	22.3	35.9	43.7
Sales of water heating units - Gas Furnace (%)	93.3	94.8	91	78.8	52.9	23.8	7.64
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.04	4.11	5.15	5.33	7.04	7.41

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	0.009	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0.001	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	9.16	9.16	9.16
Biomass w/ccu power plant (GWh)	0	0	0	0	0.958	0.958	0.958

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	1,634	4,541	9,183	9,183
Conversion capital investment - Cumulative 5-yr (million $2018)	0	0	0	16,160	28,771	45,905	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	19	52	105	105
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	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	20.8	57.7	120	120
Annual - BECCS (MMT)	0	0	0	20.8	57.7	117	117
Annual - Cement and lime (MMT)	0	0	0	0	0	3.42	3.53
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	20.8	78.5	199	319
Cumulative - BECCS (MMT)	0	0	0	20.8	78.5	195	312
Cumulative - Cement and lime (MMT)	0	0	0	0	0	3.42	6.95
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	1.85	7.49	14.3	19.7	20.1
Injection wells (wells)	0	0	3	13	23	39	49
Resource characterization, appraisal, permitting costs (million $2020)	0	50.6	222	344	344	344	344
Wells and facilities construction costs (million $2020)	0	0	101	394	701	1,173	1,456

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	499	518	1,642	3,995	4,659
Cumulative investment - All (million $2018)	0	0	2,487	2,637	3,825	7,043	7,503
Cumulative investment - Spur (million $2018)	0	0	130	265	1,323	4,317	4,777
Cumulative investment - Trunk (million $2018)	0	0	2,358	2,372	2,502	2,726	2,726
Spur (km)	0	0	34.3	51.8	1,171	3,524	4,188
Trunk (km)	0	0	465	467	471	471	471

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	-2,302
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)	0	0	-6,796
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	-211
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)	0	0	-9,309
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)	0	0	-2,302
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)	0	0	-3,578
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	-105
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)	0	0	-5,986
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	1,204
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)	0	0	8,939
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)	0	0	400
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)	0	0	67.8
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)	0	0	383
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)	0	0	10,994
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)	0	0	1,204
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)	0	0	1,906
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)	0	0	400
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)	0	0	67.8
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)	0	0	192
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)	0	0	3,769

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	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	85.6
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	611
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,255
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	1,223
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	12.7

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	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	31
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	100
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	256
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)	0	0	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	46.6
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	145
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	1,936

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)	0	5.46	5.93	0	0	0	0
Sales of cooking units - Electric Resistance (%)	67.2	67.2	67.2	67.2	67.2	67.2	67.2
Sales of cooking units - Gas (%)	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Sales of space heating units - Electric Heat Pump (%)	5.73	19.2	19.7	20.7	21.5	22.5	23.7
Sales of space heating units - Electric Resistance (%)	18.5	23.4	23.1	22.7	21.9	20.9	19.8
Sales of space heating units - Fossil (%)	6.24	8.46	8.19	7.99	8.01	8.01	8.02
Sales of space heating units - Gas (%)	69.5	49	48.9	48.6	48.6	48.6	48.5
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	39.3	55.6	55.5	55.3	55.3	55.2	55.1
Sales of water heating units - Gas Furnace (%)	60.6	44.2	44.3	44.5	44.5	44.6	44.7
Sales of water heating units - Other (%)	0.101	0.202	0.203	0.204	0.204	0.205	0.206

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 (%)	1.59	2	2.19	2.04	1.84	1.71	1.63
Vehicle sales - Light-duty - EV (%)	3.44	5.44	6.21	7.63	9.3	10.8	12
Vehicle sales - Light-duty - gasoline (%)	90.4	86.9	84.8	83	81	79	77.4
Vehicle sales - Light-duty - hybrid (%)	4.32	5.17	6.34	6.91	7.48	8.08	8.56
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.378	0.348	0.31	0.307	0.308	0.319
Vehicle sales - Light-duty - other (%)	0.104	0.108	0.104	0.105	0.104	0.103	0.106
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)	190	190	188	184	179	179	183
Final energy use - Industry (PJ)	681	703	718	717	727	733	738
Final energy use - Residential (PJ)	311	289	277	269	264	262	259
Final energy use - Transportation (PJ)	653	615	563	533	532	548	569

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)	0	19,774	20,475	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	44.2	44.3	44.3	44.3	44.4	44.5
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Sales of space heating units - Electric Heat Pump (%)	2.05	13.1	45	71.1	75.4	75.9	75.9
Sales of space heating units - Electric Resistance (%)	6.04	4.34	8.93	17.2	22.8	23.7	23.7
Sales of space heating units - Fossil (%)	3.02	2.48	1.25	0.221	0.025	0.001	0
Sales of space heating units - Gas Furnace (%)	88.9	80.1	44.8	11.5	1.77	0.439	0.36
Sales of water heating units - Electric Heat Pump (%)	0.622	0.346	0.35	0.35	0.344	0.346	0.347

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance (%)	5.71	3.27	3.23	3.24	3.22	3.2	3.2
Sales of water heating units - Gas Furnace (%)	93.3	96.2	96.2	96.2	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.34	0.189	0.189	0.191	0.19	0.19	0.19

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion $2018)	0	4.26	4.35	4.69	4.81	5.72	5.94

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

Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-6.5	0	-4.24	-3.79
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.499	0	-0.898	-0.933
Business-as-usual carbon sink - Total (Mt CO2e/y)	-7	0	-5.14	-4.73
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	0	77.5
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	14,566
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,952
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	2,158
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	168
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	2,006
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	1,264
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	3,822
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	1,284
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	38.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	3,947
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	325
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	829
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	85.6
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	611
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	702
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	632
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	290
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	433
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	58.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	9,255

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

Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	1,138
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	1,493
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	125
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,223
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,354
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	948
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	0	2,056
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	858
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	12.7
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	264
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	1,100
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	62
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	191
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	83.6
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	109
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	426
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	2,248
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	6.34
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	248
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	422
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	31
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	0	100
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	41.8
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	18.8
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	258
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,125
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	9.51
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	256

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	761
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)	0	0	0	46.6
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	145
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)	0	0	0	62.7
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)	0	0	0	136
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)	0	0	0	519
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,936

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)	0	2,684	1,775	1,369	1,167	1,097	1,071
Monetary damages from air pollution - Natural Gas (million 2019$)	0	201	233	286	306	265	234
Monetary damages from air pollution - Transportation (million 2019$)	0	1,842	1,885	1,926	1,975	2,025	2,076
Premature deaths from air pollution - Coal (deaths)	0	301	199	154	131	123	120
Premature deaths from air pollution - Natural Gas (deaths)	0	22.8	26.3	32.3	34.5	29.9	26.5
Premature deaths from air pollution - Transportation (deaths)	0	207	212	217	222	228	234