Net-Zero America - west virginia 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).

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.682	0.676	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Sales of space heating units - Electric Heat Pump	20.6	34.6	64.3	82.8	85.4	85.5	85.5
(%)							
Sales of space heating units - Electric Resistance	18.3	20.1	12	6.25	5.33	5.36	5.42
(%)							
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of water heating units - Electric Heat Pump	0	5.29	30.4	43.3	45	45.1	45.2
(%)							
Sales of water heating units - Electric Resistance	45	59.7	53.2	53.1	53.2	53.3	53.2
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64

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	0	326	832	1,355	2,050	2,233	2,128
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.06	0	0.708	0	3.17	0	5.13
Public EV charging plugs - L2 (1000 units)	0.164	0	17	0	76.1	0	123
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 (%)	1.78	2.02	1.35	0.436	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.13	12.8	42.7	80.3	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.7	52.7	18	3.49	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.66	3.99	2.95	1.12	0.268	0.057	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.353	0.222	0.07	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.112	0.109	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,826	6,488	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	3.31	21.4	54	79.9	84	84.2	84.2
Sales of space heating units - Electric Resistance (%)	3.22	8.3	10.8	13.4	13.9	13.9	13.9
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0

Table 4: E+ scenario -	PTI I AR 1. Efficiency	//Flectrification -	Commercial	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of water heating units - Electric Heat Pump (%)	0.114	6.44	36.5	54	56.3	56.5	56.5
Sales of water heating units - Electric Resistance (%)	2.92	9.46	24.7	38.5	40.7	40.8	40.8
Sales of water heating units - Gas Furnace (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.954	0.978	1.95	2.08	1.75	1.83
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	2.45	5.41	6.37	4.59
Capital invested - Solar PV - Constrained (billion \$2018)	0	0	0	1.91	3.94	5.57	3.3
Capital invested - Wind - Base (billion \$2018)	0	0	8.36	8.42	14.7	0.853	2.18
Capital invested - Wind - Constrained (billion \$2018)	0	0	26.5	33.7	0.092	0	2.31

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	0	0	0	3,967	9,289	11,351	8,667
Solar - Constrained land use assumptions (GWh)	0	0	507	3,609	4,703	5,766	4,412
Wind - Base land use assumptions (GWh)	3,100	0	21,919	21,918	37,304	2,135	5,444
Wind - Constrained land use assumptions (GWh)	3,100	0	61,846	70,396	251	0	2,728

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	136
Conversion capital investment - Cumulative 5-yr	0	0	0	0	0	0	2,949
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	4
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
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	7.32
Annual - BECCS (MMT)	0	0	0	0	0	0	3.79
Annual - Cement and lime (MMT)	0	0	0	0	0	0	3.53
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	7.32
Cumulative - BECCS (MMT)	0	0	0	0	0	0	3.79
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	3.53
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	0	0	0	0	0	0	0
costs (million \$2020)							
Wells and facilities construction costs (million	0	0	0	0	0	0	0
\$2020)							

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	316
Cumulative investment - All (million \$2018)	0	0	0	0	0	0	223
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	223
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	316
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 -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-518
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-21.1
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-539
Total (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-273
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-10.5
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-284
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	345
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	38.3
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	384
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate	0	0	182
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	19.2
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	201
deployment - Total (1000 hectares)			

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	rests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	108
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	17,784
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	6,389
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,441
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)	0	0	197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,114
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	2,750
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	53.9
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)	0	0	5,372
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	121
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)	0	0	2,454
Carbon sink potential - Low - Improve plantations (1000 tC02e/y)	0	0	30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)	0	0	69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	236
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	80.7
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)	0	0	11,577
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	2,961

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	rests (contir	nued)	
Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees	0	0	133
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	0
(1000 tC02e/y)			-
Carbon sink potential - Mid - Reforest pasture	0	0	1,675
(1000 tCO2e/y)		0	1,013
Carbon sink potential - Mid - Restore	0	0	1 0 2 0
	0	U	1,839
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	17.6
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	98.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,258
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	22.3
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)		0	0
Land impacted for carbon sink potential - High -	0	0	18.7
	0	0	10.1
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	88.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	912
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	4,415
Total impacted (over 30 years) (1000 hectares)			, -
Land impacted for carbon sink potential - Low -	0	0	8.8
Accelerate regeneration (1000 hectares)		0	0.0
Land impacted for carbon sink potential - Low -	0	0	92.1
	0	0	92.1
Avoid deforestation (over 30 years) (1000			
hectares)			10/0
Land impacted for carbon sink potential - Low -	0	0	1,248
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	11.2
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	9.87
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest pasture (1000 hectares)		0	10.0
	0	0	
Land impacted for carbon sink potential - Low -	0	0	552
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,937
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	95.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,253
Extend rotation length (1000 hectares)		0	2,200
	0	0	1/ 0
Land impacted for carbon sink potential - Mid -	0	0	16.8
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	14.3
Increase trees outside forests (1000 hectares)			
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Table 13: E+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	111
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,111
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	3,614
Total impacted (over 30 years) (1000 hectares)			

Table 14: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	444	0.449	0.444	0.407	0.298	0.027
(million 2019\$)							
Monetary damages from air pollution - Natural	0	59.9	42.9	24.9	19.4	10.8	3.95
Gas (million 2019\$)							
Monetary damages from air pollution -	0	354	313	226	124	53.7	20.3
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	49.9	0.05	0.05	0.046	0.033	0.003
(deaths)							
Premature deaths from air pollution - Natural	0	6.77	4.84	2.81	2.2	1.21	0.446
Gas (deaths)							
Premature deaths from air pollution -	0	39.8	35.2	25.4	13.9	6.04	2.28
Transportation (deaths)							

Table 15: E+ scenario - IMPACTS - Jobs

2020	2025	2030	2035	2040	2045	2050
0	0	0	0	0	0	187
4,139	3,000	4,786	8,330	13,768	13,606	14,092
5,882	8,241	9,292	11,903	11,721	9,648	11,803
15,091	9,227	6,030	4,762	3,441	2,534	1,768
195	101	282	883	1,891	2,238	2,476
570	576	498	405	305	202	170
4,264	2,755	3,602	5,766	9,371	9,332	9,924
5,408	3,088	2,895	3,916	5,799	5,886	6,180
6,505	3,826	3,995	5,997	9,625	9,272	10,485
12,400	9,180	9,560	13,054	17,709	16,762	18,204
8,290	6,444	6,702	8,804	11,602	10,887	11,717
256	190	214	300	439	425	447
19,169	13,538	13,358	17,727	23,310	21,919	23,800
1,939	1,462	1,547	2,077	2,861	2,725	2,918
0	0	0	0	0	0	800
	•	•	•	•	0	414
-	•		- 1		-	2,545
						19,155
7,319	7,105	5,936	4,650	3,639	2,141	1,247
0	0	0	0	0	0	0
7,331	6,960		5,397	3,868		1,735
1,064			6,844	10,894	12,317	14,313
935	2,956	8,109	12,949	18,516	16,204	16,877
53,933	54,948	55,705	55,935	56,689	57,386	57,960
6,616	4,850	4,991	6,734	9,081	8,574	9,252
2,375	1,683	1,810	2,536	3,653	3,504	3,721
6,139	4,709	4,981	6,776	9,115	8,609	9,352
	0 4,139 5,882 15,091 195 570 4,264 5,408 6,505 12,400 8,290 256 19,169 1,939 0 19,596 5,808 7,319 0 7,331 1,064 935 53,933 6,616	0 0 4,139 3,000 5,882 8,241 15,091 9,227 195 101 570 576 4,264 2,755 5,408 3,088 6,505 3,826 12,400 9,180 8,290 6,444 256 190 19,169 13,538 1,939 1,462 0 0 19,596 9,540 5,808 1,781 7,319 7,105 0 0 7,331 6,960 1,064 2,472 935 2,956 53,933 54,948 6,616 4,850	0 0 0 4,139 3,000 4,786 5,882 8,241 9,292 15,091 9,227 6,030 195 101 282 570 576 498 4,264 2,755 3,602 5,408 3,088 2,895 6,505 3,826 3,995 12,400 9,180 9,560 8,290 6,444 6,702 256 190 214 19,169 13,538 13,358 1,939 1,462 1,547 0 0 0 19,596 9,540 4,431 5,808 1,781 3,819 7,319 7,105 5,936 0 0 0 7,331 6,960 6,170 1,064 2,472 2,916 935 2,956 8,109 53,933 54,948 55,705 6,616 4,850	0 0 0 0 4,139 3,000 4,786 8,330 5,882 8,241 9,292 11,903 15,091 9,227 6,030 4,762 195 101 282 883 570 576 498 405 4,264 2,755 3,602 5,766 5,408 3,088 2,895 3,916 6,505 3,826 3,995 5,997 12,400 9,180 9,560 13,054 8,290 6,444 6,702 8,804 256 190 214 300 19,169 13,538 13,358 17,727 0 0 0 0 0 0 0 0 19,596 9,540 4,431 3,660 5,808 1,781 3,819 8,462 7,319 7,105 5,936 4,650 0 0 0 0	0 0 0 0 0 4,139 3,000 4,786 8,330 13,768 5,882 8,241 9,292 11,903 11,721 15,091 9,227 6,030 4,762 3,441 195 101 282 883 1,891 570 576 498 405 305 4,264 2,755 3,602 5,766 9,371 5,408 3,088 2,895 3,916 5,799 6,505 3,826 3,995 5,997 9,625 12,400 9,180 9,560 13,054 17,709 8,290 6,444 6,702 8,804 11,602 256 190 214 300 439 19,169 13,538 13,358 17,727 23,310 1,939 1,462 1,547 2,077 2,861 0 0 0 0 0 19,596 9,540 4,431 <t< td=""><td>0 0 0 0 0 0 4,139 3,000 4,786 8,330 13,768 13,606 5,882 8,241 9,292 11,903 11,721 9,648 15,091 9,227 6,030 4,762 3,441 2,534 195 101 282 883 1,891 2,238 570 576 498 405 305 202 4,264 2,755 3,602 5,766 9,371 9,332 5,408 3,088 2,895 3,916 5,799 5,886 6,505 3,826 3,995 5,997 9,625 9,272 12,400 9,180 9,560 13,054 17,709 16,762 8,290 6,444 6,702 8,804 11,602 10,887 19,169 13,538 13,358 17,727 2,861 2,725 0 0 0 0 0 0 1,939 1,462</td></t<>	0 0 0 0 0 0 4,139 3,000 4,786 8,330 13,768 13,606 5,882 8,241 9,292 11,903 11,721 9,648 15,091 9,227 6,030 4,762 3,441 2,534 195 101 282 883 1,891 2,238 570 576 498 405 305 202 4,264 2,755 3,602 5,766 9,371 9,332 5,408 3,088 2,895 3,916 5,799 5,886 6,505 3,826 3,995 5,997 9,625 9,272 12,400 9,180 9,560 13,054 17,709 16,762 8,290 6,444 6,702 8,804 11,602 10,887 19,169 13,538 13,358 17,727 2,861 2,725 0 0 0 0 0 0 1,939 1,462

Table 15:	E+ scenario -	IMPACTS	Johs	(continued)
Table 10.	L' SCCHUITO	11'11 7010		i Continuaca.

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10	279	213	236	335	472	449	488
years (jobs)							
On-Site or In-Plant Training - Total jobs - Up to 1	26,645	19,359	19,363	25,582	33,599	31,582	34,271
year (jobs)							
On-the-Job Training - All sectors - 1 to 4 years	8,315	6,120	6,350	8,609	11,691	11,048	11,911
_(jobs)							
On-the-Job Training - All sectors - 4 to 10 years	2,272	1,571	1,705	2,436	3,581	3,455	3,673
(jobs)							
On-the-Job Training - All sectors - None (jobs)	2,109	1,577	1,640	2,218	2,997	2,848	3,078
On-the-Job Training - All sectors - Over 10 years	338	288	315	428	555	515	558
(jobs)							
On-the-Job Training - All sectors - Up to 1 year	29,019	21,258	21,372	28,271	37,096	34,853	37,866
(jobs)							
Related work experience - All sectors - 1 to 4	15,812	11,455	11,507	15,228	20,204	19,039	20,539
years (jobs)			=101	2 (2)	10.000	10.000	
Related work experience - All sectors - 4 to 10	9,175	6,894	7,194	9,684	13,032	12,283	13,252
years (jobs)	5 (()	, , , , , ,		5.000	70/4	7.50	
Related work experience - All sectors - None	5,664	4,172	4,299	5,820	7,861	7,450	8,105
(jobs)	0.510	10/7	0.010	0.707	0.547	0.07/	
Related work experience - All sectors - Over 10	2,510	1,967	2,043	2,704	3,517	3,276	3,557
years (jobs)							
Related work experience - All sectors - Up to 1	8,892	6,326	6,338	8,526	11,307	10,670	11,633
year (jobs)	201-	1.00					
Wage income - All (million \$2019)	2,268	1,693	1,748	2,347	3,170	3,026	3,309

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	156	158	133	107	80.5	50.6	35.1
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	3,220
Natural gas production - Annual (tcf)	1,807	2,002	1,893	1,648	1,394	1,105	859
Oil consumption - Annual (million bbls)	33	31	26.8	20.4	14.4	9.6	5.68
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	627
Oil production - Annual (million bbls)	13.9	15.1	15.1	15.1	12	9.71	6.46

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.678	0.66	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.4	63.4	66.8	75.9	88.5	96.3	99
Sales of cooking units - Gas (%)	37.6	36.6	33.2	24.1	11.5	3.71	0.997
Sales of space heating units - Electric Heat Pump	20.6	29.9	33.3	43.4	60.9	75.7	82.6
_(%)							
Sales of space heating units - Electric Resistance	18.3	21.3	20.5	17.4	12.3	8.13	6.18
(%)							
Sales of space heating units - Fossil (%)	10.8	16.9	16.2	14	10.4	7.61	6.49
Sales of space heating units - Gas (%)	50.2	31.9	30	25.2	16.5	8.57	4.78
Sales of water heating units - Electric Heat Pump	0	1.02	3.88	12.4	26.6	38	43.1
(%)							
Sales of water heating units - Electric Resistance	45	61.1	60.3	58	54.9	53.5	53.2
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	35.8	33.7	27.7	16.7	6.76	2.07
Sales of water heating units - Other (%)	2.8	2.09	2.06	1.96	1.8	1.69	1.66

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	0	0	52.1	111	373	1,179	1,716
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.06	0	0.211	0	1.17	0	3.29
Public EV charging plugs - L2 (1000 units)	0.164	0	5.06	0	28.1	0	79
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7

Table 18: E- scenario -	PTI I AR 1: Efficienc	v/Flectrification - `	Transnortation	(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 (%)	1.8	2.17	2.1	1.68	1.1	0.568	0.242
Vehicle sales - Light-duty - EV (%)	1.61	4.08	10.6	23.8	46.1	70.5	87
Vehicle sales - Light-duty - gasoline (%)	92.6	88.6	81.6	69.2	48.7	26.4	11.6
Vehicle sales - Light-duty - hybrid (%)	3.77	4.63	5.26	4.9	3.79	2.31	1.14
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.387	0.34	0.265	0.191	0.108	0.05
Vehicle sales - Light-duty - other (%)	0.113	0.117	0.108	0.095	0.069	0.038	0.018
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)	48.6	48.8	48.2	47.6	46.4	45.3	44.7
Final energy use - Industry (PJ)	185	197	202	207	214	216	219
Final energy use - Residential (PJ)	38.4	36.2	35	33.8	32.2	30.3	28.1
Final energy use - Transportation (PJ)	151	143	129	118	110	100	89.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,823	6,480	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump	3.31	16.5	20.2	31.4	51.9	70.8	80
(%)							
Sales of space heating units - Electric Resistance	3.22	7.96	8.26	9.15	10.8	12.6	13.5
(%)							
Sales of space heating units - Fossil (%)	4.12	4.72	4.38	3.31	1.62	0.515	0.135
Sales of space heating units - Gas Furnace (%)	89.4	70.9	67.2	56.1	35.6	16.1	6.3
Sales of water heating units - Electric Heat Pump	0.114	1.49	4.92	15.1	32.6	47.1	53.7
(%)							
Sales of water heating units - Electric Resistance	2.92	7.34	9.03	14.3	24.3	33.8	38.6
(%)							
Sales of water heating units - Gas Furnace (%)	94.5	86.9	81.8	66.8	39.9	16.2	4.96
Sales of water heating units - Other (%)	2.43	4.23	4.21	3.78	3.24	2.87	2.74
Sales of water heating units - Electric Resistance (%) Sales of water heating units - Gas Furnace (%)	94.5	86.9	81.8	66.8	39.9	16.2	4.96

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.829	0.837	1.16	1.2	1.73	1.83
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-518
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-21.1
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-539
Total (1000 tC02e/y)			

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

Table 22. E Section of Telan of Edita Sinks	igi icaitai c (c	ontinucuj	
Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-273
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-10.5
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-284
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	345
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	38.3
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	384
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	182
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	19.2
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	201
deployment - Total (1000 hectares)			

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	108
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	17,784
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,114
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,750
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	53.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,372
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	30.8

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

Table 23: <i>E- scenario - PILLAR 6: Land sinks - Fo</i> Item	2020	2025	2050
Carbon sink potential - Low - Increase retention	0	2025	1,480
of HWP (1000 tCO2e/y)		0	1,400
Carbon sink potential - Low - Increase trees	0	0	69.1
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	236
(1000 tC02e/y)			
Carbon sink potential - Low - Restore	0	0	927
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	80.7
regeneration (1000 tC02e/y)			11 577
Carbon sink potential - Mid - All (not counting	0	0	11,577
overlap) (1000 tC02e/y)	0	0	/ 00
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	422
Carbon sink potential - Mid - Extend rotation	0	0	4,421
length (1000 tC02e/y)		0	4,421
Carbon sink potential - Mid - Improve plantations	0	0	45.2
(1000 tC02e/y)		0	70.2
Carbon sink potential - Mid - Increase retention	0	0	2,961
of HWP (1000 tCO2e/y)			_,, 0.
Carbon sink potential - Mid - Increase trees	0	0	133
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,675
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	1,839
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	17.6
Accelerate regeneration (1000 hectares)			00.4
Land impacted for carbon sink potential - High -	0	0	98.1
Avoid deforestation (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	3,258
Extend rotation length (1000 hectares)		0	3,230
Land impacted for carbon sink potential - High -	0	0	22.3
Improve plantations (1000 hectares)			22.0
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	18.7
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	88.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	912
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	4,415
Total impacted (over 30 years) (1000 hectares)			0.0
Land impacted for carbon sink potential - Low -	0	0	8.8
Accelerate regeneration (1000 hectares)	0	0	00.1
Land impacted for carbon sink potential - Low -	0	0	92.1
Avoid deforestation (over 30 years) (1000 hectares)			
	0	0	1,248
	U	U	1,240
Land impacted for carbon sink potential - Low -			
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	n	n	11 🤈
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	11.2
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	11.2

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

Ttom	2020	2025	2050
Item	2020		
Land impacted for carbon sink potential - Low -	0	0	9.87
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	552
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,937
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	95.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,253
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	16.8
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	14.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Reforest cropland (1000 hectares)		-	
Land impacted for carbon sink potential - Mid -	0	0	111
Reforest pasture (1000 hectares)			•••
Land impacted for carbon sink potential - Mid -	0	0	1,111
Restore productivity (1000 hectares)		ŭ	1,111
Land impacted for carbon sink potential - Mid -	0	0	3,614
Total impacted (over 30 years) (1000 hectares)		٦	3,014
Total impacted (uver 30 years) (1000 fiettal es)			

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	444	0.449	0.444	0.407	0.298	0.027
(million 2019\$)							
Monetary damages from air pollution - Natural	0	54.8	34.5	13.4	5.22	1.61	0.892
Gas (million 2019\$)							
Monetary damages from air pollution -	0	359	343	317	271	205	134
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	49.9	0.05	0.05	0.046	0.033	0.003
(deaths)							
Premature deaths from air pollution - Natural	0	6.19	3.89	1.51	0.589	0.182	0.101
Gas (deaths)							
Premature deaths from air pollution -	0	40.4	38.6	35.7	30.5	23.1	15.1
Transportation (deaths)							

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 -	0	0.682	0.676	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Sales of space heating units - Electric Heat Pump	20.6	34.6	64.3	82.8	85.4	85.5	85.5
(%)							
Sales of space heating units - Electric Resistance	18.3	20.1	12	6.25	5.33	5.36	5.42
(%)							
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of water heating units - Electric Heat Pump	0	5.29	30.4	43.3	45	45.1	45.2
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance	45	59.7	53.2	53.1	53.2	53.3	53.2
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64

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	0	326	832	1,355	2,050	2,233	2,128
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.06	0	0.708	0	3.17	0	5.13
Public EV charging plugs - L2 (1000 units)	0.164	0	17	0	76.1	0	123
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 (%)	1.78	2.02	1.35	0.436	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.13	12.8	42.7	80.3	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.7	52.7	18	3.49	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.66	3.99	2.95	1.12	0.268	0.057	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.353	0.222	0.07	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.112	0.109	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,826	6,488	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump	3.31	21.4	54	79.9	84	84.2	84.2
(%)							
Sales of space heating units - Electric Resistance	3.22	8.3	10.8	13.4	13.9	13.9	13.9
(%)							
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0
Sales of space heating units - Gas Furnace (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of water heating units - Electric Heat Pump	0.114	6.44	36.5	54	56.3	56.5	56.5
(%)							
Sales of water heating units - Electric Resistance	2.92	9.46	24.7	38.5	40.7	40.8	40.8
(%)							
Sales of water heating units - Gas Furnace (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.954	0.978	1.95	2.08	1.75	1.83
Cumulative 5-yr (billion \$2018)							

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	0.106	0.219	7.29	6.45	15.1	0
Capital invested - Wind - Base (billion \$2018)	0	0	10.9	16.1	27.2	10.4	0.041

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	145	331	11,615	10,872	26,965	0
Solar - Constrained land use assumptions (GWh)	0	689	1,000	6,174	10,975	7,154	331
Wind - Base land use assumptions (GWh)	3,100	0	28,242	40,430	59,551	22,830	87.4
Wind - Constrained land use assumptions (GWh)	3,100	0	82,146	50,348	0	0	49,733

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

Table 32. LTNLT Scenario - FILLAN O. Luna Sinks	•		
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-518
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-21.1
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-539
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-273
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-10.5
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-284
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	345
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	38.3
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	384
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	182
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	19.2
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	201
deployment - Total (1000 hectares)			

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

Carbon sink potential - High - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid deforestation	2020	2025 0	2050 108
regeneration (1000 tCO2e/y) Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid deforestation		0	108
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid deforestation		ı	.00
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid deforestation			
Carbon sink potential - High - Avoid deforestation	0	0	17,784
	0	0	724
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	6,389
length (1000 tCO2e/y)			0,007
Carbon sink potential - High - Improve	0	0	60.6
plantations (1000 tCO2e/y)	0	0	00.0
Carbon sink potential - High - Increase retention	0	0	4,441
	U	0	4,441
of HWP (1000 tCO2e/y)			107
Carbon sink potential - High - Increase trees	0	0	197
outside forests (1000 tC02e/y)			
Carbon sink potential - High - Reforest cropland	0	0	0
(1000 tCO2e/y)			
Carbon sink potential - High - Reforest pasture	0	0	3,114
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	2,750
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	53.9
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,372
overlap) (1000 tCO2e/y)			•
Carbon sink potential - Low - Avoid deforestation	0	0	121
(1000 tCO2e/y)			
Carbon sink potential - Low - Extend rotation	0	0	2,454
length (1000 tCO2e/y)	0	0	2,404
Carbon sink potential - Low - Improve	0	0	30.8
plantations (1000 tC02e/y)	U	0	30.0
	0	0	1 / 00
Carbon sink potential - Low - Increase retention	U	U	1,480
of HWP (1000 tCO2e/y)			
Carbon sink potential - Low - Increase trees	0	0	69.1
outside forests (1000 tC02e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	236
(1000 tC02e/y)			
Carbon sink potential - Low - Restore	0	0	927
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	80.7
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	11,577
overlap) (1000 tCO2e/y)			•
Carbon sink potential - Mid - Avoid deforestation	0	0	422
(1000 tCO2e/y)		9	722
Carbon sink potential - Mid - Extend rotation	0	0	4,421
length (1000 tC02e/y)	0	0	4,421
Carbon sink potential - Mid - Improve plantations	0	0	45.2
	U	U	45.2
(1000 tC02e/y)			0.0/1
Carbon sink potential - Mid - Increase retention	0	0	2,961
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	133
outside forests (1000 tC02e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	0
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,675
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	1,839
productivity (1000 tCO2e/y)	-	-	,
	0	0	17.6
Land impacted for carbon sink potential - High -	-	9	5

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

Table 33: E+RE+ scenario - PILLAR 6: Land sinks			
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	98.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,258
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	22.3
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)		O	O .
Land impacted for carbon sink potential - High -	0	0	18.7
•	0	U	10.1
Increase trees outside forests (1000 hectares)		0	
Land impacted for carbon sink potential - High -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	88.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	912
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	4,415
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	8.8
Accelerate regeneration (1000 hectares)		· ·	0.0
Land impacted for carbon sink potential - Low -	0	0	92.1
Avoid deforestation (over 30 years) (1000		U	72.1
hectares)			
•	0	0	1,248
Land impacted for carbon sink potential - Low -	0	U	1,248
Extend rotation length (1000 hectares)			44.0
Land impacted for carbon sink potential - Low -	0	0	11.2
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	9.87
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest pasture (1000 hectares)		J	10.0
Land impacted for carbon sink potential - Low -	0	0	552
Restore productivity (1000 hectares)		U	332
	0	0	1.007
Land impacted for carbon sink potential - Low -	0	0	1,937
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	95.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,253
Extend rotation length (1000 hectares)			•
Land impacted for carbon sink potential - Mid -	0	0	16.8
Improve plantations (1000 hectares)		Ü	10.0
Land impacted for carbon sink potential - Mid -	0	0	0
·	0	U	U
Increase retention of HWP (1000 hectares)		0	1/ 0
Land impacted for carbon sink potential - Mid -	0	0	14.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	111
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,111
Restore productivity (1000 hectares)		•	.,
	n	Λ	3 614
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)	0	0	3,614

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	444	0.449	0.444	0.407	0.298	0.027
(million 2019\$)							
Monetary damages from air pollution - Natural	0	52.5	36.9	19.5	11.6	3.38	0.844
Gas (million 2019\$)							
Monetary damages from air pollution -	0	354	313	226	124	53.7	20.3
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	49.9	0.05	0.05	0.046	0.033	0.003
(deaths)							
Premature deaths from air pollution - Natural	0	5.93	4.17	2.2	1.31	0.382	0.095
Gas (deaths)							
Premature deaths from air pollution -	0	39.8	35.2	25.4	13.9	6.04	2.28
Transportation (deaths)							

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 -	0	0.682	0.676	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Sales of space heating units - Electric Heat Pump	20.6	34.6	64.3	82.8	85.4	85.5	85.5
(%)							
Sales of space heating units - Electric Resistance	18.3	20.1	12	6.25	5.33	5.36	5.42
(%)							
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of water heating units - Electric Heat Pump	0	5.29	30.4	43.3	45	45.1	45.2
(%)							
Sales of water heating units - Electric Resistance	45	59.7	53.2	53.1	53.2	53.3	53.2
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64

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	0	326	832	1,355	2,050	2,233	2,128
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.06	0	0.708	0	3.17	0	5.13
Public EV charging plugs - L2 (1000 units)	0.164	0	17	0	76.1	0	123
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 (%)	1.78	2.02	1.35	0.436	0.079	0.013	0
Vehicle sales - Light-duty - EV (%)	3.13	12.8	42.7	80.3	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.7	52.7	18	3.49	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.66	3.99	2.95	1.12	0.268	0.057	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.353	0.222	0.07	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.112	0.109	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,826	6,488	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump	3.31	21.4	54	79.9	84	84.2	84.2
(%)							
Sales of space heating units - Electric Resistance	3.22	8.3	10.8	13.4	13.9	13.9	13.9
(%)							
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0
Sales of space heating units - Gas Furnace (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of water heating units - Electric Heat Pump	0.114	6.44	36.5	54	56.3	56.5	56.5
(%)							
Sales of water heating units - Electric Resistance	2.92	9.46	24.7	38.5	40.7	40.8	40.8
(%)							
Sales of water heating units - Gas Furnace (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.954	0.978	1.95	2.08	1.75	1.83
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion \$2018)	0	1.11	3.75	0	0.593	0.045	0.132
Capital invested - Wind - Constrained (billion \$2018)	0	2.36	8.13	0	1.61	0.493	0.71

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

Item	2020	2025	2030	2040	2045	2050
Wind - Base land use assumptions (GWh)	3,100	2,823	9,934	1,720	147	415
Wind - Constrained land use assumptions (GWh)	3,100	5,775	20,686	4,421	1,404	2,126

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-518
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-21.1
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-539
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-273
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-10.5
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-284
Total (1000 tC02e/y)			

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

Item	2020	2025	2050
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	345
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	38.3
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	384
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	182
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	19.2
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	201
deployment - Total (1000 hectares)			

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	108
regeneration (1000 tCO2e/y)			100
Carbon sink potential - High - All (not counting	0	0	17,784
overlap) (1000 tC02e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	724
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	6,389
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	60.6
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,441
of HWP (1000 tC02e/y)			407
Carbon sink potential - High - Increase trees	0	0	197
outside forests (1000 tC02e/y)	0	0	0
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0
Carbon sink potential - High - Reforest pasture	0	0	3,114
(1000 tC02e/y)	U	0	3,114
Carbon sink potential - High - Restore	0	0	2,750
productivity (1000 tC02e/y)	U	0	2,130
Carbon sink potential - Low - Accelerate	0	0	53.9
regeneration (1000 tCO2e/y)	J		00.7
Carbon sink potential - Low - All (not counting	0	0	5,372
overlap) (1000 tCO2e/y)			-,-
Carbon sink potential - Low - Avoid deforestation	0	0	121
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	2,454
length (1000 tCO2e/y)			
Carbon sink potential - Low - Improve	0	0	30.8
plantations (1000 tCO2e/y)			
Carbon sink potential - Low - Increase retention	0	0	1,480
of HWP (1000 tCO2e/y)			
Carbon sink potential - Low - Increase trees	0	0	69.1
outside forests (1000 tC02e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	0
(1000 tC02e/y)			00.1
Carbon sink potential - Low - Reforest pasture	0	0	236
(1000 tCO2e/y)			

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

Table 43: E+RE- scenario - PILLAR 6: Land sinks	- Forests (co	ntinueaj	
Item	2020	2025	2050
Carbon sink potential - Low - Restore	0	0	927
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	80.7
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	11,577
overlap) (1000 tC02e/y)			,
Carbon sink potential - Mid - Avoid deforestation	0	0	422
(1000 tCO2e/y)	0	0	422
Carbon sink potential - Mid - Extend rotation	0	0	4,421
	U	0	4,421
length (1000 tC02e/y)	0	-	/ - 0
Carbon sink potential - Mid - Improve plantations	0	0	45.2
(1000 tC02e/y)			0.074
Carbon sink potential - Mid - Increase retention	0	0	2,961
of HWP (1000 tC02e/y)			
Carbon sink potential - Mid - Increase trees	0	0	133
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,675
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	1,839
productivity (1000 tCO2e/y)			.,
Land impacted for carbon sink potential - High -	0	0	17.6
Accelerate regeneration (1000 hectares)			11.0
Land impacted for carbon sink potential - High -	0	0	98.1
Avoid deforestation (over 30 years) (1000	0	0	70.1
hectares)			
	0	0	2.050
Land impacted for carbon sink potential - High -	U	U	3,258
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	22.3
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	18.7
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	88.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	912
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	4,415
Total impacted (over 30 years) (1000 hectares)	0	9	7,710
Land impacted for carbon sink potential - Low -	0	0	8.8
Accelerate regeneration (1000 hectares)	0	0	0.0
Land impacted for carbon sink potential - Low -	0	0	92.1
·	U	U	92.1
Avoid deforestation (over 30 years) (1000			
hectares)			10/0
Land impacted for carbon sink potential - Low -	0	0	1,248
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	11.2
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	9.87
Increase trees outside forests (1000 hectares)		-	
Land impacted for carbon sink potential - Low -	0	0	0
Reforest cropland (1000 hectares)	<u> </u>	١ .	J
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest pasture (1000 hectares)	U	U	10.3
			EEO
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	552
Provided deductivity i ii ii i noctobool		I	

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	1,937
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	95.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,253
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	16.8
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	14.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	111
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,111
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	3,614
Total impacted (over 30 years) (1000 hectares)			

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	444	0.449	0.444	0.407	0.298	0.027
(million 2019\$)							
Monetary damages from air pollution - Natural	0	61.9	42.7	60.6	43.8	15.3	4.48
Gas (million 2019\$)							
Monetary damages from air pollution -	0	354	313	226	124	53.7	20.3
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	49.9	0.05	0.05	0.046	0.033	0.003
(deaths)							
Premature deaths from air pollution - Natural	0	6.99	4.83	6.84	4.94	1.73	0.506
Gas (deaths)							
Premature deaths from air pollution -	0	39.8	35.2	25.4	13.9	6.04	2.28
Transportation (deaths)							

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 -	0	0.678	0.66	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.4	63.4	66.8	75.9	88.5	96.3	99
Sales of cooking units - Gas (%)	37.6	36.6	33.2	24.1	11.5	3.71	0.997
Sales of space heating units - Electric Heat Pump	20.6	29.9	33.3	43.4	60.9	75.7	82.6
(%)							
Sales of space heating units - Electric Resistance	18.3	21.3	20.5	17.4	12.3	8.13	6.18
(%)							
Sales of space heating units - Fossil (%)	10.8	16.9	16.2	14	10.4	7.61	6.49
Sales of space heating units - Gas (%)	50.2	31.9	30	25.2	16.5	8.57	4.78
Sales of water heating units - Electric Heat Pump	0	1.02	3.88	12.4	26.6	38	43.1
(%)							
Sales of water heating units - Electric Resistance	45	61.1	60.3	58	54.9	53.5	53.2
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	35.8	33.7	27.7	16.7	6.76	2.07
Sales of water heating units - Other (%)	2.8	2.09	2.06	1.96	1.8	1.69	1.66

Table 1.6: F. R.	connario -	DTII A D 1.	Efficiency/	Electrification	- Transnortation
1aule 40: <i>E-D+</i>	· SCPHIII-III -	PILLARI	FIIII:IPIII:V/I	F121:11'1111:11111111111	- 1170018000700010

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	0	52.1	111	373	1,179	1,716
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.06	0	0.211	0	1.17	0	3.29
Public EV charging plugs - L2 (1000 units)	0.164	0	5.06	0	28.1	0	79
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 (%)	1.8	2.17	2.1	1.68	1.1	0.568	0.242
Vehicle sales - Light-duty - EV (%)	1.61	4.08	10.6	23.8	46.1	70.5	87
Vehicle sales - Light-duty - gasoline (%)	92.6	88.6	81.6	69.2	48.7	26.4	11.6
Vehicle sales - Light-duty - hybrid (%)	3.77	4.63	5.26	4.9	3.79	2.31	1.14
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.387	0.34	0.265	0.191	0.108	0.05
Vehicle sales - Light-duty - other (%)	0.113	0.117	0.108	0.095	0.069	0.038	0.018
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)	48.6	48.8	48.2	47.6	46.4	45.3	44.7
Final energy use - Industry (PJ)	185	197	202	207	214	216	219
Final energy use - Residential (PJ)	38.4	36.2	35	33.8	32.2	30.3	28.1
Final energy use - Transportation (PJ)	151	143	129	118	110	100	89.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,823	6,480	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump	3.31	16.5	20.2	31.4	51.9	70.8	80
(%)							
Sales of space heating units - Electric Resistance	3.22	7.96	8.26	9.15	10.8	12.6	13.5
(%)							
Sales of space heating units - Fossil (%)	4.12	4.72	4.38	3.31	1.62	0.515	0.135
Sales of space heating units - Gas Furnace (%)	89.4	70.9	67.2	56.1	35.6	16.1	6.3
Sales of water heating units - Electric Heat Pump	0.114	1.49	4.92	15.1	32.6	47.1	53.7
(%)							
Sales of water heating units - Electric Resistance	2.92	7.34	9.03	14.3	24.3	33.8	38.6
(%)							
Sales of water heating units - Gas Furnace (%)	94.5	86.9	81.8	66.8	39.9	16.2	4.96
Sales of water heating units - Other (%)	2.43	4.23	4.21	3.78	3.24	2.87	2.74

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.829	0.837	1.16	1.2	1.73	1.83
Cumulative 5-yr (billion \$2018)							

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	0	0	0	0	0	0	0
\$2018)							

Table 50: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)

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

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	0	0	0	0	0	0	0
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
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	3.53
Annual - BECCS (MMT)	0	0	0	0	0	0	0
Annual - Cement and lime (MMT)	0	0	0	0	0	0	3.53
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	3.53
Cumulative - BECCS (MMT)	0	0	0	0	0	0	0
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	3.53
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	30.7
Cumulative investment - All (million \$2018)	0	0	0	0	0	0	36
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	36
Cumulative investment - Trunk (million \$2018)	0	0	0	0	0	0	0
Spur (km)	0	0	0	0	0	0	30.7
Trunk (km)	0	0	0	0	0	0	0

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

Table 56: E-B+ scenario - PILLAR 6: Land sinks			
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-17
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-509
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	0
Cropland to woody energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	0
Pasture to energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-20.7
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-546
Total (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-17
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-268
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Cropland to woody energy crops (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Pasture to energy crops (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-10.4
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-296
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	6.53
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	838
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	0.058
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	110
deployment - Pasture to energy crops (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	37.7
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	993
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	6.53
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	179
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	0.058
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	110
deployment - Pasture to energy crops (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	18.8
deployment - Permanent conservation cover			
(1000 hectares)			
- ·			01/
Land impacted for carbon sink - Moderate	0	0	314
Land impacted for carbon sink - Moderate	0	U	314

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks	- Forests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	108
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	17,784
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	724
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	6,389
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	60.6
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,441
of HWP (1000 tC02e/y)			
Carbon sink potential - High - Increase trees	0	0	197
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	3,114
(1000 tC02e/y)			•
Carbon sink potential - High - Restore	0	0	2,750
productivity (1000 tCO2e/y)			,
Carbon sink potential - Low - Accelerate	0	0	53.9
regeneration (1000 tCO2e/y)			00.7
Carbon sink potential - Low - All (not counting	0	0	5,372
overlap) (1000 tCO2e/y)			0,012
Carbon sink potential - Low - Avoid deforestation	0	0	121
(1000 tC02e/y)			121
Carbon sink potential - Low - Extend rotation	0	0	2,454
length (1000 tC02e/y)		0	2,404
Carbon sink potential - Low - Improve	0	0	30.8
plantations (1000 tCO2e/y)		0	30.0
Carbon sink potential - Low - Increase retention	0	0	1,480
of HWP (1000 tCO2e/y)		0	1,400
Carbon sink potential - Low - Increase trees	0	0	69.1
outside forests (1000 tC02e/y)		0	07.1
Carbon sink potential - Low - Reforest cropland	0	0	0
(1000 tC02e/y)	0	0	U
Carbon sink potential - Low - Reforest pasture	0	0	236
(1000 tC02e/y)	0	0	230
		0	927
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	921
Carbon sink potential - Mid - Accelerate	0	0	80.7
regeneration (1000 tCO2e/y)	0	U	80.7
	0	0	11 [77
Carbon sink potential - Mid - All (not counting	U	0	11,577
overlap) (1000 tC02e/y)		0	/ 00
Carbon sink potential - Mid - Avoid deforestation	0	0	422
(1000 tC02e/y)			, , , ,
Carbon sink potential - Mid - Extend rotation	0	0	4,421
length (1000 tC02e/y)		_	
Carbon sink potential - Mid - Improve plantations	0	0	45.2
(1000 tCO2e/y)			
Carbon sink potential - Mid - Increase retention	0	0	2,961
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	133
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	0
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,675
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	1,839
productivity (1000 tCO2e/y)			
productivity (1000 tooze/y)			
Land impacted for carbon sink potential - High -	0	0	17.6

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks	- Forests (con	tinueaj	
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	98.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,258
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	22.3
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)			· ·
Land impacted for carbon sink potential - High -	0	0	18.7
Increase trees outside forests (1000 hectares)		0	10.1
Land impacted for carbon sink potential - High -	0	0	0
Reforest cropland (1000 hectares)		0	U
	0	0	00.5
Land impacted for carbon sink potential - High -	0	0	88.5
Reforest pasture (1000 hectares)		-	010
Land impacted for carbon sink potential - High -	0	0	912
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	4,415
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	8.8
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	92.1
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,248
Extend rotation length (1000 hectares)			, -
Land impacted for carbon sink potential - Low -	0	0	11.2
Improve plantations (1000 hectares)		9	11.2
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)		0	U
		0	9.87
Land impacted for carbon sink potential - Low -	0	0	9.87
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Reforest cropland (1000 hectares)		_	
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	552
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,937
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	95.1
Avoid deforestation (over 30 years) (1000			70
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,253
Extend rotation length (1000 hectares)		0	2,200
Land impacted for carbon sink potential - Mid -	0	0	16.8
	0	U	16.8
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	14.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	111
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,111
Restore productivity (1000 hectares)			.,
Land impacted for carbon sink potential - Mid -	0	0	3,614
Total impacted (over 30 years) (1000 hectares)		٦	0,017
Total Impactor (over 50 years) (1000 lieutal'es)			

Table 58: RFF scenario -	DTLLAD 1. Efficiency	//Electrification	Pacidontial
TADIE 58' REE SCENDING -	· PII I AR I' FIIII:12111.\	//FIRCHTIHICHHIDH :	- Resinentini

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.676	0.631	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	62.1	62.1	62.1	62.1	62.1	62.1	62.1
Sales of cooking units - Gas (%)	37.9	37.9	37.9	37.9	37.9	37.9	37.9
Sales of space heating units - Electric Heat Pump	19.1	38.2	38.9	39.9	40.6	41.6	42.9
(%)							
Sales of space heating units - Electric Resistance	18.7	19	18.9	18.2	17.3	16.5	15
(%)							
Sales of space heating units - Fossil (%)	11	14.2	11.6	10.1	9.89	9.86	9.99
Sales of space heating units - Gas (%)	51.1	28.6	30.6	31.9	32.2	32.1	32
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
(%)							
Sales of water heating units - Electric Resistance	45	61.3	61.3	61	60.7	60.7	60.4
(%)							
Sales of water heating units - Gas Furnace (%)	52.2	36.6	36.6	36.8	37.1	37.2	37.3
Sales of water heating units - Other (%)	2.8	2.1	2.11	2.14	2.17	2.19	2.21

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 (%)	1.79	2.17	2.23	2.07	1.87	1.75	1.66
Vehicle sales - Light-duty - EV (%)	2.78	4.6	5.28	6.43	7.88	9.28	10.4
Vehicle sales - Light-duty - gasoline (%)	91.5	88.2	86.4	84.9	83	81	79.4
Vehicle sales - Light-duty - hybrid (%)	3.67	4.56	5.61	6.19	6.81	7.49	8.11
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.385	0.36	0.323	0.323	0.325	0.336
Vehicle sales - Light-duty - other (%)	0.113	0.116	0.114	0.114	0.114	0.114	0.117
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)	48.6	49.4	49.9	50.1	50.6	52.1	55
Final energy use - Industry (PJ)	186	200	210	215	221	226	233
Final energy use - Residential (PJ)	38.4	36.3	35.7	35.7	36	36.8	37.6
Final energy use - Transportation (PJ)	151	143	130	122	122	126	130

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,743	5,973	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric Heat Pump	3.31	21.2	47.1	68.4	72	72.3	72.3
(%)							
Sales of space heating units - Electric Resistance	3.22	8.68	12.7	19.9	24.9	25.7	25.8
(%)							
Sales of space heating units - Fossil (%)	4.12	4.58	3.35	1.41	0.205	0.017	0
Sales of space heating units - Gas Furnace (%)	89.4	65.6	36.9	10.2	2.94	1.96	1.9
Sales of water heating units - Electric Heat Pump	0.114	0.273	0.269	0.271	0.272	0.271	0.272
(%)							

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	2.92	6.72	6.66	6.66	6.69	6.67	6.68
(%)							
Sales of water heating units - Gas Furnace (%)	94.5	88.7	88.7	88.7	88.7	88.7	88.7
Sales of water heating units - Other (%)	2.43	4.27	4.39	4.32	4.36	4.39	4.37

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.92	0.94	1.05	1.08	1.2	1.24
Cumulative 5-yr (billion \$2018)							

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

Table 63: REF scenario - PILLAR 6: Land sinks - F				
Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-5.21	0	-10.5	-9.4
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.21	0	-2.17	-2.26
Business-as-usual carbon sink - Total (Mt CO2e/y)	-6.42	0	-12.7	-11.7
Carbon sink potential - High - Accelerate	0	0	0	108
regeneration (1000 tCO2e/y)				
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	17,784
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	724
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	0	6,389
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	0	60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	0
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)	0	0	0	3,114
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	0	2,750
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	53.9
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	5,372
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)	0	0	0	121
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)	0	0	0	2,454
Carbon sink potential - Low - Improve	0	0	0	30.8
plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)	0	0	0	1,480
Carbon sink potential - Low - Increase trees	0	0	0	69.1
outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland	0	0	0	0
(1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture	0	0	0	236
(1000 tC02e/y) Carbon sink potential - Low - Restore	0	0	0	927
productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate	0	0	0	80.7
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,577

Table 63: REF scenario - PILLAR 6: Land sinks - I	Forests (coi	ntinued)		
Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	4,421
Carbon sink potential - Mid - Improve plantations (1000 tC02e/y)	0	0	0	45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	0	2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	133
Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y)	0	0	0	0
Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y)	0	0	0	1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	1,839
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	22.3
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	18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	0	88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	0	912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	0	4,415
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	11.2
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	9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	95.1

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

0000	0000	0000	0050
2020	2025	2030	2050
0	0	0	2,253
0	0	0	16.8
0	0	0	0
0	0	0	14.3
0	0	0	0
0	0	0	111
0	0	0	1,111
0	0	0	3,614
	0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Table 64: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	1,207	733	666	633	613	568
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	47.2	55.1	60.8	58.4	60.2	53.9
Monetary damages from air pollution - Transportation (million 2019\$)	0	359	348	338	329	321	313
Premature deaths from air pollution - Coal (deaths)	0	135	82.3	74.7	71	68.8	63.8
Premature deaths from air pollution - Natural Gas (deaths)	0	5.33	6.23	6.87	6.6	6.8	6.09
Premature deaths from air pollution - Transportation (deaths)	0	40.4	39.1	38	37	36.1	35.2