# Net-Zero America - ohio state report

Larson et al. 2020

#### February 2021

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

#### **Notes**

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

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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	9.7	12.8	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	5.51	13.7	41.4	84.2	91.7	92.1	91.9
(%)							
Sales of space heating units - Electric Resistance	15.4	21.4	16.1	7.17	5.54	5.47	5.69
(%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump	0	1.79	15.1	34.7	38	38.3	38.3
(%)							
Sales of water heating units - Electric Resistance	32.2	48.8	51.7	60	61.5	61.6	61.5
(%)							
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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	2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326	0	3.65	0	16	0	25.9
Public EV charging plugs - L2 (1000 units)	1.06	0	87.7	0	386	0	624
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.331	0.191	0.059	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	36,680	40,065	0	0	0	0
Cumulative 5-yr (million \$2018)							
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 (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	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 (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	6.24	6.43	13.3	14.2	13.1	13.8
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	0	0	0	0	0	0	0
\$2018)							
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)							
Capital invested - Solar PV - Base (billion \$2018)	0	0	0.621	12.5	9.71	12.6	4.83
Capital invested - Solar PV - Constrained (billion	0	1.55	0.276	10.4	9.72	11.5	5.9
\$2018)							
Capital invested - Wind - Base (billion \$2018)	0	0	5.07	13.6	21.4	2.52	3.08
Capital invested - Wind - Constrained (billion	0	0	12.9	11.3	0	0	0.2
\$2018)							

# 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)	1,454	0	915	19,820	16,205	22,080	8,874
Solar - Constrained land use assumptions (GWh)	1,334	0	2,761	16,908	20,103	22,310	12,598
Wind - Base land use assumptions (GWh)	2,973	0	11,912	33,278	50,514	5,936	7,442
Wind - Constrained land use assumptions (GWh)	2,973	0	25,595	24,964	0	0	0

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

ocitor gy						
2020	2025	2030	2035	2040	2045	2050
0	0	0	0	0	402	1,858
0	0	0	0	0	6,167	22,362
0	0	0	0	0	0	0
0	0	0	0	0	7	30
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
0	0	0	0	0	0	0
0	0	0	0	0	0	0
	2020 0 0 0 0	2020 2025 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2020         2025         2030           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	2020         2025         2030         2035           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         0         0           0         0         0         0           0         0         0         0           0         0         0         0	2020         2025         2030         2035         2040           0         0         0         0         0         0           0         0         0         0         0         0         0           0	2020         2025         2030         2035         2040         2045           0         0         0         0         0         402           0         0         0         0         0         6,167           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           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 9: E+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	7.93	36.7
Annual - BECCS (MMT)	0	0	0	0	0	7.93	36.7
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	7.93	44.6
Cumulative - BECCS (MMT)	0	0	0	0	0	7.93	44.6
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	0	0	0	0	0
Injection wells (wells)	0	0	0	0	0	0	0
Resource characterization, appraisal, permitting	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	477	477	477	778	2,027
Cumulative investment - All (million \$2018)	0	0	1,555	1,555	1,555	1,905	3,017
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	350	1,462
Cumulative investment - Trunk (million \$2018)	0	0	1,555	1,555	1,555	1,555	1,555
Spur (km)	0	0	0	0	0	301	1,550
Trunk (km)	0	0	477	477	477	477	477

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

-1,255
-5,463
-214
-6,932
-1,255
-2,883
-107
-4,245
523
3,526
390
4,439
523

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate	0	0	1,861
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	195
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	2,578
deployment - Total (1000 hectares)			

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	180
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	21,474
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,130
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	4,749
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)	0	0	1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,927
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	135
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	2,37
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	3,166

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	rests (contin	ued)	
Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees	0	0	1,296
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	874
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,477
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	1,384
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	29.5
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	424
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	1,751
Extend rotation length (1000 hectares)			.,
Land impacted for carbon sink potential - High -	0	0	80.7
Improve plantations (1000 hectares)		0	00.1
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	182
	"	0	102
Increase trees outside forests (1000 hectares)		0	771
Land impacted for carbon sink potential - High -	0	0	77.1
Reforest cropland (1000 hectares)			404
Land impacted for carbon sink potential - High -	0	0	131
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	686
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	3,362
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	14.7
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	398
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	671
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	40.4
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	96
Increase trees outside forests (1000 hectares)			, ,
Land impacted for carbon sink potential - Low -	0	0	38.5
Reforest cropland (1000 hectares)		Ŭ	00.0
Land impacted for carbon sink potential - Low -	0	0	22.7
Reforest pasture (1000 hectares)		0	22.1
Land impacted for carbon sink potential - Low -	0	0	415
	"	0	415
Restore productivity (1000 hectares)	0	0	1,07
Land impacted for carbon sink potential - Low -	0	0	1,696
Total impacted (over 30 years) (1000 hectares)		0	00.1
Land impacted for carbon sink potential - Mid -	0	0	22.1
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	411
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,211
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	60.8
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	139
Increase trees outside forests (1000 hectares)			
	1		

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid -	0	0	57.8
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	164
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	836
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,902
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	2,199	5.78	5.76	5.53	4.21	0.41
(million 2019\$)							
Monetary damages from air pollution - Natural	0	382	309	197	163	88.5	34.3
Gas (million 2019\$)							
Monetary damages from air pollution -	0	3,979	3,697	2,802	1,624	753	313
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	247	0.648	0.646	0.62	0.473	0.046
(deaths)							
Premature deaths from air pollution - Natural	0	43.2	34.9	22.2	18.4	10	3.88
Gas (deaths)							
Premature deaths from air pollution -	0	448	416	315	183	84.6	35.2
Transportation (deaths)							

# Table 15: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	983	991	1,049	946	522	572	1,838
By economic sector - Construction (jobs)	10,659	9,969	11,487	23,730	28,313	28,695	27,060
By economic sector - Manufacturing (jobs)	10,579	18,228	21,175	27,550	26,341	21,459	26,714
By economic sector - Mining (jobs)	13,847	11,133	8,438	6,292	4,037	2,522	1,363
By economic sector - Other (jobs)	543	431	631	2,989	3,778	4,619	4,316
By economic sector - Pipeline (jobs)	1,605	1,603	1,561	1,101	823	555	476
By economic sector - Professional (jobs)	6,243	5,422	5,881	12,178	16,070	16,982	18,364
By economic sector - Trade (jobs)	6,535	5,336	5,040	8,351	9,996	10,432	10,368
By economic sector - Utilities (jobs)	13,441	12,259	12,458	19,950	24,333	23,209	23,300
By education level - All sectors - Associates	19,256	19,760	20,727	32,380	36,393	34,853	36,016
degree or some college (jobs)							
By education level - All sectors - Bachelors	14,540	14,492	14,596	21,253	23,462	22,280	23,250
degree (jobs)							
By education level - All sectors - Doctoral degree	459	420	419	681	807	810	847
(jobs)							
By education level - All sectors - High school	26,736	27,390	28,670	43,786	47,886	45,610	47,970
diploma or less (jobs)							
By education level - All sectors - Masters or	3,445	3,311	3,307	4,987	5,665	5,492	5,715
professional degree (jobs)							
By resource sector - Biomass (jobs)	2,457	2,429	2,442	2,131	1,241	2,132	8,003
By resource sector - CO2 (jobs)	0	0	1,539	0	0	131	1,132
By resource sector - Coal (jobs)	4,891	1,710	216	18	13.3	10.4	8.76
By resource sector - Grid (jobs)	11,342	10,491	12,032	29,799	39,082	39,898	42,049
By resource sector - Natural Gas (jobs)	18,236	18,143	15,108	12,583	10,498	6,865	3,994
By resource sector - Nuclear (jobs)	953	662	651	641	631	366	0
By resource sector - Oil (jobs)	20,941	19,280	16,571	13,779	9,722	6,954	4,254
By resource sector - Solar (jobs)	3,978	6,458	8,175	23,990	24,898	28,191	28,184
By resource sector - Wind (jobs)	1,640	6,200	10,985	20,146	28,128	24,499	26,172
Median wages - Annual - All (\$2019 per job)	60,131	59,967	60,097	60,244	61,374	62,277	62,669
On-Site or In-Plant Training - Total jobs - 1 to 4	10,253	10,393	10,820	16,714	18,681	17,853	18,325
years (jobs)							
On-Site or In-Plant Training - Total jobs - 4 to 10	4,089	3,916	4,051	6,532	7,521	7,323	7,285
years (jobs)							
On-Site or In-Plant Training - Total jobs - None	10,253	10,491	10,907	16,728	18,591	17,806	18,682
(jobs)							

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	503	516	548	872	993	954	981
years (jobs)							
On-Site or In-Plant Training - Total jobs - Up to 1	39,340	40,057	41,394	62,240	68,427	65,110	68,525
year (jobs)							
On-the-Job Training - All sectors - 1 to 4 years	13,115	13,258	13,803	21,420	24,058	23,014	23,535
_(jobs)							
On-the-Job Training - All sectors - 4 to 10 years	3,820	3,634	3,793	6,314	7,357	7,217	7,153
(jobs)							
On-the-Job Training - All sectors - None (jobs)	3,528	3,513	3,596	5,508	6,090	5,862	6,104
On-the-Job Training - All sectors - Over 10 years	607	661	703	1,062	1,150	1,074	1,115
(jobs)							
On-the-Job Training - All sectors - Up to 1 year	43,367	44,308	45,825	68,782	75,558	71,879	75,890
(jobs)							
Related work experience - All sectors - 1 to 4	23,644	23,759	24,437	36,940	40,984	39,168	40,692
years (jobs)							
Related work experience - All sectors - 4 to 10	15,031	15,181	15,678	23,869	26,667	25,442	26,263
years (jobs)							
Related work experience - All sectors - None	9,151	9,280	9,636	14,744	16,343	15,666	16,368
(jobs)							
Related work experience - All sectors - Over 10	4,139	4,310	4,458	6,604	7,250	6,813	7,112
years (jobs)							
Related work experience - All sectors - Up to 1	12,472	12,843	13,510	20,929	22,969	21,957	23,363
year (jobs)							
Wage income - All (million \$2019)	3,875	3,920	4,070	6,211	7,010	6,792	7,132

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	869	882	743	596	449	282	196
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	17,958
Natural gas production - Annual (tcf)	2,585	2,865	2,708	2,358	1,994	1,581	1,228
Oil consumption - Annual (million bbls)	195	183	157	120	85.6	58.3	37
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	3,717
Oil production - Annual (million bbls)	27.8	30.1	30.2	30.2	23.9	19.4	12.9

# 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	9.67	12.6	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric Heat Pump	5.51	11.2	14.4	24.6	46.6	71.6	85.5
(%)							
Sales of space heating units - Electric Resistance	15.4	21.8	21.1	19.1	14.6	9.52	6.85
(%)							
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric Heat Pump	0	0.549	2.08	6.92	17.2	28.8	35.3
(%)							
Sales of water heating units - Electric Resistance	32.2	48.8	49	50.1	53.4	57.7	60.3
(%)							
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17

# 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	338	712	2,404	7,567	11,023
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.12	0	5.95	0	16.6
Public EV charging plugs - L2 (1000 units)	1.06	0	27	0	143	0	400
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.376	0.317	0.239	0.168	0.092	0.043
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
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)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	36,676	40,057	0	0	0	0
Cumulative 5-yr (million \$2018)							
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	1.41	6.26	9.41	19.5	41.8	67.8	82.5
(%)							
Sales of space heating units - Electric Resistance	4.39	3.42	3.62	4.32	6.06	8.25	9.52
(%)							
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of space heating units - Gas Furnace (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of water heating units - Electric Heat Pump	0.454	1.05	3.02	9.27	22.8	38.3	47
(%)							
Sales of water heating units - Electric Resistance	4.26	3.81	5.35	10.5	22.3	36.6	44.8
(%)							
Sales of water heating units - Gas Furnace (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	5.04	5.08	6.88	7.14	11.1	11.9
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	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-5,463
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-214
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-6,932
Total (1000 tC02e/y)			

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

Table 22. L Scenario I ILLAN S. Lana Sinks 7	igi icaitai c (c	ontinacaj	
Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-2,883
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-107
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-4,245
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	3,526
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	390
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	4,439
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,861
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	195
deployment - Permanent conservation cover		_	
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	2,578
deployment - Total (1000 hectares)			•

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

Table 23: E- Scenario - Pillar 6: Lana Sinks - Fo			
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	180
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	21,474
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,130
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	3,434
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	219
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,749
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	1,920
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	1,166
(1000 tCO2e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,605
(1000 tCO2e/y)			
Carbon sink potential - High - Restore	0	0	2,070
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	90.3
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,927
overlap) (1000 tC02e/y)			•
Carbon sink potential - Low - Avoid deforestation	0	0	522
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,319
length (1000 tC02e/y)	-		,
Carbon sink potential - Low - Improve	0	0	112
plantations (1000 tCO2e/y)	-	-	
P (			

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

Table 23: E- scenario - PILLAR 6: Land sinks - Fo			0050
Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y)	0	0	583
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)	0	0	349
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	698
Carbon sink potential - Mid - Accelerate	0	0	135
regeneration (1000 tC02e/y)  Carbon sink potential - Mid - All (not counting	0	0	13,699
overlap) (1000 tC02e/y)  Carbon sink potential - Mid - Avoid deforestation	0	0	1,826
(1000 tCO2e/y)  Carbon sink potential - Mid - Extend rotation	0	0	2,377
length (1000 tC02e/y)  Carbon sink potential - Mid - Improve plantations	0	0	163
(1000 tCO2e/y)  Carbon sink potential - Mid - Increase retention	0	0	3,166
of HWP (1000 tCO2e/y)  Carbon sink potential - Mid - Increase trees	0	0	1,296
outside forests (1000 tC02e/y)  Carbon sink potential - Mid - Reforest cropland	0	0	874
(1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture	0	0	2,477
(1000 tCO2e/y) Carbon sink potential - Mid - Restore	0	0	1,384
productivity (1000 tCO2e/y) Land impacted for carbon sink potential - High -	0	0	29.5
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High -	0	0	424
Avoid deforestation (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	80.7
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	182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	3,362
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000	0	0	398
hectares) Land impacted for carbon sink potential - Low -	0	0	671
Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	40.4
Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	96
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	38.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	22.7
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	415
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,696
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.1
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	411
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,211
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	60.8
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	139
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	57.8
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	164
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	836
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,902
Total impacted (over 30 years) (1000 hectares)			

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	2,199	5.78	5.76	5.53	4.21	0.41
(million 2019\$)							
Monetary damages from air pollution - Natural	0	350	225	86.9	38.1	12.7	7.66
Gas (million 2019\$)							
Monetary damages from air pollution -	0	4,048	4,080	3,966	3,572	2,847	1,959
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	247	0.648	0.646	0.62	0.473	0.046
(deaths)							
Premature deaths from air pollution - Natural	0	39.5	25.5	9.81	4.31	1.44	0.866
Gas (deaths)							
Premature deaths from air pollution -	0	455	459	446	402	320	220
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	9.7	12.8	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	5.51	13.7	41.4	84.2	91.7	92.1	91.9
(%)							
Sales of space heating units - Electric Resistance	15.4	21.4	16.1	7.17	5.54	5.47	5.69
(%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump	0	1.79	15.1	34.7	38	38.3	38.3
(%)							

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	32.2	48.8	51.7	60	61.5	61.6	61.5
(%)							
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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	2,095	5,367	8,700	13,178	14,344	13,675
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.326	0	3.65	0	16	0	25.9
Public EV charging plugs - L2 (1000 units)	1.06	0	87.7	0	386	0	624
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 (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.331	0.191	0.059	0.012	0.002	0
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	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)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	36,680	40,065	0	0	0	0
Cumulative 5-yr (million \$2018)							
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	1.41	8.43	35.7	81.1	89	89.5	89.5
(%)							
Sales of space heating units - Electric Resistance	4.39	3.49	5.31	9.37	10.1	10.2	10.2
(%)							
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump	0.454	2.53	19.6	46.2	50.8	51.1	51.1
(%)							
Sales of water heating units - Electric Resistance	4.26	4.67	18.3	43.9	48.4	48.7	48.7
(%)							
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	6.24	6.43	13.3	14.2	13.1	13.8
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	1.49	2.39	24.4	14.9	8.53	10.3
Capital invested - Wind - Base (billion \$2018)	0	0	11.4	22	18.4	0.135	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)	1,454	1,976	3,522	38,403	24,543	14,799	19,567
Solar - Constrained land use assumptions (GWh)	1,454	612	6,994	35,358	16,495	3,550	27,649
Wind - Base land use assumptions (GWh)	2,973	0	26,510	51,446	40,723	275	0
Wind - Constrained land use assumptions (GWh)	2,973	0	47,355	3,203	0	0	75,490

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

Table 62: 2 The Food and Table 1122 The Great Commo	, igi ioaireai	· ·	
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-5,463
Cropland measures (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-214
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-6,932
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-2,883
Cropland measures (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-107
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-4,245
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	3,526
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	390
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	4,439
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,861
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	195
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	2,578
deployment - Total (1000 hectares)			

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

Table 33: E+RE+ scenario - PILLAR 6: Land sinks	: - Forests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	180
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	21,474
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,130
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	3,434
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	219
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,749
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	1,920
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	1,166
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,605
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	2,070
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	90.3
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,927
overlap) (1000 tC02e/y)		_	
Carbon sink potential - Low - Avoid deforestation	0	0	522
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,319
length (1000 tC02e/y)			
Carbon sink potential - Low - Improve	0	0	112
plantations (1000 tC02e/y)	0		1.500
Carbon sink potential - Low - Increase retention	0	0	1,583
of HWP (1000 tCO2e/y)	0		/70
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)	0	0	672
Carbon sink potential - Low - Reforest cropland	0	0	583
(1000 tCO2e/y)	U	U	563
Carbon sink potential - Low - Reforest pasture	0	0	349
(1000 tCO2e/y)	0	0	347
	0	0	698
productivity (1000 tCO2e/y)	U	0	070
Carbon sink potential - Mid - Accelerate	0	0	135
regeneration (1000 tCO2e/y)	0	0	133
Carbon sink potential - Mid - All (not counting	0	0	13,699
overlap) (1000 tC02e/y)	0	0	10,077
Carbon sink potential - Mid - Avoid deforestation	0	0	1,826
(1000 tC02e/y)	0	0	1,020
Carbon sink potential - Mid - Extend rotation	0	0	2,377
length (1000 tC02e/y)	0	0	2,011
Carbon sink potential - Mid - Improve plantations	0	0	163
(1000 tC02e/y)	0	0	103
Carbon sink potential - Mid - Increase retention	0	0	3,166
of HWP (1000 tCO2e/y)	0	0	3,100
Carbon sink potential - Mid - Increase trees	0	0	1,296
outside forests (1000 tC02e/y)	0	0	1,270
Carbon sink potential - Mid - Reforest cropland	0	0	874
(1000 tC02e/y)	0	0	014
Carbon sink potential - Mid - Reforest pasture	0	0	2,477
(1000 tC02e/y)	0	0	۷,→۱۱
Carbon sink potential - Mid - Restore	0	0	1,384
productivity (1000 tCO2e/y)	0	0	1,004
Land impacted for carbon sink potential - High -	0	0	29.5
Accelerate regeneration (1000 hectares)	9	0	27.0

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	424
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	1,751
Extend rotation length (1000 hectares)	Ŭ	ŭ	.,
	0	0	80.7
Land impacted for carbon sink potential - High -	U	U	80.7
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	182
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	77.1
Reforest cropland (1000 hectares)	0	9	
	0		101
Land impacted for carbon sink potential - High -	0	0	131
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	686
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	3,362
Total impacted (over 30 years) (1000 hectares)			0,002
Land impacted for carbon sink potential - Low -	0	0	14.7
	U	0	14.7
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	398
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	671
Extend rotation length (1000 hectares)		_	
Land impacted for carbon sink potential - Low -	0	0	40.4
	U	0	40.4
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	96
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	38.5
Reforest cropland (1000 hectares)		<u> </u>	00.0
	0	0	00.7
Land impacted for carbon sink potential - Low -	U	U	22.7
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	415
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,696
Total impacted (over 30 years) (1000 hectares)			•
Land impacted for carbon sink potential - Mid -	0	0	22.1
Accelerate regeneration (1000 hectares)	0	0	22.1
Land impacted for carbon sink potential - Mid -	0	0	411
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,211
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	60.8
Improve plantations (1000 hectares)	0	9	00.0
	0		
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	139
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	57.8
Reforest cropland (1000 hectares)	ŭ	Ŭ	00
	0	0	1//
Land impacted for carbon sink potential - Mid -	U	υ	164
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	836
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,902
Total impacted (over 30 years) (1000 hectares)	-	-	
rotar impactor (over 50 year of (1000 ficetal 65)			

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	2,199	5.78	5.76	5.53	4.21	0.41
(million 2019\$)							
Monetary damages from air pollution - Natural	0	316	231	136	90.5	30.2	7.22
Gas (million 2019\$)							
Monetary damages from air pollution -	0	3,979	3,697	2,802	1,624	753	313
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	247	0.648	0.646	0.62	0.473	0.046
(deaths)							
Premature deaths from air pollution - Natural	0	35.7	26	15.4	10.2	3.41	0.815
Gas (deaths)							
Premature deaths from air pollution -	0	448	416	315	183	84.6	35.2
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	9.7	12.8	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	5.51	13.7	41.4	84.2	91.7	92.1	91.9
(%)							
Sales of space heating units - Electric Resistance	15.4	21.4	16.1	7.17	5.54	5.47	5.69
(%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric Heat Pump	0	1.79	15.1	34.7	38	38.3	38.3
(%)							
Sales of water heating units - Electric Resistance	32.2	48.8	51.7	60	61.5	61.6	61.5
(%)							
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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

2020	2025	2030	2035	2040	2045	2050
0	2,095	5,367	8,700	13,178	14,344	13,675
0.326	0	3.65	0	16	0	25.9
1.06	0	87.7	0	386	0	624
97.2	92.1	67	23.3	4.22	0.628	0
0.588	3.81	19	45.6	57.4	59.6	60
0.227	0.227	0.176	0.066	0.013	0.002	0
0.082	0.09	0.077	0.031	0.007	0.001	0
0.392	2.54	12.7	30.4	38.2	39.7	40
1.5	1.23	1.07	0.568	0.163	0.038	0
1.4	1.68	1.2	0.382	0.072	0.013	0
4.42	16.7	48.8	82.7	96.4	99.3	100
89.1	76.3	46.4	15.6	3.17	0.586	0
4.91	4.9	3.38	1.24	0.304	0.067	0
0.11	0.331	0.191	0.059	0.012	0.002	0
0.095	0.091	0.058	0.02	0.004	0.001	0
64.7	59.7	42.3	14.4	2.59	0.384	0
0.784	5.07	25.3	60.8	76.5	79.5	80
33.7	33.3	25.5	9.32	1.77	0.277	0
0.363	0.402	0.341	0.14	0.03	0.005	0
0.196	1.27	6.33	15.2	19.1	19.9	20
0.253	0.255	0.205	0.083	0.019	0.004	0
	0.326 1.06 97.2 0.588 0.227 0.082 0.392 1.5 1.4 4.42 89.1 4.91 0.11 0.095 64.7 0.784 33.7 0.363 0.196	0         2,095           0.326         0           1.06         0           97.2         92.1           0.588         3.81           0.227         0.227           0.082         0.09           0.392         2.54           1.5         1.23           1.4         1.68           4.42         16.7           89.1         76.3           4.91         4.9           0.11         0.331           0.095         0.091           64.7         59.7           0.784         5.07           33.7         33.3           0.363         0.402           0.196         1.27	0         2,095         5,367           0.326         0         3.65           1.06         0         87.7           97.2         92.1         67           0.588         3.81         19           0.227         0.227         0.176           0.082         0.09         0.077           0.392         2.54         12.7           1.5         1.23         1.07           1.4         1.68         1.2           4.42         16.7         48.8           89.1         76.3         46.4           4.91         4.9         3.38           0.11         0.331         0.191           0.095         0.091         0.058           64.7         59.7         42.3           0.784         5.07         25.3           33.7         33.3         25.5           0.363         0.402         0.341           0.196         1.27         6.33	0         2,095         5,367         8,700           0.326         0         3.65         0           1.06         0         87.7         0           97.2         92.1         67         23.3           0.588         3.81         19         45.6           0.227         0.227         0.176         0.066           0.082         0.09         0.077         0.031           0.392         2.54         12.7         30.4           1.5         1.23         1.07         0.568           1.4         1.68         1.2         0.382           4.42         16.7         48.8         82.7           89.1         76.3         46.4         15.6           4.91         4.9         3.38         1.24           0.11         0.331         0.191         0.059           0.095         0.091         0.058         0.02           64.7         59.7         42.3         14.4           0.784         5.07         25.3         60.8           33.7         33.3         25.5         9.32           0.363         0.402         0.341         0.14	0         2,095         5,367         8,700         13,178           0.326         0         3.65         0         16           1.06         0         87.7         0         386           97.2         92.1         67         23.3         4.22           0.588         3.81         19         45.6         57.4           0.227         0.227         0.176         0.066         0.013           0.082         0.09         0.077         0.031         0.007           0.392         2.54         12.7         30.4         38.2           1.5         1.23         1.07         0.568         0.163           1.4         1.68         1.2         0.382         0.072           4.42         16.7         48.8         82.7         96.4           89.1         76.3         46.4         15.6         3.17           4.91         4.9         3.38         1.24         0.304           0.11         0.331         0.191         0.059         0.012           0.095         0.091         0.058         0.02         0.004           64.7         59.7         42.3         14.4	0         2,095         5,367         8,700         13,178         14,344           0.326         0         3.65         0         16         0           1.06         0         87.7         0         386         0           97.2         92.1         67         23.3         4.22         0.628           0.588         3.81         19         45.6         57.4         59.6           0.227         0.227         0.176         0.066         0.013         0.002           0.082         0.09         0.077         0.031         0.007         0.001           0.392         2.54         12.7         30.4         38.2         39.7           1.5         1.23         1.07         0.568         0.163         0.038           1.4         1.68         1.2         0.382         0.072         0.013           4.42         16.7         48.8         82.7         96.4         99.3           89.1         76.3         46.4         15.6         3.17         0.586           4.91         4.9         3.38         1.24         0.304         0.067           0.11         0.331         0.191

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	36,680	40,065	0	0	0	0
Cumulative 5-yr (million \$2018)							
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	1.41	8.43	35.7	81.1	89	89.5	89.5
(%)							
Sales of space heating units - Electric Resistance	4.39	3.49	5.31	9.37	10.1	10.2	10.2
(%)							
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump	0.454	2.53	19.6	46.2	50.8	51.1	51.1
(%)							
Sales of water heating units - Electric Resistance	4.26	4.67	18.3	43.9	48.4	48.7	48.7
(%)							
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	6.24	6.43	13.3	14.2	13.1	13.8
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 - Solar PV - Base (billion \$2018)	0	0	0	0.381	0.599	1.35	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0	0	0.265	2.47	1.43	0
Capital invested - Wind - Base (billion \$2018)	0	0	0.252	0	0.132	0	0.036
Capital invested - Wind - Constrained (billion \$2018)	0	0	0.873	0	0.71	0.217	0.157

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	0	0	611	1,014	2,420	0
Solar - Constrained land use assumptions (GWh)	1,454	0	0	425	4,187	2,562	0
Wind - Base land use assumptions (GWh)	2,973	0	606	0	358	0	108
Wind - Constrained land use assumptions (GWh)	2,973	0	2,006	0	1,815	562	442

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-5,463
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-214
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-6,932
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,255
Corn-ethanol to energy grasses (1000 tCO2e/y)			

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-2,883
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-107
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-4,245
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	3,526
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	390
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	4,439
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	523
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,861
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	195
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	2,578
deployment - Total (1000 hectares)			

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

Table 43. LTRL- Scenario - FILLAN O. Lana Sinks			
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	180
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	21,474
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,130
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	3,434
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	219
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,749
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	1,920
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	1,166
(1000 tCO2e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,605
(1000 tCO2e/y)			
Carbon sink potential - High - Restore	0	0	2,070
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	90.3
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,927
overlap) (1000 tCO2e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	522
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,319
length (1000 tCO2e/y)			
Carbon sink potential - Low - Improve	0	0	112
plantations (1000 tCO2e/y)			
Carbon sink potential - Low - Increase retention	0	0	1,583
of HWP (1000 tCO2e/y)			
·			

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

Table 43: E+RE- scenario - PILLAR 6: Land sinks			
Item	2020	2025	2050
Carbon sink potential - Low - Increase trees	0	0	672
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	583
(1000 tC02e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	349
(1000 tC02e/y)			
Carbon sink potential - Low - Restore	0	0	698
productivity (1000 tCO2e/y)		•	070
Carbon sink potential - Mid - Accelerate	0	0	135
regeneration (1000 tCO2e/y)	0	0	100
Carbon sink potential - Mid - All (not counting	0	0	13,699
	U	0	13,077
overlap) (1000 tC02e/y)	0	0	1.007
Carbon sink potential - Mid - Avoid deforestation	0	0	1,826
(1000 tC02e/y)			
Carbon sink potential - Mid - Extend rotation	0	0	2,377
length (1000 tCO2e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	163
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	3,166
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	1,296
outside forests (1000 tCO2e/y)		-	.,
Carbon sink potential - Mid - Reforest cropland	0	0	874
(1000 tCO2e/y)		•	0
Carbon sink potential - Mid - Reforest pasture	0	0	2,477
(1000 tCO2e/y)	0	0	2,411
	0	0	1.007
Carbon sink potential - Mid - Restore	0	0	1,384
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	29.5
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	424
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	1,751
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	80.7
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)		•	Ū
Land impacted for carbon sink potential - High -	0	0	182
Increase trees outside forests (1000 hectares)	0	0	102
	0	0	771
Land impacted for carbon sink potential - High -	0	0	77.1
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	131
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	686
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	3,362
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	14.7
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	398
Avoid deforestation (over 30 years) (1000	0	١ -	370
7 7 7			
hectares)			/71
Land impacted for carbon sink potential - Low -	0	0	671
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	40.4
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	96
Increase trees outside forests (1000 hectares)			
(			

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

	1010010 (00		
Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	38.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	22.7
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	415
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,696
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.1
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	411
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,211
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	60.8
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	139
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	57.8
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	164
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	836
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,902
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	2,199	5.78	5.76	5.53	4.21	0.41
(million 2019\$)							
Monetary damages from air pollution - Natural	0	358	286	365	270	94.9	28.9
Gas (million 2019\$)							
Monetary damages from air pollution -	0	3,979	3,697	2,802	1,624	753	313
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	247	0.648	0.646	0.62	0.473	0.046
(deaths)							
Premature deaths from air pollution - Natural	0	40.4	32.3	41.2	30.5	10.7	3.26
Gas (deaths)							
Premature deaths from air pollution -	0	448	416	315	183	84.6	35.2
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	9.67	12.6	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric Heat Pump	5.51	11.2	14.4	24.6	46.6	71.6	85.5
(%)							
Sales of space heating units - Electric Resistance	15.4	21.8	21.1	19.1	14.6	9.52	6.85
(%)							
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric Heat Pump	0	0.549	2.08	6.92	17.2	28.8	35.3
(%)							
Sales of water heating units - Electric Resistance	32.2	48.8	49	50.1	53.4	57.7	60.3
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17

#### 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	0	0	338	712	2,404	7,567	11,023
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.326	0	1.12	0	5.95	0	16.6
Public EV charging plugs - L2 (1000 units)	1.06	0	27	0	143	0	400
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 (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.376	0.317	0.239	0.168	0.092	0.043
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
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)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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

2020	2025	2030	2035	2040	2045	2050
0	36,676	40,057	0	0	0	0
41	45.8	49.8	60.5	75.4	84.5	87.7
59	54.2	50.2	39.5	24.6	15.5	12.3
1.41	6.26	9.41	19.5	41.8	67.8	82.5
4.39	3.42	3.62	4.32	6.06	8.25	9.52
5.44	2.99	2.75	2.06	1.03	0.337	0.088
88.8	87.3	84.2	74.1	51.1	23.6	7.9
0.454	1.05	3.02	9.27	22.8	38.3	47
4.26	3.81	5.35	10.5	22.3	36.6	44.8
95	94.9	91.4	80	54.7	25	8.07
0.252	0.187	0.187	0.189	0.188	0.188	0.189
	0 41 59 1.41 4.39 5.44 88.8 0.454 4.26	41 45.8 59 54.2 1.41 6.26 4.39 3.42 5.44 2.99 88.8 87.3 0.454 1.05 4.26 3.81 95 94.9	0     36,676     40,057       41     45.8     49.8       59     54.2     50.2       1.41     6.26     9.41       4.39     3.42     3.62       5.44     2.99     2.75       88.8     87.3     84.2       0.454     1.05     3.02       4.26     3.81     5.35       95     94.9     91.4	0     36,676     40,057     0       41     45.8     49.8     60.5       59     54.2     50.2     39.5       1.41     6.26     9.41     19.5       4.39     3.42     3.62     4.32       5.44     2.99     2.75     2.06       88.8     87.3     84.2     74.1       0.454     1.05     3.02     9.27       4.26     3.81     5.35     10.5       95     94.9     91.4     80	0       36,676       40,057       0       0         41       45.8       49.8       60.5       75.4         59       54.2       50.2       39.5       24.6         1.41       6.26       9.41       19.5       41.8         4.39       3.42       3.62       4.32       6.06         5.44       2.99       2.75       2.06       1.03         88.8       87.3       84.2       74.1       51.1         0.454       1.05       3.02       9.27       22.8         4.26       3.81       5.35       10.5       22.3         95       94.9       91.4       80       54.7	0     36,676     40,057     0     0     0       41     45.8     49.8     60.5     75.4     84.5       59     54.2     50.2     39.5     24.6     15.5       1.41     6.26     9.41     19.5     41.8     67.8       4.39     3.42     3.62     4.32     6.06     8.25       5.44     2.99     2.75     2.06     1.03     0.337       88.8     87.3     84.2     74.1     51.1     23.6       0.454     1.05     3.02     9.27     22.8     38.3       4.26     3.81     5.35     10.5     22.3     36.6       95     94.9     91.4     80     54.7     25

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

	•		•				
Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	5.04	5.08	6.88	7.14	11.1	11.9
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 \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0.179	0.179

#### 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	1,897	5,611
Conversion capital investment - Cumulative 5-yr	0	0	0	0	0	19,240	37,955
(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	23	65
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	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	0	1	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	1

#### 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	24.7	72.9
Annual - BECCS (MMT)	0	0	0	0	0	24.7	72.9
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	24.7	97.6
Cumulative - BECCS (MMT)	0	0	0	0	0	24.7	97.6
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	477	477	477	1,409	3,066
Cumulative investment - All (million \$2018)	0	0	1,555	1,555	1,555	3,014	4,988
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	1,080	3,054
Cumulative investment - Trunk (million \$2018)	0	0	1,555	1,555	1,555	1,934	1,934
Spur (km)	0	0	0	0	0	932	2,589
Trunk (km)	0	0	477	477	477	477	477

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

2020	2025	2050
0	0	
	0	-1,772
0	0	-4,907
0	0	0
0	0	0
0	0	-193
0	0	-6,872
0	0	-1,772
		•
0	0	-2,589
		,
0	0	0
0	0	0
		•
0	0	-96.4
		70.4
0	n	-4,458
0	0	7,700
n	0	903
0	0	700
0	0	7,832
0	0	1,002
0	0	166
0	0	100
	0	129
0	0	127
0	0	351
U	0	331
0	0	0.201
U	0	9,381
0	0	000
U	U	903
		1 /7/
U	U	1,674
		1//
U	U	166
		100
U	U	129
0	0	175
0	0	3,047
U		- • -
	0 0 0 0 0	

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	180
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	21,474
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,130
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	3,434
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	219
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,749
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	1,920
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	1,166
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,605
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	2,070
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	90.3
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,927
overlap) (1000 tC02e/y)		_	
Carbon sink potential - Low - Avoid deforestation	0	0	522
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,319
length (1000 tC02e/y)			
Carbon sink potential - Low - Improve	0	0	112
plantations (1000 tC02e/y)			1.500
Carbon sink potential - Low - Increase retention	0	0	1,583
of HWP (1000 tCO2e/y)			/70
Carbon sink potential - Low - Increase trees	0	0	672
outside forests (1000 tC02e/y)	0	0	583
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	583
· ·	0	0	349
Carbon sink potential - Low - Reforest pasture	"	0	349
(1000 tC02e/y)	0	0	698
productivity (1000 tC02e/y)	0	0	070
Carbon sink potential - Mid - Accelerate	0	0	135
regeneration (1000 tCO2e/y)		0	133
Carbon sink potential - Mid - All (not counting	0	0	13,699
overlap) (1000 tCO2e/y)		0	13,077
Carbon sink potential - Mid - Avoid deforestation	0	0	1,826
(1000 tC02e/y)		0	1,020
Carbon sink potential - Mid - Extend rotation	0	0	2,377
length (1000 tC02e/y)		0	2,311
Carbon sink potential - Mid - Improve plantations	0	0	163
(1000 tC02e/y)		0	103
Carbon sink potential - Mid - Increase retention	0	0	3,166
of HWP (1000 tCO2e/y)	0	0	3,100
Carbon sink potential - Mid - Increase trees	0	0	1,296
outside forests (1000 tCO2e/y)	"	0	1,290
		0	07/
Carbon sink potential - Mid - Reforest cropland	0	0	874
(1000 tC02e/y)	0	0	0.77
Carbon sink potential - Mid - Reforest pasture	0	0	2,477
(1000 tC02e/y)			1.007
Carbon sink potential - Mid - Restore	0	0	1,384
productivity (1000 tC02e/y)			00 5
Land impacted for carbon sink potential - High -	0	0	29.5
Accelerate regeneration (1000 hectares)			

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks	- Forests (con	tınuedJ	
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	424
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	1,751
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	80.7
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	182
Increase trees outside forests (1000 hectares)		0	102
Land impacted for carbon sink potential - High -	0	0	77.1
Reforest cropland (1000 hectares)	0	0	11.1
	0	0	101
Land impacted for carbon sink potential - High -	0	0	131
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	686
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	3,362
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	14.7
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	398
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	671
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	40.4
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	96
Increase trees outside forests (1000 hectares)		0	70
Land impacted for carbon sink potential - Low -	0	0	38.5
Reforest cropland (1000 hectares)	0	0	36.5
	0	0	22.7
Land impacted for carbon sink potential - Low -	0	U	22.1
Reforest pasture (1000 hectares)			/15
Land impacted for carbon sink potential - Low -	0	0	415
Restore productivity (1000 hectares)			1 (0)
Land impacted for carbon sink potential - Low -	0	0	1,696
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.1
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	411
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,211
Extend rotation length (1000 hectares)			.
Land impacted for carbon sink potential - Mid -	0	0	60.8
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)		0	0
Land impacted for carbon sink potential - Mid -	0	0	139
	0	0	137
Increase trees outside forests (1000 hectares)			E7.0
Land impacted for carbon sink potential - Mid -	0	0	57.8
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	164
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	836
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,902
Total impacted (over 30 years) (1000 hectares)			
	1		

Table EQ. DEC cooperio	PILLAR 1: Efficiency/Electrification -	Dooidontial
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Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	9.28	9.99	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Sales of cooking units - Gas (%)	38.7	38.7	38.7	38.7	38.7	38.7	38.7
Sales of space heating units - Electric Heat Pump	4.34	15.8	16.3	17.1	17.8	18.6	19.7
(%)							
Sales of space heating units - Electric Resistance	15.7	20.7	20.5	20.2	19.5	18.6	17.7
(%)							
Sales of space heating units - Fossil (%)	5.21	7.94	7.37	6.96	6.98	7	6.99
Sales of space heating units - Gas (%)	74.7	55.6	55.9	55.8	55.7	55.8	55.7
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
(%)							
Sales of water heating units - Electric Resistance	32.2	48.7	48.5	48.4	48.4	48.3	48.2
(%)							
Sales of water heating units - Gas Furnace (%)	67.7	51.2	51.4	51.4	51.5	51.6	51.6
Sales of water heating units - Other (%)	0.083	0.169	0.171	0.171	0.171	0.172	0.172

# 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 (%)	1.4	1.84	2.16	2.01	1.81	1.68	1.6
Vehicle sales - Light-duty - EV (%)	4.06	6.25	7.06	8.72	10.6	12.1	13.3
Vehicle sales - Light-duty - gasoline (%)	89.4	85.7	83.3	81.3	79.2	77.2	75.7
Vehicle sales - Light-duty - hybrid (%)	4.93	5.76	7	7.56	8.09	8.59	8.95
Vehicle sales - Light-duty - hydrogen FC (%)	0.11	0.371	0.337	0.297	0.293	0.293	0.303
Vehicle sales - Light-duty - other (%)	0.095	0.099	0.095	0.096	0.095	0.094	0.096
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)	372	372	369	360	351	351	360
Final energy use - Industry (PJ)	602	634	654	668	689	709	731
Final energy use - Residential (PJ)	555	517	496	481	472	466	461
Final energy use - Transportation (PJ)	953	894	818	774	775	799	830

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	36,280	37,607	0	0	0	0
Cumulative 5-yr (million \$2018)							
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	1.41	12.6	44.7	71.1	75.4	75.9	75.9
(%)							
Sales of space heating units - Electric Resistance	4.39	4.3	8.91	17.1	22.8	23.6	23.7
(%)							
Sales of space heating units - Fossil (%)	5.44	2.76	1.39	0.243	0.027	0.001	0
Sales of space heating units - Gas Furnace (%)	88.8	80.4	45	11.5	1.77	0.436	0.356
Sales of water heating units - Electric Heat Pump	0.454	0.344	0.348	0.348	0.342	0.344	0.345
(%)							

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	4.26	3.24	3.2	3.21	3.19	3.18	3.18
(%)							
Sales of water heating units - Gas Furnace (%)	95	96.2	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	5.42	5.51	10.6	11.3	10.6	11.1
Cumulative 5-yr (billion \$2018)							

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

	2025		2050
0.94	0	-7.03	-6.29
-1.29	0	-2.32	-2.42
-0.352	0	-9.35	-8.7
0	0	0	180
0	0	0	
U	U	U	21,474
0	0	0	3,130
0	0	0	3,434
0	0	0	219
0	0	0	4,749
0	0	0	1,920
0	0	0	1,166
0	0	0	4,605
0	0	0	2,070
0	0	0	90.3
0	0	0	5,927
0	0	0	522
0	0	0	1,319
0	0	0	112
0	0	0	1,583
0	0	0	672
0	0	0	583
0	0	0	349
0	0	0	698
0	0	0	135
0	0	0	13,699
	2020 0.94 -1.29 -0.352 0 0 0 0 0 0 0 0 0 0 0 0 0	2020         2025           0.94         0           -1.29         0           -0.352         0           0         0	0.94       0       -7.03         -1.29       0       -2.32         -0.352       0       -9.35         0       0       0         0       0       <

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

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	1,826
Carbon sink potential - Mid - Extend rotation	0	0	0	2,377
length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations	0	0	0	163
(1000 tCO2e/y) Carbon sink potential - Mid - Increase retention	0	0	0	3,166
of HWP (1000 tCO2e/y)  Carbon sink potential - Mid - Increase trees	0	0	0	1,296
outside forests (1000 tCO2e/y)  Carbon sink potential - Mid - Reforest cropland	0	0	0	874
(1000 tC02e/y)	0	0	0	2,477
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)				
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)	0	0	0	1,384
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	0	29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000	0	0	0	424
hectares)				
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	0	1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	0	80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - High -	0	0	0	182
Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - High -	0	0	0	77.1
Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - High -	0	0	0	131
Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - High -	0	0	0	686
Restore productivity (1000 hectares)  Land impacted for carbon sink potential - High -	0	0	0	3,362
Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	14.7
Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	398
Avoid deforestation (over 30 years) (1000 hectares)				
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low -	0	0	0	96
Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	38.5
Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	22.7
Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	415
Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low -	0	0	0	1,696
Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid -	0	0	0	22.1
Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid -	0	0	0	411
Avoid deforestation (over 30 years) (1000 hectares)		0		711

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid -	0	0	0	1,211
Extend rotation length (1000 hectares)				,
Land impacted for carbon sink potential - Mid -	0	0	0	60.8
Improve plantations (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	0
Increase retention of HWP (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	139
Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	57.8
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	164
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	836
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	2,902
Total impacted (over 30 years) (1000 hectares)				

# Table 64: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	5,616	3,730	3,272	3,037	2,944	2,760
(million 2019\$)							
Monetary damages from air pollution - Natural	0	287	334	429	450	425	367
Gas (million 2019\$)							
Monetary damages from air pollution -	0	4,043	4,133	4,226	4,344	4,463	4,584
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	630	419	367	341	330	310
(deaths)							
Premature deaths from air pollution - Natural	0	32.4	37.8	48.5	50.8	48	41.5
Gas (deaths)							
Premature deaths from air pollution -	0	455	465	475	489	502	516
Transportation (deaths)							