Net-Zero America - nebraska 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	1.79	2.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	74.2	79.7	96.5	99.8	100	100	100
Sales of cooking units - Gas (%)	25.8	20.3	3.47	0.175	0	0	0
Sales of space heating units - Electric Heat Pump	6.37	12.2	35.2	81.9	90.3	90.9	90.6
(%)							
Sales of space heating units - Electric Resistance	16.5	22	17.4	7.5	5.7	5.65	5.9
(%)							
Sales of space heating units - Fossil (%)	5.83	9.86	7.69	3.24	2.34	2.21	2.25
Sales of space heating units - Gas (%)	71.3	55.9	39.7	7.36	1.62	1.25	1.22
Sales of water heating units - Electric Heat Pump	0	0.739	10.1	30.7	34.4	34.6	34.6
(%)							
Sales of water heating units - Electric Resistance	35.5	51.5	55.3	63.7	65.3	65.4	65.3
(%)							
Sales of water heating units - Gas Furnace (%)	64.5	47.7	34.5	5.53	0.326	0	0
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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	377	964	1,565	2,370	2,580	2,460
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.061	0	0.695	0	3.07	0	4.98
Public EV charging plugs - L2 (1000 units)	0.164	0	16.7	0	74	0	120
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 (%)	1.66	1.92	1.3	0.418	0.076	0.013	0
Vehicle sales - Light-duty - EV (%)	3.53	14	44.6	81.1	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.5	79.4	50.7	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.05	4.27	3.08	1.16	0.28	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.346	0.212	0.066	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.068	0.024	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)	70.8	69.4	66.6	62.4	57.8	54.2	52.1
Final energy use - Industry (PJ)	281	293	298	298	301	304	307
Final energy use - Residential (PJ)	86.4	81.9	77.8	69.7	60.5	53.3	48.7
Final energy use - Transportation (PJ)	182	170	150	125	103	89.2	83.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,541	6,031	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	3.92	7.61	30.1	78	86.6	87.1	87.1
Sales of space heating units - Electric Resistance (%)	6.31	5.8	8.21	11.8	12.4	12.4	12.4
Sales of space heating units - Fossil (%)	0	1.82	0.351	0.015	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 (%)	89.8	84.8	61.3	10.2	1.03	0.454	0.456
Sales of water heating units - Electric Heat Pump (%)	0.944	1.84	14.5	42	47	47.3	47.3
Sales of water heating units - Electric Resistance (%)	8.03	8	20.3	47	51.8	52.1	52.1
Sales of water heating units - Gas Furnace (%)	90.2	89.2	64.5	10.3	0.61	0	0
Sales of water heating units - Other (%)	0.788	0.941	0.732	0.684	0.681	0.683	0.683

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.62	1.68	2.88	3.08	2.81	2.96
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	0.013	0.004	0	0
plant (billion \$2018)							
Capital invested - Biomass w/ccu power plant	0	0	0	0	0.005	0	0.597
(billion \$2018)							
Capital invested - Solar PV - Base (billion \$2018)	0	2.03	11	9.43	6.82	5.94	15.3
Capital invested - Solar PV - Constrained (billion	0	3.44	13.4	6.07	7	7.8	11.1
\$2018)							
Capital invested - Wind - Base (billion \$2018)	0	0.55	11.5	23.7	25.9	28.6	37
Capital invested - Wind - Constrained (billion	0	17	13.9	23.4	20.3	25.7	27.6
\$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	13.1	17.1	17.1	17.1
Biomass w/ccu power plant (GWh)	0	0	0	0	5.71	5.71	676
Solar - Base land use assumptions (GWh)	3.05	2,886	17,500	16,511	12,674	11,749	32,035
Solar - Constrained land use assumptions (GWh)	0	5,512	13,421	11,662	11,432	16,132	28,383
Wind - Base land use assumptions (GWh)	13,033	1,310	30,087	66,059	74,417	85,745	117,331
Wind - Constrained land use assumptions (GWh)	13,033	19,444	38,260	65,181	60,818	77,662	83,575

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

Table 6. E. Containe Tilling C. Crean Jacie Bre		2005	0000	0005	00/0	0015	2050
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	47.4	122	699	3,814
Conversion capital investment - Cumulative 5-yr	0	0	0	687	1,056	8,178	62,939
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	2	11	29
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	1	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	33
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	0.86	2.21	12.7	56.8
Annual - BECCS (MMT)	0	0	0	0.86	2.21	12.7	56.8
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	0.86	3.07	15.8	72.6
Cumulative - BECCS (MMT)	0	0	0	0.86	3.07	15.8	72.6
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	276	678	573	1,227	4,968
Cumulative investment - All (million \$2018)	0	0	1,459	2,992	2,939	3,694	6,651
Cumulative investment - Spur (million \$2018)	0	0	0	72.9	19.6	775	3,732
Cumulative investment - Trunk (million \$2018)	0	0	1,459	2,919	2,919	2,919	2,919
Spur (km)	0	0	0	126	21.5	675	4,416
Trunk (km)	0	0	276	552	552	552	552

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

2020 2	025	2050
sink potential - Aggressive deployment - 0	0	-2,594
nanol to energy grasses (1000 tCO2e/y)		
sink potential - Aggressive deployment - 0	0	-7,779
d measures (1000 tCO2e/y)		
sink potential - Aggressive deployment - 0	0	-286
ent conservation cover (1000 tCO2e/y)		
sink potential - Aggressive deployment - 0	0	-10,659
00 tC02e/y)		
sink potential - Moderate deployment - 0	0	-2,594
nanol to energy grasses (1000 tCO2e/y)		
sink potential - Moderate deployment - 0	0	-4,000
d measures (1000 tCO2e/y)		
sink potential - Moderate deployment - 0	0	-143
ent conservation cover (1000 tCO2e/y)		
sink potential - Moderate deployment - 0	0	-6,737
pacted for carbon sink - Aggressive 0	0	1,456
ent - Corn-ethanol to energy grasses		
	0	7,064
pacted for carbon sink - Aggressive 0	0	489
ent - Permanent conservation cover		
ctares)		
pacted for carbon sink - Aggressive 0	0	9,008
ent - Total (1000 hectares)		
pacted for carbon sink - Moderate 0	0	1,456
ent - Corn-ethanol to energy grasses		
ctares)		
oo tCO2e/y) sink potential - Moderate deployment - nanol to energy grasses (1000 tCO2e/y) sink potential - Moderate deployment - d measures (1000 tCO2e/y) sink potential - Moderate deployment - ent conservation cover (1000 tCO2e/y) sink potential - Moderate deployment - oo tCO2e/y) sink potential - Moderate deployment - oo tCO2e/y) sink potential - Moderate deployment - oo tCO2e/y) sacted for carbon sink - Aggressive ent - Corn-ethanol to energy grasses sectares) sacted for carbon sink - Aggressive ent - Cropland measures (1000 s) soacted for carbon sink - Aggressive ent - Permanent conservation cover sectares) sacted for carbon sink - Aggressive ent - Total (1000 hectares) sacted for carbon sink - Moderate ent - Corn-ethanol to energy grasses	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-2,5° -4,00 -1,-6,7 1,4- 7,00 4- 9,00

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate	0	0	3,654
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	244
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	5,354
deployment - Total (1000 hectares)			

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	248
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	17,146
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	947
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	427
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	46.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	285
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)	0	0	2,717
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	7,855
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,189
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	43
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)	0	0	124
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)	0	0	5,906
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	164
Carbon sink potential - Low - Improve plantations (1000 tC02e/y)	0	0	23.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	9
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	95
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	3,928
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	31
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	14
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	180
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	11,520
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	550
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	290
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	34.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	190

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo			
Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees	0	0	1,834
outside forests (1000 tC02e/y)	0	0	F 001
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	5,891
Carbon sink potential - Mid - Reforest pasture	0	0	2,253
(1000 tCO2e/y)	U	U	2,233
Carbon sink potential - Mid - Restore	0	0	288
	U	U	288
productivity (1000 tC02e/y)	0	0	/ 0 5
Land impacted for carbon sink potential - High -	0	0	40.5
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High -	0	0	100
	0	0	128
Avoid deforestation (over 30 years) (1000			
hectares)	0	0	010
Land impacted for carbon sink potential - High -	0	0	218
Extend rotation length (1000 hectares)	0	0	17.0
Land impacted for carbon sink potential - High -	0	0	17.3
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)			050
Land impacted for carbon sink potential - High -	0	0	258
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	519
Reforest cropland (1000 hectares)	_	_	
Land impacted for carbon sink potential - High -	0	0	119
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	143
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,443
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	120
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	83.4
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	8.63
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	136
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	260
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.6
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	86.4
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	735
Total impacted (over 30 years) (1000 hectares)			100
Land impacted for carbon sink potential - Mid -	0	0	30.4
Accelerate regeneration (1000 hectares)		<u> </u>	00.4
Land impacted for carbon sink potential - Mid -	0	0	124
Avoid deforestation (over 30 years) (1000	o	0	124
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	151
Extend rotation length (1000 hectares)	o	U	וטו
	0	0	10
Land impacted for carbon sink potential - Mid -	U	U	13
Improve plantations (1000 hectares)	0		
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)			107
Land impacted for carbon sink potential - Mid -	0	0	197
Increase trees outside forests (1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid -	0	0	390
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	149
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	174
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,228
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	126	0.123	0.116	0.092	0.062	0.001
(million 2019\$)							
Monetary damages from air pollution - Natural	0	73.5	43.7	18.5	11.7	7.14	3.49
Gas (million 2019\$)							
Monetary damages from air pollution -	0	195	183	140	81.3	37.2	14.7
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	14.1	0.014	0.013	0.01	0.007	0
(deaths)							
Premature deaths from air pollution - Natural	0	8.31	4.94	2.09	1.32	0.806	0.395
Gas (deaths)							
Premature deaths from air pollution -	0	22	20.6	15.7	9.14	4.19	1.65
Transportation (deaths)							

Table 15: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	3,679	3,679	3,685	3,623	2,083	1,054	3,462
By economic sector - Construction (jobs)	3,806	5,602	16,136	23,789	28,510	34,963	55,610
By economic sector - Manufacturing (jobs)	4,243	6,180	7,502	9,750	9,262	8,469	13,621
By economic sector - Mining (jobs)	1,411	1,054	702	481	303	184	105
By economic sector - Other (jobs)	272	586	2,339	3,234	3,948	4,846	8,590
By economic sector - Pipeline (jobs)	201	199	349	315	105	99.8	425
By economic sector - Professional (jobs)	2,927	3,529	8,228	13,833	18,367	24,472	40,728
By economic sector - Trade (jobs)	3,189	3,206	5,632	8,311	10,371	13,345	21,991
By economic sector - Utilities (jobs)	4,787	5,243	10,308	17,535	21,910	28,841	47,111
By education level - All sectors - Associates	6,529	8,127	16,530	25,051	30,079	37,368	61,009
degree or some college (jobs)							
By education level - All sectors - Bachelors	4,635	5,488	10,348	15,757	19,124	24,036	39,535
degree (jobs)							
By education level - All sectors - Doctoral degree	159	188	397	627	797	1,035	1,715
(jobs)							
By education level - All sectors - High school	12,058	14,142	25,005	35,392	39,857	47,457	78,860
diploma or less (jobs)							
By education level - All sectors - Masters or	1,135	1,334	2,602	4,044	5,000	6,378	10,524
professional degree (jobs)							
By resource sector - Biomass (jobs)	8,884	8,621	8,390	8,104	4,972	4,014	15,388
By resource sector - CO2 (jobs)	0	0	1,453	1,457	14.1	247	3,162
By resource sector - Coal (jobs)	1,639	1,025	257	0	0	0	0
By resource sector - Grid (jobs)	6,414	7,621	16,428	30,894	41,013	53,982	87,725
By resource sector - Natural Gas (jobs)	1,685	1,577	1,420	1,280	1,070	1,313	1,251
By resource sector - Nuclear (jobs)	411	404	398	231	0.007	0.015	0.026
By resource sector - Oil (jobs)	2,596	2,295	1,889	1,433	1,005	703	450
By resource sector - Solar (jobs)	683	3,760	14,627	15,670	15,382	15,001	29,215
By resource sector - Wind (jobs)	2,204	3,975	10,020	21,801	31,402	41,013	54,454
Median wages - Annual - All (\$2019 per job)	53,266	53,898	55,469	57,289	58,995	60,632	61,479
On-Site or In-Plant Training - Total jobs - 1 to 4	3,416	4,224	8,567	12,917	15,446	19,150	31,237
years (jobs)							
On-Site or In-Plant Training - Total jobs - 4 to 10	1,329	1,641	3,637	5,562	6,755	8,490	13,771
years (jobs)							
On-Site or In-Plant Training - Total jobs - None	3,847	4,653	8,875	13,119	15,487	19,057	31,441
(jobs)							

Table 15: E+ scenario - IMPACTS - Jobs (continued	Table 15: <i>E</i>	+ scenario -	IMPACTS	Inhs	<i>(continued</i>
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Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10	200	244	483	726	860	1,060	1,729
years (jobs)							
On-Site or In-Plant Training - Total jobs - Up to 1	15,722	18,516	33,320	48,546	56,310	68,515	113,466
year (jobs)							
On-the-Job Training - All sectors - 1 to 4 years	4,197	5,243	10,903	16,590	19,991	24,911	40,519
(jobs)							
On-the-Job Training - All sectors - 4 to 10 years	1,240	1,556	3,585	5,517	6,735	8,490	13,752
(jobs)							
On-the-Job Training - All sectors - None (jobs)	1,402	1,652	3,065	4,436	5,168	6,301	10,438
On-the-Job Training - All sectors - Over 10 years	207	269	531	766	885	1,057	1,706
(jobs)							
On-the-Job Training - All sectors - Up to 1 year	17,469	20,559	36,798	53,562	62,080	75,515	125,229
(jobs)							
Related work experience - All sectors - 1 to 4	8,174	9,814	18,898	28,302	33,735	41,852	68,915
years (jobs)							
Related work experience - All sectors - 4 to 10	4,940	6,040	12,063	18,303	22,044	27,492	44,903
years (jobs)							
Related work experience - All sectors - None	3,832	4,504	8,224	11,928	13,773	16,748	27,786
(jobs)							
Related work experience - All sectors - Over 10	1,332	1,645	3,158	4,764	5,689	7,031	11,460
years (jobs)							
Related work experience - All sectors - Up to 1	6,236	7,275	12,540	17,573	19,616	23,150	38,579
year (jobs)							
Wage income - All (million \$2019)	1,306	1,578	3,045	4,634	5,597	7,051	11,784

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	142	144	121	97.3	73.2	46.1	32
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	2,931
Natural gas production - Annual (tcf)	0.477	0.529	0.5	0.435	0.368	0.292	0.227
Oil consumption - Annual (million bbls)	48.1	46.1	40.8	32.6	24.4	18	12.3
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	991
Oil production - Annual (million bbls)	2.46	2.66	2.67	2.67	2.12	1.72	1.14

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	1.78	2.27	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	74.1	74.8	77.2	83.4	92.1	97.4	99.3
Sales of cooking units - Gas (%)	25.9	25.2	22.8	16.6	7.91	2.55	0.687
Sales of space heating units - Electric Heat Pump	6.37	11	13.7	22.5	43.2	68.9	83.6
(%)							
Sales of space heating units - Electric Resistance	16.5	22.2	21.5	19.8	15.5	10.2	7.2
(%)							
Sales of space heating units - Fossil (%)	5.83	9.99	9.81	8.95	6.83	4.3	2.95
Sales of space heating units - Gas (%)	71.3	56.8	54.9	48.8	34.5	16.7	6.23
Sales of water heating units - Electric Heat Pump	0	0.395	1.48	5.1	13.9	24.9	31.5
(%)							
Sales of water heating units - Electric Resistance	35.5	51.4	51.8	53.2	56.8	61.3	64
(%)							
Sales of water heating units - Gas Furnace (%)	64.5	48.2	46.7	41.7	29.3	13.7	4.47
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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	60.7	128	432	1,362	1,983
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.061	0	0.212	0	1.14	0	3.19
Public EV charging plugs - L2 (1000 units)	0.164	0	5.1	0	27.4	0	76.8
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 (%)	1.68	2.07	2.08	1.66	1.07	0.552	0.236
Vehicle sales - Light-duty - EV (%)	1.75	4.38	11.2	24.9	47.3	71.3	87.3
Vehicle sales - Light-duty - gasoline (%)	92.2	88	80.6	67.9	47.4	25.6	11.3
Vehicle sales - Light-duty - hybrid (%)	4.19	5.02	5.67	5.21	3.97	2.38	1.16
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.384	0.333	0.257	0.184	0.103	0.048
Vehicle sales - Light-duty - other (%)	0.108	0.111	0.102	0.089	0.065	0.036	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	70.8	69.4	67.5	65.7	63.5	60.8	58.1
Final energy use - Industry (PJ)	281	293	300	302	307	311	314
Final energy use - Residential (PJ)	86.4	82	78.8	75.5	71.4	65.8	59.3
Final energy use - Transportation (PJ)	182	171	156	144	135	124	111

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,540	6,039	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric Heat Pump	3.92	6.69	9.32	17.9	38.6	64.5	79.7
(%)							
Sales of space heating units - Electric Resistance	6.31	5.58	5.85	6.72	8.6	10.7	11.9
(%)							
Sales of space heating units - Fossil (%)	0	2.1	1.98	1.48	0.719	0.234	0.062
Sales of space heating units - Gas Furnace (%)	89.8	85.6	82.9	73.9	52.1	24.5	8.31
Sales of water heating units - Electric Heat Pump	0.944	1.35	2.81	7.68	19.4	34.3	43
(%)							
Sales of water heating units - Electric Resistance	8.03	7.53	8.96	13.7	25.1	39.5	48
(%)							
Sales of water heating units - Gas Furnace (%)	90.2	90.1	87.3	77.8	54.7	25.5	8.33
Sales of water heating units - Other (%)	0.788	0.981	0.957	0.887	0.782	0.716	0.691
-							

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.33	1.36	1.77	1.84	2.53	2.68
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	-2,594
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,779
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-286
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-10,659
Total (1000 tC02e/y)			

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

Table 22. E Section of TEEAN O. Earla Siliks	igi icaitai c (c	ontinucuj	
Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-2,594
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-4,000
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-143
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-6,737
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	7,064
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	489
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	9,008
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,654
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	244
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	5,354
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	248
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	17,146
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	947
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	427
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	46.9
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	285
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,717
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	7,855
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,189
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	431
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	124
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	5,906
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	164
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	23.8

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

Table 23: E- scenario - PILLAR 6: Land sinks - Fo			0050
Item Carbon sink potential - Low - Increase retention	2020	2025	2050 95
of HWP (1000 tCO2e/y)		0	75
Carbon sink potential - Low - Increase trees	0	0	951
outside forests (1000 tCO2e/y)			701
Carbon sink potential - Low - Reforest cropland	0	0	3,928
(1000 tCO2e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	317
(1000 tCO2e/y)			
Carbon sink potential - Low - Restore	0	0	145
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	186
regeneration (1000 tCO2e/y)			11 50/
Carbon sink potential - Mid - All (not counting	0	0	11,526
overlap) (1000 tC02e/y)	0	0	EEO
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	"	U	553
Carbon sink potential - Mid - Extend rotation	0	0	296
length (1000 tC02e/y)		0	270
Carbon sink potential - Mid - Improve plantations	0	0	34.9
(1000 tC02e/y)			04.7
Carbon sink potential - Mid - Increase retention	0	0	190
of HWP (1000 tCO2e/y)		-	
Carbon sink potential - Mid - Increase trees	0	0	1,834
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	5,891
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,253
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	288
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	40.5
Accelerate regeneration (1000 hectares)			100
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000	0	0	128
hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Extend rotation length (1000 hectares)		0	210
Land impacted for carbon sink potential - High -	0	0	17.3
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	258
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	519
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	119
Reforest pasture (1000 hectares)		_	
Land impacted for carbon sink potential - High -	0	0	143
Restore productivity (1000 hectares)			1 / / 0
Land impacted for carbon sink potential - High -	0	0	1,443
Total impacted (over 30 years) (1000 hectares)	0	0	20.0
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	"	0	20.2
Land impacted for carbon sink potential - Low -	0	0	120
Avoid deforestation (over 30 years) (1000	"	U	120
hectares)			
Land impacted for carbon sink potential - Low -	0	0	83.4
Extend rotation length (1000 hectares)		<u> </u>	55.4
Land impacted for carbon sink potential - Low -	0	0	8.63
Improve plantations (1000 hectares)			
Improve plantations (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	136
Increase trees outside forests (1000 hectares)		0	100
Land impacted for carbon sink potential - Low -	0	0	260
Reforest cropland (1000 hectares)		0	200
Land impacted for carbon sink potential - Low -	0	0	20.6
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	86.4
Restore productivity (1000 hectares)			00
Land impacted for carbon sink potential - Low -	0	0	735
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	30.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	124
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	151
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13
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	197
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	390
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	149
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	174
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,228
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	126	0.123	0.116	0.092	0.062	0.001
(million 2019\$)							
Monetary damages from air pollution - Natural	0	81.7	39.4	14.4	6.66	2.65	2.09
Gas (million 2019\$)							
Monetary damages from air pollution -	0	198	202	197	179	143	98.4
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	14.1	0.014	0.013	0.01	0.007	0
(deaths)							
Premature deaths from air pollution - Natural	0	9.23	4.45	1.63	0.753	0.3	0.236
Gas (deaths)							
Premature deaths from air pollution -	0	22.3	22.7	22.2	20.1	16.1	11.1
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	1.79	2.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	74.2	79.7	96.5	99.8	100	100	100
Sales of cooking units - Gas (%)	25.8	20.3	3.47	0.175	0	0	0
Sales of space heating units - Electric Heat Pump	6.37	12.2	35.2	81.9	90.3	90.9	90.6
(%)							
Sales of space heating units - Electric Resistance	16.5	22	17.4	7.5	5.7	5.65	5.9
(%)							
Sales of space heating units - Fossil (%)	5.83	9.86	7.69	3.24	2.34	2.21	2.25
Sales of space heating units - Gas (%)	71.3	55.9	39.7	7.36	1.62	1.25	1.22
Sales of water heating units - Electric Heat Pump	0	0.739	10.1	30.7	34.4	34.6	34.6
(%)							

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	35.5	51.5	55.3	63.7	65.3	65.4	65.3
(%)							
Sales of water heating units - Gas Furnace (%)	64.5	47.7	34.5	5.53	0.326	0	0
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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	377	964	1,565	2,370	2,580	2,460
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.061	0	0.695	0	3.07	0	4.98
Public EV charging plugs - L2 (1000 units)	0.164	0	16.7	0	74	0	120
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 (%)	1.66	1.92	1.3	0.418	0.076	0.013	0
Vehicle sales - Light-duty - EV (%)	3.53	14	44.6	81.1	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.5	79.4	50.7	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.05	4.27	3.08	1.16	0.28	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.346	0.212	0.066	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.068	0.024	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)	70.8	69.4	66.6	62.4	57.8	54.2	52.1
Final energy use - Industry (PJ)	281	293	298	298	301	304	307
Final energy use - Residential (PJ)	86.4	81.9	77.8	69.7	60.5	53.3	48.7
Final energy use - Transportation (PJ)	182	170	150	125	103	89.2	83.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,541	6,031	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump	3.92	7.61	30.1	78	86.6	87.1	87.1
(%)							
Sales of space heating units - Electric Resistance	6.31	5.8	8.21	11.8	12.4	12.4	12.4
(%)							
Sales of space heating units - Fossil (%)	0	1.82	0.351	0.015	0	0	0
Sales of space heating units - Gas Furnace (%)	89.8	84.8	61.3	10.2	1.03	0.454	0.456
Sales of water heating units - Electric Heat Pump	0.944	1.84	14.5	42	47	47.3	47.3
(%)							
Sales of water heating units - Electric Resistance	8.03	8	20.3	47	51.8	52.1	52.1
(%)							
Sales of water heating units - Gas Furnace (%)	90.2	89.2	64.5	10.3	0.61	0	0
Sales of water heating units - Other (%)	0.788	0.941	0.732	0.684	0.681	0.683	0.683

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.62	1.68	2.88	3.08	2.81	2.96
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	15.6	12	14.6	12.2	52.8
Capital invested - Wind - Base (billion \$2018)	0	2.4	13.8	28.7	46.8	55.8	72.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	3.05	0	24,913	21,186	27,829	24,604	116,034
Solar - Constrained land use assumptions (GWh)	3.05	0	28,987	19,022	22,015	28,639	79,291
Wind - Base land use assumptions (GWh)	13,033	5,731	36,051	79,728	133,394	167,139	226,317
Wind - Constrained land use assumptions (GWh)	13,033	25,603	44,290	78,529	113,434	133,374	221,760

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

Table 32. L+NL+ Scenario - Fillan o. Lana sinks			
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-2,594
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,779
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-286
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-10,659
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-2,594
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-4,000
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-143
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-6,737
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	7,064
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	489
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	9,008
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,654
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	244
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	5,354
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	248
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	17,146
overlap) (1000 tC02e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	947
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	427
length (1000 tC02e/y)			
Carbon sink potential - High - Improve	0	0	46.9
plantations (1000 tC02e/y)			10.7
Carbon sink potential - High - Increase retention	0	0	285
of HWP (1000 tC02e/y)	0	0	200
Carbon sink potential - High - Increase trees	0	0	2,717
outside forests (1000 tC02e/y)	0	0	۷,۱۱۱
Carbon sink potential - High - Reforest cropland	0	0	7,855
	U	0	1,000
(1000 tC02e/y)	0	0	/ 100
Carbon sink potential - High - Reforest pasture	0	0	4,189
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	431
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	124
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,906
overlap) (1000 tC02e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	158
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	164
length (1000 tC02e/y)			
Carbon sink potential - Low - Improve	0	0	23.8
plantations (1000 tCO2e/y)			_0.0
Carbon sink potential - Low - Increase retention	0	0	95
of HWP (1000 tC02e/y)		0	70
Carbon sink potential - Low - Increase trees	0	0	951
outside forests (1000 tC02e/y)	0	0	701
Carbon sink potential - Low - Reforest cropland	0	0	3,928
(1000 tCO2e/y)	0	0	3,720
Carbon sink potential - Low - Reforest pasture	0	0	317
•	U	0	317
(1000 tC02e/y)	0	-	1/ 5
Carbon sink potential - Low - Restore	0	0	145
productivity (1000 tC02e/y)			
Carbon sink potential - Mid - Accelerate	0	0	186
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	11,526
overlap) (1000 tC02e/y)			
Carbon sink potential - Mid - Avoid deforestation	0	0	553
(1000 tC02e/y)			
Carbon sink potential - Mid - Extend rotation	0	0	296
length (1000 tC02e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	34.9
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	190
of HWP (1000 tCO2e/y)			.,,
Carbon sink potential - Mid - Increase trees	0	0	1,834
outside forests (1000 tC02e/y)	0	0	1,004
Carbon sink potential - Mid - Reforest cropland	0	0	E 001
	U	U	5,891
(1000 tC02e/y)			0.050
Carbon sink potential - Mid - Reforest pasture	0	0	2,253
(1000 tC02e/y)			000
Carbon sink potential - Mid - Restore	0	0	288
productivity (1000 tCO2e/y)			
	0	0	40.5

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	128
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	17.3
	U	0	11.5
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	258
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	519
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	119
Reforest pasture (1000 hectares)	o	•	117
Land impacted for carbon sink potential - High -	0	0	1/.9
	U	0	143
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,443
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	120
Avoid deforestation (over 30 years) (1000	o	0	120
hectares)			00.7
Land impacted for carbon sink potential - Low -	0	0	83.4
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	8.63
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	136
Increase trees outside forests (1000 hectares)	0	0	150
	0	0	0/0
Land impacted for carbon sink potential - Low -	0	0	260
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.6
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	86.4
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	735
Total impacted (over 30 years) (1000 hectares)	· ·		.00
Land impacted for carbon sink potential - Mid -	0	0	30.4
	U	U	30.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	124
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	151
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13
The state of the s	o	0	10
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	197
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	390
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	149
	0	١ -	147
Reforest pasture (1000 hectares)			477
Land impacted for carbon sink potential - Mid -	0	0	174
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,228
Total impacted (over 30 years) (1000 hectares)			
rotar impactou (over ou your o) (1000 ficulai 65)			

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	126	0.123	0.116	0.092	0.062	0.001
(million 2019\$)							
Monetary damages from air pollution - Natural	0	68.4	37.8	10.9	6.51	2.87	1.88
Gas (million 2019\$)							
Monetary damages from air pollution -	0	195	183	140	81.3	37.2	14.7
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	14.1	0.014	0.013	0.01	0.007	0
(deaths)							
Premature deaths from air pollution - Natural	0	7.72	4.27	1.24	0.735	0.324	0.212
Gas (deaths)							
Premature deaths from air pollution -	0	22	20.6	15.7	9.14	4.19	1.65
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	1.79	2.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	74.2	79.7	96.5	99.8	100	100	100
Sales of cooking units - Gas (%)	25.8	20.3	3.47	0.175	0	0	0
Sales of space heating units - Electric Heat Pump	6.37	12.2	35.2	81.9	90.3	90.9	90.6
(%)							
Sales of space heating units - Electric Resistance	16.5	22	17.4	7.5	5.7	5.65	5.9
(%)							
Sales of space heating units - Fossil (%)	5.83	9.86	7.69	3.24	2.34	2.21	2.25
Sales of space heating units - Gas (%)	71.3	55.9	39.7	7.36	1.62	1.25	1.22
Sales of water heating units - Electric Heat Pump	0	0.739	10.1	30.7	34.4	34.6	34.6
(%)							
Sales of water heating units - Electric Resistance	35.5	51.5	55.3	63.7	65.3	65.4	65.3
(%)							
Sales of water heating units - Gas Furnace (%)	64.5	47.7	34.5	5.53	0.326	0	0
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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	377	964	1,565	2,370	2,580	2,460
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.061	0	0.695	0	3.07	0	4.98
Public EV charging plugs - L2 (1000 units)	0.164	0	16.7	0	74	0	120
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 (%)	1.66	1.92	1.3	0.418	0.076	0.013	0
Vehicle sales - Light-duty - EV (%)	3.53	14	44.6	81.1	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.5	79.4	50.7	17.3	3.39	0.593	0
Vehicle sales - Light-duty - hybrid (%)	4.05	4.27	3.08	1.16	0.28	0.06	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.346	0.212	0.066	0.013	0.002	0
Vehicle sales - Light-duty - other (%)	0.107	0.103	0.068	0.024	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)	70.8	69.4	66.6	62.4	57.8	54.2	52.1
Final energy use - Industry (PJ)	281	293	298	298	301	304	307
Final energy use - Residential (PJ)	86.4	81.9	77.8	69.7	60.5	53.3	48.7
Final energy use - Transportation (PJ)	182	170	150	125	103	89.2	83.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,541	6,031	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump	3.92	7.61	30.1	78	86.6	87.1	87.1
(%)							
Sales of space heating units - Electric Resistance	6.31	5.8	8.21	11.8	12.4	12.4	12.4
(%)							
Sales of space heating units - Fossil (%)	0	1.82	0.351	0.015	0	0	0
Sales of space heating units - Gas Furnace (%)	89.8	84.8	61.3	10.2	1.03	0.454	0.456
Sales of water heating units - Electric Heat Pump	0.944	1.84	14.5	42	47	47.3	47.3
(%)							
Sales of water heating units - Electric Resistance	8.03	8	20.3	47	51.8	52.1	52.1
(%)							
Sales of water heating units - Gas Furnace (%)	90.2	89.2	64.5	10.3	0.61	0	0
Sales of water heating units - Other (%)	0.788	0.941	0.732	0.684	0.681	0.683	0.683

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.62	1.68	2.88	3.08	2.81	2.96
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	5.7	3.92	4.66	3.09	1.34	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	2.15	3.06	7.09	4.01	1.27	0
Capital invested - Wind - Base (billion \$2018)	0	0	3.21	9.2	11.5	16.6	0.769
Capital invested - Wind - Constrained (billion \$2018)	0	2.45	9.77	10.6	13.1	16.1	0.65

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	622	8,129	6,288	8,093	5,727	2,599	0
Solar - Constrained land use assumptions (GWh)	348	3,080	4,933	12,356	7,405	2,497	0
Wind - Base land use assumptions (GWh)	13,033	0	8,466	25,822	33,799	50,787	2,455
Wind - Constrained land use assumptions (GWh)	13,033	5,785	25,419	29,011	37,227	48,462	1,995

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-2,594
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,779
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-286
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-10,659
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-2,594
Corn-ethanol to energy grasses (1000 tC02e/y)			

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

Table 42. LTNL Scenario Tillan G. Lana Siling	rigilicultu	i e (continu	Juj
Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-4,000
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-143
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-6,737
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	7,064
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	489
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	9,008
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,456
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,654
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	244
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	5,354
deployment - Total (1000 hectares)			

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

Titem 2020 Carbon sink potential - High - Accelerate 0 regeneration (1000 tC02e/y) Carbon sink potential - High - All (not counting 0	2025 0 0	2050 248
regeneration (1000 tC02e/y) Carbon sink potential - High - All (not counting 0		240
Carbon sink potential - High - All (not counting 0	0	
	0	17,146
overlap) (1000 tC02e/y)		11,140
Carbon sink potential - High - Avoid deforestation 0	0	947
(1000 tC02e/y)	0	741
Carbon sink potential - High - Extend rotation 0	0	427
length (1000 tC02e/y)	0	421
Carbon sink potential - High - Improve 0	0	46.9
plantations (1000 tC02e/y)	0	40.7
Carbon sink potential - High - Increase retention 0	0	285
of HWP (1000 tC02e/y)	0	200
Carbon sink potential - High - Increase trees 0	0	2,717
outside forests (1000 tC02e/y)		_,
Carbon sink potential - High - Reforest cropland 0	0	7,855
(1000 tCO2e/y)		1,000
Carbon sink potential - High - Reforest pasture 0	0	4,189
(1000 tC02e/y)		
Carbon sink potential - High - Restore 0	0	431
productivity (1000 tCO2e/y)		
Carbon sink potential - Low - Accelerate 0	0	124
regeneration (1000 tC02e/y)		
Carbon sink potential - Low - All (not counting 0	0	5,906
overlap) (1000 tC02e/y)		
Carbon sink potential - Low - Avoid deforestation 0	0	158
(1000 tC02e/y)		
Carbon sink potential - Low - Extend rotation 0	0	164
length (1000 tCO2e/y)		
Carbon sink potential - Low - Improve 0	0	23.8
plantations (1000 tCO2e/y)		
Carbon sink potential - Low - Increase retention 0	0	95
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	- Forests (c	ontinued)	
Item	2020	2025	2050
Carbon sink potential - Low - Increase trees	0	0	951
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	3,928
(1000 tC02e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	317
(1000 tCO2e/y)		-	
Carbon sink potential - Low - Restore	0	0	145
productivity (1000 tCO2e/y)			1-0
Carbon sink potential - Mid - Accelerate	0	0	186
regeneration (1000 tC02e/y)		0	100
Carbon sink potential - Mid - All (not counting	0	0	11,526
overlap) (1000 tC02e/y)		0	11,320
Carbon sink potential - Mid - Avoid deforestation	0	0	553
(1000 tC02e/y)		0	333
	0	0	207
Carbon sink potential - Mid - Extend rotation	0	0	296
length (1000 tC02e/y)			0/.0
Carbon sink potential - Mid - Improve plantations	0	0	34.9
(1000 tC02e/y)	_	_	
Carbon sink potential - Mid - Increase retention	0	0	190
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	1,834
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	5,891
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,253
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	288
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	40.5
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	128
Avoid deforestation (over 30 years) (1000			0
hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Extend rotation length (1000 hectares)		•	210
Land impacted for carbon sink potential - High -	0	0	17.3
Improve plantations (1000 hectares)		0	11.0
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)	0	0	U
	0	0	050
Land impacted for carbon sink potential - High -	0	0	258
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	519
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	119
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	143
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,443
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	120
Avoid deforestation (over 30 years) (1000		-	
hectares)			
Land impacted for carbon sink potential - Low -	0	0	83.4
Extend rotation length (1000 hectares)		0	00.4
	0	0	0 / 0
Land impacted for carbon sink potential - Low -	0	U	8.63
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			
	0	0	136
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	•	

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	260
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.6
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	86.4
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	735
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	30.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	124
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	151
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13
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	197
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	390
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	149
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	174
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,228
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	126	0.123	0.116	0.092	0.062	0.001
(million 2019\$)							
Monetary damages from air pollution - Natural	0	75.3	34	42.7	25.1	10.1	4.53
Gas (million 2019\$)							
Monetary damages from air pollution -	0	195	183	140	81.3	37.2	14.7
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	14.1	0.014	0.013	0.01	0.007	0
(deaths)							
Premature deaths from air pollution - Natural	0	8.5	3.85	4.82	2.84	1.14	0.512
Gas (deaths)							
Premature deaths from air pollution -	0	22	20.6	15.7	9.14	4.19	1.65
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	1.78	2.27	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	74.1	74.8	77.2	83.4	92.1	97.4	99.3
Sales of cooking units - Gas (%)	25.9	25.2	22.8	16.6	7.91	2.55	0.687
Sales of space heating units - Electric Heat Pump	6.37	11	13.7	22.5	43.2	68.9	83.6
(%)							
Sales of space heating units - Electric Resistance	16.5	22.2	21.5	19.8	15.5	10.2	7.2
(%)							
Sales of space heating units - Fossil (%)	5.83	9.99	9.81	8.95	6.83	4.3	2.95
Sales of space heating units - Gas (%)	71.3	56.8	54.9	48.8	34.5	16.7	6.23
Sales of water heating units - Electric Heat Pump	0	0.395	1.48	5.1	13.9	24.9	31.5
(%)							
Sales of water heating units - Electric Resistance	35.5	51.4	51.8	53.2	56.8	61.3	64
(%)							

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 (%)	64.5	48.2	46.7	41.7	29.3	13.7	4.47
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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	60.7	128	432	1,362	1,983
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.061	0	0.212	0	1.14	0	3.19
Public EV charging plugs - L2 (1000 units)	0.164	0	5.1	0	27.4	0	76.8
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 (%)	1.68	2.07	2.08	1.66	1.07	0.552	0.236
Vehicle sales - Light-duty - EV (%)	1.75	4.38	11.2	24.9	47.3	71.3	87.3
Vehicle sales - Light-duty - gasoline (%)	92.2	88	80.6	67.9	47.4	25.6	11.3
Vehicle sales - Light-duty - hybrid (%)	4.19	5.02	5.67	5.21	3.97	2.38	1.16
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.384	0.333	0.257	0.184	0.103	0.048
Vehicle sales - Light-duty - other (%)	0.108	0.111	0.102	0.089	0.065	0.036	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	70.8	69.4	67.5	65.7	63.5	60.8	58.1
Final energy use - Industry (PJ)	281	293	300	302	307	311	314
Final energy use - Residential (PJ)	86.4	82	78.8	75.5	71.4	65.8	59.3
Final energy use - Transportation (PJ)	182	171	156	144	135	124	111

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,540	6,039	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric Heat Pump	3.92	6.69	9.32	17.9	38.6	64.5	79.7
(%)							
Sales of space heating units - Electric Resistance	6.31	5.58	5.85	6.72	8.6	10.7	11.9
(%)							
Sales of space heating units - Fossil (%)	0	2.1	1.98	1.48	0.719	0.234	0.062
Sales of space heating units - Gas Furnace (%)	89.8	85.6	82.9	73.9	52.1	24.5	8.31
Sales of water heating units - Electric Heat Pump	0.944	1.35	2.81	7.68	19.4	34.3	43
(%)							
Sales of water heating units - Electric Resistance	8.03	7.53	8.96	13.7	25.1	39.5	48
(%)							
Sales of water heating units - Gas Furnace (%)	90.2	90.1	87.3	77.8	54.7	25.5	8.33
Sales of water heating units - Other (%)	0.788	0.981	0.957	0.887	0.782	0.716	0.691

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

•••	•		•				
Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.33	1.36	1.77	1.84	2.53	2.68
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	0.003	0.032	0	0	0	0
Capital invested - Biomass w/ccu allam power	0	Ω	0	0.024	0.006	0.01	0
plant (billion \$2018)		· ·	Ü	0.024	0.000	0.01	J
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0.061	0.002	0.208	0.095

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	5.4	67.8	67.8	67.8	67.8	67.8
Biomass w/ccu allam power plant (GWh)	0	0	0	24.1	30.2	40.1	40.1
Biomass w/ccu power plant (GWh)	0	0	0	68	69.9	303	410

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0.41	4.64	117	1,093	2,577	6,002
Conversion capital investment - Cumulative 5-yr	0	3.12	35.5	1,454	12,265	18,692	53,340
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	2	3	3
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	15	35	41
Number of facilities - Diesel (quantity)	0	0	0	1	1	2	3
Number of facilities - Diesel ccu (quantity)	0	0	0	1	2	3	4
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	1	2	3	3
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	2	32
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	2	3	17
Number of facilities - Sng (quantity)	0	1	1	1	1	2	2
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	1	2

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	1.79	17.5	41.5	57.6
Annual - BECCS (MMT)	0	0	0	1.79	17.5	41.5	57.6
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	1.79	19.3	60.8	118
Cumulative - BECCS (MMT)	0	0	0	1.79	19.3	60.8	118
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	276	573	1,503	2,642	3,732
Cumulative investment - All (million \$2018)	0	0	1,627	3,273	5,868	6,875	7,932
Cumulative investment - Spur (million \$2018)	0	0	0	17.9	986	1,993	3,050
Cumulative investment - Trunk (million \$2018)	0	0	1,627	3,255	4,882	4,882	4,882
Spur (km)	0	0	0	21.5	675	1,814	2,905
Trunk (km)	0	0	276	552	828	828	828

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	-2,881
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,608
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	-273
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-10,762
Total (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-2,881
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-3,910
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	-136
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-6,927
Total (1000 tC02e/y)			-,
Land impacted for carbon sink - Aggressive	0	0	1,679
deployment - Corn-ethanol to energy grasses			.,
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	16,939
deployment - Cropland measures (1000			•
hectares)			
Land impacted for carbon sink - Aggressive	0	0	15.7
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	288
deployment - Pasture to energy crops (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	466
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	19,388
deployment - Total (1000 hectares)			,
Land impacted for carbon sink - Moderate	0	0	1,679
deployment - Corn-ethanol to energy grasses			, -
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,547
deployment - Cropland measures (1000			-,-
hectares)			
Land impacted for carbon sink - Moderate	0	0	15.7
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	288
deployment - Pasture to energy crops (1000			_00
hectares)			
Land impacted for carbon sink - Moderate	0	0	233
deployment - Permanent conservation cover			200
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	5,762
deployment - Total (1000 hectares)			5,.02

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	248
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	17,146
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	947
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	427
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	46.9
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	285
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	2,717
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	7,855
(1000 tC02e/y)			•
Carbon sink potential - High - Reforest pasture	0	0	4,189
(1000 tC02e/y)			,
Carbon sink potential - High - Restore	0	0	431
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	124
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	5,906
overlap) (1000 tC02e/y)		•	0,,00
Carbon sink potential - Low - Avoid deforestation	0	0	158
(1000 tC02e/y)		0	100
Carbon sink potential - Low - Extend rotation	0	0	164
length (1000 tC02e/y)		0	104
Carbon sink potential - Low - Improve	0	0	23.8
plantations (1000 tCO2e/y)		0	23.0
Carbon sink potential - Low - Increase retention	0	0	95
of HWP (1000 tC02e/y)		0	73
Carbon sink potential - Low - Increase trees	0	0	951
outside forests (1000 tCO2e/y)	0	0	751
Carbon sink potential - Low - Reforest cropland	0	0	3,928
(1000 tCO2e/y)	0	0	3,720
Carbon sink potential - Low - Reforest pasture	0	0	317
(1000 tCO2e/y)	0	0	317
	0	0	145
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	145
Carbon sink potential - Mid - Accelerate	0	0	10/
regeneration (1000 tCO2e/y)	0	0	186
Carbon sink potential - Mid - All (not counting	0	0	11 50/
overlap) (1000 tCO2e/y)	0	U	11,526
		0	FF0
Carbon sink potential - Mid - Avoid deforestation	0	0	553
(1000 tCO2e/y)		0	007
Carbon sink potential - Mid - Extend rotation	0	0	296
length (1000 tC02e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	34.9
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	190
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	1,834
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	5,891
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,253
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	288
productivity (1000 tCO2e/y)			
		0	40.5
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	υļ	40.5

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks -	- Forests (con	tinuedJ	
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	128
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Extend rotation length (1000 hectares)			-
Land impacted for carbon sink potential - High -	0	0	17.3
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	258
Increase trees outside forests (1000 hectares)		0	230
	0	0	519
Land impacted for carbon sink potential - High -	0	0	519
Reforest cropland (1000 hectares)			110
Land impacted for carbon sink potential - High -	0	0	119
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	143
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,443
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	20.2
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	120
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	83.4
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	8.63
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	136
Increase trees outside forests (1000 hectares)		0	100
Land impacted for carbon sink potential - Low -	0	0	260
Reforest cropland (1000 hectares)		0	200
Land impacted for carbon sink potential - Low -	0	0	20.6
Reforest pasture (1000 hectares)		0	20.0
	0	0	07.7
Land impacted for carbon sink potential - Low -	0	0	86.4
Restore productivity (1000 hectares)	0		705
Land impacted for carbon sink potential - Low -	U	0	735
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	30.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	124
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	151
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	13
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)		-	Ĭ
Land impacted for carbon sink potential - Mid -	0	0	197
Increase trees outside forests (1000 hectares)		ŭ	'''
Land impacted for carbon sink potential - Mid -	0	0	390
Reforest cropland (1000 hectares)		U	370
Land impacted for carbon sink potential - Mid -	0	0	149
	0	0	149
Reforest pasture (1000 hectares)			477
Land impacted for carbon sink potential - Mid -	0	0	174
Restore productivity (1000 hectares)			4.000
Land impacted for carbon sink potential - Mid -	0	0	1,228
Total impacted (over 30 years) (1000 hectares)			

Table 58: RFF scenario -	DILLAD 1. Efficience	v/Electrification	Dooidontial
Table 58' RFF Scenorio -	PILLAR I. FAICIBUC	V/FIRCTRITICATION :	- Kesinentini

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.71	1.81	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	73.9	73.9	73.9	73.9	73.9	73.9	73.9
Sales of cooking units - Gas (%)	26.1	26.1	26.1	26.1	26.1	26.1	26.1
Sales of space heating units - Electric Heat Pump	5.61	14.1	14.5	15.1	15.7	16.4	17.4
(%)							
Sales of space heating units - Electric Resistance	16.7	21.4	21.2	20.9	20.5	19.8	18.9
(%)							
Sales of space heating units - Fossil (%)	5.95	9.38	9.47	9.46	9.32	9.23	9.3
Sales of space heating units - Gas (%)	71.7	55	54.8	54.5	54.5	54.6	54.4
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
(%)							
Sales of water heating units - Electric Resistance	35.5	51.2	51.2	51.1	51.1	51	51
(%)							
Sales of water heating units - Gas Furnace (%)	64.5	48.7	48.8	48.9	48.9	48.9	49
Sales of water heating units - Other (%)	0.03	0.032	0.032	0.032	0.032	0.032	0.032

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 (%)	1.67	2.06	2.2	2.05	1.85	1.72	1.64
Vehicle sales - Light-duty - EV (%)	3.18	5.11	5.84	7.15	8.75	10.2	11.4
Vehicle sales - Light-duty - gasoline (%)	90.9	87.4	85.4	83.7	81.8	79.8	78.2
Vehicle sales - Light-duty - hybrid (%)	4.06	4.93	6.05	6.62	7.22	7.85	8.38
Vehicle sales - Light-duty - hydrogen FC (%)	0.111	0.381	0.353	0.315	0.313	0.314	0.325
Vehicle sales - Light-duty - other (%)	0.107	0.111	0.108	0.108	0.108	0.107	0.11
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)	70.8	71	71	70.2	69.4	70	71.9
Final energy use - Industry (PJ)	281	297	305	312	321	329	340
Final energy use - Residential (PJ)	86.4	82.5	80.6	79.4	79.2	79.6	79.9
Final energy use - Transportation (PJ)	182	171	157	149	149	153	158

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	5,476	5,633	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	44.8	47.8	47.9	47.8	47.9	47.9	48
Sales of cooking units - Gas (%)	55.2	52.2	52.1	52.2	52.1	52.1	52
Sales of space heating units - Electric Heat Pump	3.92	13	44.6	70.5	74.8	75.2	75.2
(%)							
Sales of space heating units - Electric Resistance	6.31	6.4	10.8	18.4	23.4	24.2	24.3
(%)							
Sales of space heating units - Fossil (%)	0	2.06	1.59	0.699	0.102	0.009	0
Sales of space heating units - Gas Furnace (%)	89.8	78.5	43	10.4	1.69	0.518	0.457
Sales of water heating units - Electric Heat Pump	0.944	0.821	0.817	0.818	0.814	0.81	0.81
(%)							

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	8.03	7.01	7.03	7.01	7.01	7.01	7.01
(%)							
Sales of water heating units - Gas Furnace (%)	90.2	91.2	91.2	91.2	91.2	91.2	91.2
Sales of water heating units - Other (%)	0.788	0.989	0.989	0.988	0.987	0.991	0.991

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.36	1.39	1.46	1.5	1.63	1.69
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)	-0.18	0	0.307	0.088
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.078	0	-0.161	-0.17
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.258	0	0.146	-0.081
Carbon sink potential - High - Accelerate	0	0	0	248
regeneration (1000 tCO2e/y)	0	0	0	
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	17,146
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	947
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	427
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	46.9
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y)	0	0	0	285
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)	0	0	0	2,717
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	7,855
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)	0	0	0	4,189
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	0	431
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	124
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	5,906
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)	0	0	0	158
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)	0	0	0	164
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	23.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	95
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	951
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	3,928
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	317
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	0	145
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	186
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,526

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

Table 63: REF scenario - PILLAR 6: Land sinks -	•	ıtınueuj		
Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation	0	0	0	553
(1000 tCO2e/y) Carbon sink potential - Mid - Extend rotation	0	0	0	296
length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations	0	0	0	34.9
(1000 tCO2e/y) Carbon sink potential - Mid - Increase retention	0	0	0	190
of HWP (1000 tCO2e/y)			_	
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	0	1,834
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	0	5,891
Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y)	0	0	0	2,253
Carbon sink potential - Mid - Restore	0	0	0	288
productivity (1000 tC02e/y) Land impacted for carbon sink potential - High -	0	0	0	40.5
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	128
Avoid deforestation (over 30 years) (1000		O		120
hectares) Land impacted for carbon sink potential - High -	0	0	0	218
Extend rotation length (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	17.3
Improve plantations (1000 hectares)			_	
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	258
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	0	519
Land impacted for carbon sink potential - High -	0	0	0	119
Reforest pasture (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	143
Restore productivity (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	1,443
Total impacted (over 30 years) (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0	20.2
Accelerate regeneration (1000 hectares)				
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	120
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	83.4
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	8.63
Land impacted for carbon sink potential - Low -	0	0	0	0
Increase retention of HWP (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0	136
Increase trees outside forests (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0	260
Reforest cropland (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0	20.6
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)	0	0	0	86.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)	0	0	0	735
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)	0	0	0	30.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	124

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid -	0	0		151
Extend rotation length (1000 hectares)		J		
Land impacted for carbon sink potential - Mid -	0	0	0	13
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	197
Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	390
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	149
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	174
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	1,228
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 (million 2019\$)	0	371	191	124	97.1	84.2	82
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	95.5	78.3	89.6	56.7	32.9	29.7
Monetary damages from air pollution - Transportation (million 2019\$)	0	198	204	210	217	224	231
Premature deaths from air pollution - Coal (deaths)	0	41.6	21.4	13.9	10.9	9.45	9.2
Premature deaths from air pollution - Natural Gas (deaths)	0	10.8	8.84	10.1	6.41	3.72	3.36
Premature deaths from air pollution - Transportation (deaths)	0	22.3	23	23.6	24.4	25.2	26