# Net-Zero America - south dakota 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	0.653	0.813	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump	6.73	12	35.6	81.1	89.5	90.1	89.6
(%)							
Sales of space heating units - Electric Resistance	18.5	23.6	18.7	8.06	6.1	6.05	6.33
(%)							
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump	0	0.703	9.63	29.2	32.7	32.9	33
(%)							
Sales of water heating units - Electric Resistance	41.1	57.1	59.9	65.9	67	67.1	67
(%)							
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

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

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Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	244	624	1,015	1,535	1,673	1,594
Public EV charging plugs - DC Fast (1000 units)	0.054	0	0.519	0	2.31	0	3.75
Public EV charging plugs - L2 (1000 units)	0.074	0	12.5	0	55.8	0	90.3
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 (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	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)	30.2	29.7	28.5	26.9	25.1	23.7	22.9
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,507	2,731	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	4.48	7.71	30.2	77.8	86.2	86.8	86.8
(%)							
Sales of space heating units - Electric Resistance	7.28	5.82	8.4	12	12.7	12.7	12.7
(%)							
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump (%)	1.15	1.83	14.5	42	46.9	47.2	47.2
Sales of water heating units - Electric Resistance (%)	9.7	8.05	20.3	47	51.8	52.1	52.1
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.836	0.87	1.6	1.72	1.54	1.62
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.023	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0.094	0
Capital invested - Wind - Base (billion \$2018)	0	0.537	4.5	4.27	2.85	6.72	12.7
Capital invested - Wind - Constrained (billion \$2018)	0	1.93	4.75	8.88	18.1	29.2	41.3

# 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	26	26	26	26	26
Solar - Base land use assumptions (GWh)	0	0	0	0	0	185	0
Solar - Constrained land use assumptions (GWh)	0	0	0	0	0	146	0
Wind - Base land use assumptions (GWh)	10,866	1,365	12,405	12,406	8,591	21,350	41,871
Wind - Constrained land use assumptions (GWh)	10,866	3,284	8,231	27,096	47,943	83,897	131,679

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

•	<b>.</b>						
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	1.37	78.9	78.9	98.7	1,354
Conversion capital investment - Cumulative 5-yr	0	0	21.3	1,107	0	283	24,538
(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	2	2	3	12
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	1	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	10
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.03	1.45	1.45	1.81	20.4
Annual - BECCS (MMT)	0	0	0.03	1.45	1.45	1.81	20.4

Table 9: E+ scenario - PILLAR 4: CCUS - CO2 capture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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	0.03	1.48	2.93	4.74	25.1
Cumulative - BECCS (MMT)	0	0	0.03	1.48	2.93	4.74	25.1
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	1.1	1.76	3.61	6.02	8.39
Injection wells (wells)	0	0	1	5	9	14	18
Resource characterization, appraisal, permitting costs (million \$2020)	0	44.3	133	177	177	177	177
Wells and facilities construction costs (million	0	0	36.9	144	256	428	531
\$2020)		,	00.7				

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	160	637	637	851	3,475
Cumulative investment - All (million \$2018)	0	0	82.3	1,853	1,853	1,971	3,961
Cumulative investment - Spur (million \$2018)	0	0	82.3	191	191	309	2,299
Cumulative investment - Trunk (million \$2018)	0	0	0	1,662	1,662	1,662	1,662
Spur (km)	0	0	160	302	302	516	3,140
Trunk (km)	0	0	0	335	335	335	335

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-1,155
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,394
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-431
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-8,980
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,155
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-3,896
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-215
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-5,266
Total (1000 tCO2e/y)			
Land impacted for carbon sink - Aggressive	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	6,610
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	716
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	8,024
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,484
deployment - Cropland measures (1000			
hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate	0	0	358
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	4,540
deployment - Total (1000 hectares)			

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	771
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	301
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	845
Carbon sink potential - Low - Reforest cropland	0	0	2,286
(1000 tC02e/y) Carbon sink potential - Low - Reforest pasture	0	0	360
(1000 tC02e/y) Carbon sink potential - Low - Restore	0	0	222
productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate	0	0	284
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting	0	0	9,320
overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid deforestation	0	0	450
(1000 tCO2e/y) Carbon sink potential - Mid - Extend rotation	0	0	208
length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations	0	0	30.9
(1000 tC02e/y)  Carbon sink potential - Mid - Increase retention	0	0	296
of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,630

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo		ued)	
Item	2020	2025	2050
Carbon sink potential - Mid - Reforest cropland	0	0	3,429
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,553
(1000 tC02e/y)			.
Carbon sink potential - Mid - Restore	0	0	440
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	61.9
Accelerate regeneration (1000 hectares)	"	0	01.9
Land impacted for carbon sink potential - High -	0	0	107
	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)		_	
Land impacted for carbon sink potential - High -	0	0	153
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	15.3
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	229
Increase trees outside forests (1000 hectares)		•	
Land impacted for carbon sink potential - High -	0	0	302
Reforest cropland (1000 hectares)		0	302
		0	105
Land impacted for carbon sink potential - High -	0	0	135
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,219
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	31
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	98
Avoid deforestation (over 30 years) (1000		•	, ,
hectares)			
	0	0	E0.7
Land impacted for carbon sink potential - Low -	0	0	58.7
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	7.63
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	121
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	151
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	23.4
Reforest pasture (1000 hectares)		0	25.4
	0	0	100
Land impacted for carbon sink potential - Low -	0	0	132
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	622
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	46.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	106
Extend rotation length (1000 hectares)		0	100
	0	0	11.5
Land impacted for carbon sink potential - Mid -	"	U	11.5
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	175
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	227
Reforest cropland (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	169
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	266
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,102
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 (million 2019\$)	0	43	0.034	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	12.4	6.95	3.89	3.19	1.99	0.891
Monetary damages from air pollution - Transportation (million 2019\$)	0	37.9	34.9	26.2	14.9	6.62	2.51
Premature deaths from air pollution - Coal (deaths)	0	4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)	0	1.4	0.785	0.44	0.361	0.225	0.101
Premature deaths from air pollution - Transportation (deaths)	0	4.26	3.93	2.95	1.67	0.744	0.282

# Table 15: E+ scenario - IMPACTS - Jobs

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Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	1,821	1,821	1,822	1,879	1,056	252	1,242
By economic sector - Construction (jobs)	1,977	2,383	3,423	5,290	4,971	6,712	11,980
By economic sector - Manufacturing (jobs)	1,943	2,681	3,033	3,657	3,137	2,500	4,114
By economic sector - Mining (jobs)	623	502	400	311	228	204	175
By economic sector - Other (jobs)	138	174	279	400	454	654	1,077
By economic sector - Pipeline (jobs)	103	103	89.5	303	86.8	111	497
By economic sector - Professional (jobs)	1,432	1,674	2,468	3,439	3,651	4,891	9,469
By economic sector - Trade (jobs)	1,526	1,499	1,772	2,110	2,048	2,596	4,558
By economic sector - Utilities (jobs)	1,831	2,189	2,837	4,802	4,446	6,191	11,659
By education level - All sectors - Associates	2,994	3,550	4,569	6,609	6,148	7,728	14,138
degree or some college (jobs)							
By education level - All sectors - Bachelors	2,133	2,449	3,097	4,278	4,048	5,035	9,332
degree (jobs)							
By education level - All sectors - Doctoral degree	76	86.3	118	161	162	210	399
(jobs)							
By education level - All sectors - High school	5,664	6,337	7,559	10,063	8,678	9,819	18,435
diploma or less (jobs)							
By education level - All sectors - Masters or	526	602	780	1,081	1,042	1,319	2,465
professional degree (jobs)							
By resource sector - Biomass (jobs)	4,393	4,261	4,146	4,254	2,536	1,006	5,600
By resource sector - CO2 (jobs)	0	23.5	60.7	1,988	356	750	4,100
By resource sector - Coal (jobs)	190	60.9	0	0	0	0	0
By resource sector - Grid (jobs)	2,725	3,464	4,769	6,848	7,761	10,845	18,517
By resource sector - Natural Gas (jobs)	810	804	634	560	468	448	321
By resource sector - Nuclear (jobs)	0	0	0	0	0	0	0
By resource sector - Oil (jobs)	1,376	1,229	1,023	789	581	431	312
By resource sector - Solar (jobs)	219	522	613	897	930	917	1,173
By resource sector - Wind (jobs)	1,680	2,660	4,876	6,854	7,447	9,714	14,746
Median wages - Annual - All (\$2019 per job)	52,887	53,946	55,470	57,237	59,079	61,497	62,411
On-Site or In-Plant Training - Total jobs - 1 to 4	1,572	1,850	2,369	3,417	3,160	3,963	7,256
years (jobs)							
On-Site or In-Plant Training - Total jobs - 4 to 10	618	722	954	1,428	1,326	1,734	3,187
years (jobs)							
On-Site or In-Plant Training - Total jobs - None	1,796	2,065	2,583	3,563	3,260	3,938	7,335
(jobs)							
On-Site or In-Plant Training - Total jobs - Over 10	93.2	109	138	197	178	220	405
years (jobs)							

					- 13
Table 15:	E+ scenario -	IMPACIS	Inns	Lcontinue	:dI

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)	7,313	8,279	10,079	13,585	12,154	14,256	26,586
On-the-Job Training - All sectors - 1 to 4 years (jobs)	1,926	2,288	2,970	4,349	4,055	5,156	9,421
On-the-Job Training - All sectors - 4 to 10 years (jobs)	576	680	913	1,392	1,301	1,722	3,160
On-the-Job Training - All sectors - None (jobs)	658	736	900	1,202	1,085	1,287	2,390
On-the-Job Training - All sectors - Over 10 years (jobs)	97.8	117	148	206	186	221	397
On-the-Job Training - All sectors - Up to 1 year (jobs)	8,133	9,203	11,191	15,043	13,451	15,724	29,401
Related work experience - All sectors - 1 to 4 years (jobs)	3,764	4,338	5,449	7,633	7,046	8,676	16,089
Related work experience - All sectors - 4 to 10 years (jobs)	2,274	2,662	3,411	4,877	4,552	5,718	10,515
Related work experience - All sectors - None (jobs)	1,792	2,017	2,446	3,331	2,939	3,460	6,487
Related work experience - All sectors - Over 10 years (jobs)	611	724	918	1,291	1,204	1,482	2,700
Related work experience - All sectors - Up to 1 year (jobs)	2,951	3,284	3,898	5,058	4,337	4,774	8,978
Wage income - All (million \$2019)	603	703	894	1,270	1,186	1,483	2,794

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	68.2	69.2	58.4	46.8	35.2	22.2	15.4
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	1,410
Natural gas production - Annual (tcf)	0.475	0.526	0.497	0.433	0.366	0.29	0.226
Oil consumption - Annual (million bbls)	26.7	26	23.4	19.3	15.3	12.1	9.45
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	589
Oil production - Annual (million bbls)	1.53	1.65	1.66	1.65	1.31	1.06	0.708

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.651	0.8	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.4	72.1	74.7	81.6	91.2	97.2	99.2
Sales of cooking units - Gas (%)	28.6	27.9	25.3	18.4	8.76	2.83	0.76
Sales of space heating units - Electric Heat Pump	6.73	10.2	11.7	16.8	28.5	42.8	50.8
(%)							
Sales of space heating units - Electric Resistance	18.5	23.9	23.5	22.4	19.7	16.4	14.8
(%)							
Sales of space heating units - Fossil (%)	15.6	21.7	21.5	20.2	17.1	13.7	12.1
Sales of space heating units - Gas (%)	59.2	44.2	43.2	40.6	34.7	27.1	22.3
Sales of water heating units - Electric Heat Pump	0	0.211	0.789	2.72	7.4	13.3	16.8
(%)							
Sales of water heating units - Electric Resistance	41.1	57	57.1	57.5	59	60.8	61.9
(%)							
Sales of water heating units - Gas Furnace (%)	58.8	42.8	42.1	39.7	33.6	25.8	21.3
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

# 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	39.1	83.1	280	883	1,285
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.054	0	0.156	0	0.855	0	2.4
Public EV charging plugs - L2 (1000 units)	0.074	0	3.75	0	20.6	0	57.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051

Table 18: E- scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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 (%)	1.87	2.23	2.11	1.7	1.11	0.578	0.246
Vehicle sales - Light-duty - EV (%)	1.53	3.89	10.2	23.2	45.4	70	86.8
Vehicle sales - Light-duty - gasoline (%)	92.9	89	82.2	70.1	49.6	27	11.8
Vehicle sales - Light-duty - hybrid (%)	3.52	4.4	5	4.71	3.68	2.26	1.13
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.389	0.344	0.27	0.196	0.111	0.051
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.111	0.098	0.072	0.04	0.018
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.9	28.2	27.4	26.7	26
Final energy use - Industry (PJ)	163	171	174	176	179	181	183
Final energy use - Residential (PJ)	41.4	39.1	37.4	35.9	34.3	32.5	30.6
Final energy use - Transportation (PJ)	91.5	86	78.8	73.1	68.9	64	58.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,507	2,735	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	4.48	6.34	7.8	12.5	23.6	37.7	45.9
(%)							
Sales of space heating units - Electric Resistance	7.28	5.52	5.66	6.19	7.32	8.52	9.17
(%)							
Sales of space heating units - Fossil (%)	6.1	2.55	2.51	2.23	1.76	1.38	1.26
Sales of space heating units - Gas Furnace (%)	82.1	85.6	84	79.1	67.3	52.4	43.6
Sales of water heating units - Electric Heat Pump	1.15	1.12	1.94	4.67	11.3	19.6	24.5
(%)							
Sales of water heating units - Electric Resistance	9.7	7.35	8.16	10.8	17.2	25.3	30
(%)							
Sales of water heating units - Gas Furnace (%)	87.4	90.5	88.9	83.6	70.7	54.3	44.7
Sales of water heating units - Other (%)	1.76	0.994	0.977	0.938	0.876	0.841	0.828

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.676	0.691	0.924	0.965	1.37	1.46
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	-1,155
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,394
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-431
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-8,980
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,155
Corn-ethanol to energy grasses (1000 tCO2e/y)			

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

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Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-3,896
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-215
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-5,266
Total (1000 tCO2e/y)			
Land impacted for carbon sink - Aggressive	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	6,610
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	716
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	8,024
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,484
deployment - Cropland measures (1000			•
hectares)			
Land impacted for carbon sink - Moderate	0	0	358
deployment - Permanent conservation cover		_	
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	4,540
deployment - Total (1000 hectares)		_	, -
. ,			

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

Table 25. L- Scenario - Fillan G. Lana Sinks - 10			
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	378
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	14,326
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	771
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	301
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	41.4
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	444
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	2,415
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	4,571
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,746
(1000 tCO2e/y)			
Carbon sink potential - High - Restore	0	0	658
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	190
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	4,315
overlap) (1000 tC02e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	129
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	115
length (1000 tC02e/y)			
Carbon sink potential - Low - Improve	0	0	21.1
plantations (1000 tCO2e/y)			
Carbon sink potential - Low - Increase retention	0	0	148
of HWP (1000 tCO2e/y)			
- ''			

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

Table 23: <i>E- scenario - PILLAR 6: Land sinks - Fo</i> Item	2020	2025	2050
Carbon sink potential - Low - Increase trees	0	0	845
outside forests (1000 tCO2e/y)			0.10
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y)	0	0	2,286
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)	0	0	360
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)	0	0	296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)	0	0	1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)	0	0	3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)	0	0	2,553
Carbon sink potential - Mid - Restore productivity (1000 tC02e/y)	0	0	440
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)	0	0	61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)	0	0	104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	15.3
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	229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	7.63
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	121

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	151
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	23.4
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	132
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	622
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	46.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	106
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	11.5
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	175
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	227
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	169
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	266
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,102
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	43	0.034	0.033	0.024	0.015	0
(million 2019\$)							
Monetary damages from air pollution - Natural	0	12.4	6.24	3.12	1.74	0.804	0.566
Gas (million 2019\$)							
Monetary damages from air pollution -	0	38.4	38.2	36.8	32.7	25.7	17.4
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	4.82	0.004	0.004	0.003	0.002	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.4	0.705	0.353	0.196	0.091	0.064
Gas (deaths)							
Premature deaths from air pollution -	0	4.32	4.3	4.14	3.68	2.9	1.96
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.653	0.813	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump	6.73	12	35.6	81.1	89.5	90.1	89.6
(%)							
Sales of space heating units - Electric Resistance	18.5	23.6	18.7	8.06	6.1	6.05	6.33
(%)							
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump	0	0.703	9.63	29.2	32.7	32.9	33
(%)							
Sales of water heating units - Electric Resistance	41.1	57.1	59.9	65.9	67	67.1	67
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

### 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	244	624	1,015	1,535	1,673	1,594
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.054	0	0.519	0	2.31	0	3.75
Public EV charging plugs - L2 (1000 units)	0.074	0	12.5	0	55.8	0	90.3
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 (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	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)	30.2	29.7	28.5	26.9	25.1	23.7	22.9
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,507	2,731	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	4.48	7.71	30.2	77.8	86.2	86.8	86.8
(%)							
Sales of space heating units - Electric Resistance	7.28	5.82	8.4	12	12.7	12.7	12.7
(%)							
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump	1.15	1.83	14.5	42	46.9	47.2	47.2
(%)							
Sales of water heating units - Electric Resistance	9.7	8.05	20.3	47	51.8	52.1	52.1
(%)							
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

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

	•		•				
Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.836	0.87	1.6	1.72	1.54	1.62
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	0	0.519	0.39	0	0.205
Capital invested - Wind - Base (billion \$2018)	0	1.96	9.01	7.52	15	42.8	106

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	891	708	0	417
Solar - Constrained land use assumptions (GWh)	0	0	0	745	1,708	0	1,815
Wind - Base land use assumptions (GWh)	10,866	2,745	13,772	12,080	25,089	73,446	188,261
Wind - Constrained land use assumptions (GWh)	10,866	3,803	12,946	32,182	110,300	159,712	64,258

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

Table 32: E+RE+ Scendrio - Pillar 6: Lunu Sinks	•		
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-1,155
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,394
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-431
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-8,980
Total (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,155
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-3,896
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-215
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-5,266
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	6,610
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	716
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	8,024
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,484
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	358
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	4,540
deployment - Total (1000 hectares)			

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	378
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	14,326
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	771
(1000 tC02e/y)			

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

Table 33: E+RE+ scenario - PILLAR 6: Land sinks	s - Forests (i	continueaj	
Item	2020	2025	2050
Carbon sink potential - High - Extend rotation	0	0	301
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	41.4
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	444
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	2,415
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	4,571
(1000 tCO2e/y)			
Carbon sink potential - High - Reforest pasture	0	0	4,746
(1000 tCO2e/y)			
Carbon sink potential - High - Restore	0	0	658
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	190
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	4,315
overlap) (1000 tC02e/y)			·
Carbon sink potential - Low - Avoid deforestation	0	0	129
(1000 tC02e/y)	_		
Carbon sink potential - Low - Extend rotation	0	0	115
length (1000 tC02e/y)		· ·	
Carbon sink potential - Low - Improve	0	0	21.1
plantations (1000 tC02e/y)		Ü	21
Carbon sink potential - Low - Increase retention	0	0	148
of HWP (1000 tCO2e/y)		O	140
Carbon sink potential - Low - Increase trees	0	0	845
outside forests (1000 tCO2e/y)		O	040
Carbon sink potential - Low - Reforest cropland	0	0	2,286
(1000 tC02e/y)	0	U	2,200
Carbon sink potential - Low - Reforest pasture	0	0	360
(1000 tC02e/y)	0	U	300
Carbon sink potential - Low - Restore	0	0	222
productivity (1000 tC02e/y)	0	0	222
Carbon sink potential - Mid - Accelerate	0	0	284
regeneration (1000 tC02e/y)	0	U	204
Carbon sink potential - Mid - All (not counting	0	0	0.000
	0	0	9,320
overlap) (1000 tC02e/y)	0		/ 50
Carbon sink potential - Mid - Avoid deforestation	0	0	450
(1000 tC02e/y)			200
Carbon sink potential - Mid - Extend rotation	0	0	208
length (1000 tC02e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	30.9
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	296
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	1,630
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	3,429
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,553
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	440
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	61.9
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	104
Avoid deforestation (over 30 years) (1000		-	
hectares)			
Land impacted for carbon sink potential - High -	0	0	153
Extend rotation length (1000 hectares)		U	100
Land impacted for carbon sink potential - High -	0	0	15.3
Improve plantations (1000 hectares)	0	U	10.3
Timbi ove highrations (1000 necrailes)			

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

Table 33: E+RE+ Scenario - PILLAR 6: Land Sinks	s - Furests (ct		
Item	2020	2025	2050
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	229
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	302
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	135
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,219
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	31
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	98
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	58.7
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	7.63
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	121
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	151
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	23.4
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	132
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	622
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	46.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	106
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	11.5
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	175
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	227
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	169
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	266
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,102
Total impacted (over 30 years) (1000 hectares)		-	,

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)	0	43	0.034	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	11.4	6.21	2.37	1.72	0.866	0.495
Monetary damages from air pollution - Transportation (million 2019\$)	0	37.9	34.9	26.2	14.9	6.62	2.51

Table 34: E+RE+ scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Coal	0	4.82	0.004	0.004	0.003	0.002	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.29	0.701	0.268	0.194	0.098	0.056
Gas (deaths)							
Premature deaths from air pollution -	0	4.26	3.93	2.95	1.67	0.744	0.282
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.653	0.813	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.73	12	35.6	81.1	89.5	90.1	89.6
Sales of space heating units - Electric Resistance (%)	18.5	23.6	18.7	8.06	6.1	6.05	6.33
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump (%)	0	0.703	9.63	29.2	32.7	32.9	33
Sales of water heating units - Electric Resistance (%)	41.1	57.1	59.9	65.9	67	67.1	67
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

 ${\it Table~36:}~\textit{E+RE-scenario-PILLAR~1:}~\textit{Efficiency/Electrification-Transportation}$ 

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	244	624	1,015	1,535	1,673	1,594
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.054	0	0.519	0	2.31	0	3.75
Public EV charging plugs - L2 (1000 units)	0.074	0	12.5	0	55.8	0	90.3
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 (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	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)	30.2	29.7	28.5	26.9	25.1	23.7	22.9
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,507	2,731	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	4.48	7.71	30.2	77.8	86.2	86.8	86.8
(%)							
Sales of space heating units - Electric Resistance	7.28	5.82	8.4	12	12.7	12.7	12.7
(%)							
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump	1.15	1.83	14.5	42	46.9	47.2	47.2
(%)							
Sales of water heating units - Electric Resistance	9.7	8.05	20.3	47	51.8	52.1	52.1
(%)							
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.836	0.87	1.6	1.72	1.54	1.62
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	0	0.075	0
Capital invested - Wind - Base (billion \$2018)	0	0	1.36	3.83	2.22	1.94	0.034
Capital invested - Wind - Constrained (billion \$2018)	0	0.574	1.01	3.01	5	6.14	0.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	0	0	146	0
Wind - Base land use assumptions (GWh)	10,866	0	3,776	11,318	6,792	6,164	114
Wind - Constrained land use assumptions (GWh)	10,866	1,442	2,765	8,768	15,215	18,878	764

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

2020	2025	2050
0	0	-1,155
		,
0	0	-7,394
0	0	-431
0	0	-8,980
0	0	-1,155
0	0	-3,896
0	0	-215
0	0	-5,266
0	0	699
0	0	6,610
	0 0 0 0 0	

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

Item	2020	2025	2050
Land impacted for carbon sink - Aggressive	0	0	716
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	8,024
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	699
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,484
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	358
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	4,540
deployment - Total (1000 hectares)			

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	21.
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	222
Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y)	0	0	284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	9,320

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

Table 43: E+RE- scenario - PILLAR 6: Land sinks	- FUI ESIS (CU	nunueuj	
Item	2020	2025	2050
Carbon sink potential - Mid - Avoid deforestation	0	0	450
(1000 tCO2e/y)			
Carbon sink potential - Mid - Extend rotation	0	0	208
length (1000 tCO2e/y)			200
Carbon sink potential - Mid - Improve plantations	0	0	30.9
(1000 tCO2e/y)	U	0	30.7
•	0	0	296
Carbon sink potential - Mid - Increase retention	U	U	296
of HWP (1000 tC02e/y)			1 (00
Carbon sink potential - Mid - Increase trees	0	0	1,630
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	3,429
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,553
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	440
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	61.9
Accelerate regeneration (1000 hectares)	ı		0,
Land impacted for carbon sink potential - High -	0	0	104
Avoid deforestation (over 30 years) (1000	U	0	104
hectares)			450
Land impacted for carbon sink potential - High -	0	0	153
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	15.3
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	229
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	302
Reforest cropland (1000 hectares)			002
Land impacted for carbon sink potential - High -	0	0	135
	U	0	100
Reforest pasture (1000 hectares)	0	0	010
Land impacted for carbon sink potential - High -	0	0	218
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,219
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	31
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	98
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	58.7
Extend rotation length (1000 hectares)	ı		00.1
Land impacted for carbon sink potential - Low -	0	0	7.63
	U	0	1.03
Improve plantations (1000 hectares)	0	0	
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	121
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	151
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	23.4
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	132
Restore productivity (1000 hectares)			.02
Land impacted for carbon sink potential - Low -	0	0	622
	U	0	022
Total impacted (over 30 years) (1000 hectares)			,,,
Land impacted for carbon sink potential - Mid -	0	0	46.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	101
Avoid deforestation (over 30 years) (1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid -	0	0	106
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	11.5
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	175
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	227
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	169
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	266
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,102
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 (million 2019\$)	0	43	0.034	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	12.6	6.82	7	6.05	2.7	1.01
Monetary damages from air pollution - Transportation (million 2019\$)	0	37.9	34.9	26.2	14.9	6.62	2.51
Premature deaths from air pollution - Coal (deaths)	0	4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)	0	1.42	0.77	0.791	0.683	0.305	0.114
Premature deaths from air pollution - Transportation (deaths)	0	4.26	3.93	2.95	1.67	0.744	0.282

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.651	0.8	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.4	72.1	74.7	81.6	91.2	97.2	99.2
Sales of cooking units - Gas (%)	28.6	27.9	25.3	18.4	8.76	2.83	0.76
Sales of space heating units - Electric Heat Pump	6.73	10.2	11.7	16.8	28.5	42.8	50.8
(%)							
Sales of space heating units - Electric Resistance	18.5	23.9	23.5	22.4	19.7	16.4	14.8
(%)							
Sales of space heating units - Fossil (%)	15.6	21.7	21.5	20.2	17.1	13.7	12.1
Sales of space heating units - Gas (%)	59.2	44.2	43.2	40.6	34.7	27.1	22.3
Sales of water heating units - Electric Heat Pump	0	0.211	0.789	2.72	7.4	13.3	16.8
(%)							
Sales of water heating units - Electric Resistance	41.1	57	57.1	57.5	59	60.8	61.9
(%)							
Sales of water heating units - Gas Furnace (%)	58.8	42.8	42.1	39.7	33.6	25.8	21.3
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

## 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	39.1	83.1	280	883	1,285
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.054	0	0.156	0	0.855	0	2.4
Public EV charging plugs - L2 (1000 units)	0.074	0	3.75	0	20.6	0	57.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051

Table 46. F-R+ scenario -	PTI I AR 1. Efficiency/Electrification	n - Transnortation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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 (%)	1.87	2.23	2.11	1.7	1.11	0.578	0.246
Vehicle sales - Light-duty - EV (%)	1.53	3.89	10.2	23.2	45.4	70	86.8
Vehicle sales - Light-duty - gasoline (%)	92.9	89	82.2	70.1	49.6	27	11.8
Vehicle sales - Light-duty - hybrid (%)	3.52	4.4	5	4.71	3.68	2.26	1.13
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.389	0.344	0.27	0.196	0.111	0.051
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.111	0.098	0.072	0.04	0.018
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.9	28.2	27.4	26.7	26
Final energy use - Industry (PJ)	163	171	174	176	179	181	183
Final energy use - Residential (PJ)	41.4	39.1	37.4	35.9	34.3	32.5	30.6
Final energy use - Transportation (PJ)	91.5	86	78.8	73.1	68.9	64	58.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,507	2,735	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	4.48	6.34	7.8	12.5	23.6	37.7	45.9
(%)							
Sales of space heating units - Electric Resistance	7.28	5.52	5.66	6.19	7.32	8.52	9.17
(%)							
Sales of space heating units - Fossil (%)	6.1	2.55	2.51	2.23	1.76	1.38	1.26
Sales of space heating units - Gas Furnace (%)	82.1	85.6	84	79.1	67.3	52.4	43.6
Sales of water heating units - Electric Heat Pump	1.15	1.12	1.94	4.67	11.3	19.6	24.5
(%)							
Sales of water heating units - Electric Resistance	9.7	7.35	8.16	10.8	17.2	25.3	30
(%)							
Sales of water heating units - Gas Furnace (%)	87.4	90.5	88.9	83.6	70.7	54.3	44.7
Sales of water heating units - Other (%)	1.76	0.994	0.977	0.938	0.876	0.841	0.828

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.676	0.691	0.924	0.965	1.37	1.46
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	0.03	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	34	34	34	34	34

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

•	<b>U</b> ,						
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	2.19	190	243	1,415	1,991
Conversion capital investment - Cumulative 5-yr	0	0	28	2,268	651	14,187	7,387
(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	3	4	19	19
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	1	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	8
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	2	2

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.03	2.95	3.79	22	22.3
Annual - BECCS (MMT)	0	0	0.03	2.95	3.79	22	22.3
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	0.03	2.98	6.77	28.8	51.1
Cumulative - BECCS (MMT)	0	0	0.03	2.98	6.77	28.8	51.1
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	1.85	6.42	13.1	18.7	19.2
Injection wells (wells)	0	0	3	12	22	37	46
Resource characterization, appraisal, permitting costs (million \$2020)	0	44.3	204	319	319	319	319
Wells and facilities construction costs (million \$2020)	0	0	95.8	373	666	1,113	1,382

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	125	707	845	2,492	2,422
Cumulative investment - All (million \$2018)	0	0	64	2,061	2,139	3,632	3,611
Cumulative investment - Spur (million \$2018)	0	0	64	295	373	1,866	1,845
Cumulative investment - Trunk (million \$2018)	0	0	0	1,766	1,766	1,766	1,766
Spur (km)	0	0	125	372	511	2,157	2,087
Trunk (km)	0	0	0	335	335	335	335

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-1,508
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-7,051
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	0
Cropland to woody energy crops (1000 tCO2e/y)			

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

Table 56: E-B+ scenario - PILLAR 6: Land sinks -	- Agriculture	e (continue	dJ
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Pasture to energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-406
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-8,966
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,508
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-3,715
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	-203
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-5,426
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	1,080
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	15,438
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	16.4
deployment - Cropland to woody energy crops			
(1000 hectares)			0/.0
Land impacted for carbon sink - Aggressive	0	0	84.8
deployment - Pasture to energy crops (1000			
hectares)		0	/7/
Land impacted for carbon sink - Aggressive	0	0	676
deployment - Permanent conservation cover			
(1000 hectares)	0	0	17 OOE
Land impacted for carbon sink - Aggressive	0	0	17,295
deployment - Total (1000 hectares)  Land impacted for carbon sink - Moderate	0	0	1,080
deployment - Corn-ethanol to energy grasses	0	U	1,000
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	3,295
deployment - Cropland measures (1000		0	3,273
hectares)			
Land impacted for carbon sink - Moderate	0	0	16.4
deployment - Cropland to woody energy crops		0	10.4
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	84.8
deployment - Pasture to energy crops (1000		0	04.0
hectares)			
Land impacted for carbon sink - Moderate	0	0	338
deployment - Permanent conservation cover		0	550
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	4,814
deployment - Total (1000 hectares)		<u> </u>	4,014

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	378
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	14,326
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	771
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	301
length (1000 tCO2e/y)			

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

Carbon sink potential - High - Improve plantations (1000 tCO2e/y)  Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)  Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	020 0 0 0 0 0 0 0	2025 0 0 0 0 0 0 0 0 0	2050 41.4 444 2,415 4,571 4,746 658 190 4,315 129
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)  Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0	0 0 0 0 0 0 0 0 0	444 2,415 4,571 4,746 658 190 4,315
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - High - Reforest cropland (1000 tC02e/y)  Carbon sink potential - High - Reforest pasture (1000 tC02e/y)  Carbon sink potential - High - Restore productivity (1000 tC02e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	2,415 4,571 4,746 658 190 4,315
of HWP (1000 tCO2e/y)  Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)  Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	2,415 4,571 4,746 658 190 4,315
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - High - Reforest cropland (1000 tC02e/y)  Carbon sink potential - High - Reforest pasture (1000 tC02e/y)  Carbon sink potential - High - Restore productivity (1000 tC02e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	4,571 4,746 658 190 4,315
outside forests (1000 tCO2e/y)  Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)  Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	4,571 4,746 658 190 4,315
Carbon sink potential - High - Reforest cropland (1000 tC02e/y)  Carbon sink potential - High - Reforest pasture (1000 tC02e/y)  Carbon sink potential - High - Restore productivity (1000 tC02e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0	0 0 0 0 0	4,746 658 190 4,315
(1000 tCO2e/y)  Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0 0	0 0 0 0 0	4,746 658 190 4,315
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)  Carbon sink potential - High - Restore productivity (1000 tC02e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0	0 0 0 0	658 190 4,315 129
(1000 tCO2e/y)  Carbon sink potential - High - Restore productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0 0 0	0 0 0 0	658 190 4,315 129
Carbon sink potential - High - Restore productivity (1000 tC02e/y)  Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0	0 0	190 4,315 129
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0 0 0	0 0	190 4,315 129
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)  Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)  Carbon sink potential - Low - Improve plantations (1000 tC02e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland	0 0	0	4,315 129
regeneration (1000 tCO2e/y)  Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0 0	0	4,315 129
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0	0	129
overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0		129
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0		
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland		0	115
length (1000 tCO2e/y)  Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland		0	115
Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland	0		_
plantations (1000 tCO2e/y)  Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland	0		
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland		0	21.1
of HWP (1000 tCO2e/y)  Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)  Carbon sink potential - Low - Reforest cropland			
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland	0	0	148
outside forests (1000 tC02e/y)  Carbon sink potential - Low - Reforest cropland			
Carbon sink potential - Low - Reforest cropland	0	0	845
	0	0	2,286
(1000 tCO2e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	360
(1000 tCO2e/y)	0		
Carbon sink potential - Low - Restore	0	0	222
productivity (1000 tC02e/y)	0	0	007
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	284
Carbon sink potential - Mid - All (not counting	0	0	9,320
overlap) (1000 tC02e/y)	0	0	7,320
Carbon sink potential - Mid - Avoid deforestation	0	0	450
(1000 tCO2e/y)	0	0	400
Carbon sink potential - Mid - Extend rotation	0	0	208
length (1000 tC02e/y)		Ŭ	200
Carbon sink potential - Mid - Improve plantations	0	0	30.9
(1000 tCO2e/y)			00.7
Carbon sink potential - Mid - Increase retention	0	0	296
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	1,630
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	3,429
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	2,553
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	440
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	61.9
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	153
Extend rotation length (1000 hectares)			
	0	0	15.3
Land impacted for carbon sink potential - High -			
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks -	- Forests (coi	ntınued)	
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	229
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	302
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	135
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	218
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,219
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	31
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	98
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	58.7
Extend rotation length (1000 hectares)			00.1
Land impacted for carbon sink potential - Low -	0	0	7.63
Improve plantations (1000 hectares)		0	1.00
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)		0	U
Land impacted for carbon sink potential - Low -	0	0	121
Increase trees outside forests (1000 hectares)		0	121
Land impacted for carbon sink potential - Low -	0	0	151
Reforest cropland (1000 hectares)	"	0	131
Land impacted for carbon sink potential - Low -	+	0	23.4
	0	U	23.4
Reforest pasture (1000 hectares)	0	0	100
Land impacted for carbon sink potential - Low -	"	U	132
Restore productivity (1000 hectares)		0	/00
Land impacted for carbon sink potential - Low -	0	0	622
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	46.4
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	106
Extend rotation length (1000 hectares)		_	
Land impacted for carbon sink potential - Mid -	0	0	11.5
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	175
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	227
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	169
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	266
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,102
Total impacted (over 30 years) (1000 hectares)			

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	0.63	0.659	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	71.1	71.1	71.1	71.1	71.1	71.1	71.1
Sales of cooking units - Gas (%)	28.9	28.9	28.9	28.9	28.9	28.9	28.9
Sales of space heating units - Electric Heat Pump	5.86	14.1	14.5	15	15.7	16.5	17.4
(%)							
Sales of space heating units - Electric Resistance	18.7	23	22.7	22.5	21.9	21.1	20.3
(%)							

Table 58: REF scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Fossil (%)	15.7	20.1	19.3	18.7	18.3	18	18.2
Sales of space heating units - Gas (%)	59.7	42.8	43.5	43.8	44.2	44.4	44
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	41.1	56.9	56.9	56.7	56.6	56.6	56.5
Sales of water heating units - Gas Furnace (%)	58.8	43.1	43.1	43.3	43.4	43.4	43.5
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.034

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 (%)	1.86	2.23	2.24	2.08	1.89	1.76	1.68
Vehicle sales - Light-duty - EV (%)	2.54	4.29	4.93	5.97	7.34	8.69	9.8
Vehicle sales - Light-duty - gasoline (%)	91.9	88.6	87	85.6	83.8	81.8	80.1
Vehicle sales - Light-duty - hybrid (%)	3.43	4.34	5.33	5.92	6.55	7.26	7.93
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.388	0.364	0.328	0.328	0.332	0.343
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.117	0.118	0.118	0.118	0.121
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)	30.2	30.3	30.4	30.1	29.9	30.1	31
Final energy use - Industry (PJ)	163	172	176	178	183	186	191
Final energy use - Residential (PJ)	41.4	39.2	38.1	37.3	36.9	36.9	36.9
Final energy use - Transportation (PJ)	91.4	86.1	79.4	75.5	75.4	77.5	80.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	2,478	2,548	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	4.48	13.1	44.5	70.3	74.5	75	75
(%)							
Sales of space heating units - Electric Resistance	7.28	6.37	10.8	18.4	23.7	24.5	24.5
(%)							
Sales of space heating units - Fossil (%)	6.1	2.47	1.92	0.869	0.131	0.011	0
Sales of space heating units - Gas Furnace (%)	82.1	78.1	42.8	10.4	1.7	0.533	0.471
Sales of water heating units - Electric Heat Pump	1.15	0.821	0.819	0.82	0.818	0.815	0.812
(%)							
Sales of water heating units - Electric Resistance	9.7	7.06	7.08	7.05	7.05	7.05	7.05
(%)							
Sales of water heating units - Gas Furnace (%)	87.4	91.1	91.1	91.1	91.1	91.1	91.1
Sales of water heating units - Other (%)	1.76	0.999	0.996	0.994	0.992	0.996	0.997

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	0.688	0.705	0.782	0.806	0.832	0.856
Cumulative 5-yr (billion \$2018)							

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

Table 63: REF scenario - PILLAR 6: Land sinks -	Forests			
Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-2.82	0	0.391	0.112
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.121	0	-0.251	-0.264
Business-as-usual carbon sink - Total (Mt CO2e/y)	-2.94	0	0.14	-0.152
Carbon sink potential - High - Accelerate	0	0	0	378
regeneration (1000 tC02e/y)				11.001
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	0	301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	0	41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	444
Carbon sink potential - High - Increase trees	0	0	0	2,415
outside forests (1000 tC02e/y)  Carbon sink potential - High - Reforest cropland	0	0	0	4,571
(1000 tCO2e/y) Carbon sink potential - High - Reforest pasture	0	0	0	4,746
(1000 tC02e/y) Carbon sink potential - High - Restore	0	0	0	658
productivity (1000 tCO2e/y)  Carbon sink potential - Low - Accelerate	0	0	0	190
regeneration (1000 tC02e/y)  Carbon sink potential - Low - All (not counting	0	0	0	4,315
overlap) (1000 tCO2e/y)  Carbon sink potential - Low - Avoid deforestation	0	0	0	129
(1000 tCO2e/y)  Carbon sink potential - Low - Extend rotation	0	0	0	115
length (1000 tCO2e/y)				
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	360
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	0	222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	284
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)	0	0	0	9,320
Carbon sink potential - Mid - Avoid deforestation	0	0	0	450
(1000 tC02e/y) Carbon sink potential - Mid - Extend rotation	0	0	0	208
length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	0	30.9
[1000 [6026/7]			0	296

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

Team	Table 63: REF scenario - PILLAR 6: Land sinks - I		tinued)		
Outside forests (1000 tCO2e/y)		2020	2025	2030	2050
Carbon sink potential - Mid - Reforest cropland   O		0	0	0	1,630
Grabon sink potential - Mid - Reforest pasture					
Carbon sink potential - Mid - Reforest pasture   0		0	0	0	3,429
Corbon sink potential - Mid - Restore   0					0.550
Carbon sink potential - Mid - Restore productivity (1000 tC02e/y) Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) Land impacted for carbon sink potential - High - Company of the Middle of the M		U	0	U	2,553
productivity (1000 tC02e/y)   Land impacted for carbon sink potential - High -		0	0	0	//0
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)   Compared to the C		U	U	U	440
Accelerate regeneration (1000 hectares)		0	0	0	<b>610</b>
Land impacted for carbon sink potential - High -		U	0	U	01.9
Avoid deforestation (over 30 years) (1000 hectares) Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) Land impacted for carbon sink potential - High - O O O O O O O O O O O O O O O O O O		n	n	Λ	10/.
Land impacted for carbon sink potential - High -		U	0	U	104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)					
Extend rotation length (1000 hectares)   Land impacted for carbon sink potential - High - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - High - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - High - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - High - Increase the productivity (1000 hectares)   Land impacted for carbon sink potential - High - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retenting to		0	0	0	153
Land impacted for carbon sink potential - High -				o	.00
Improve plantations (1000 hectares)		0	0	0	15.3
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)   0					
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)   Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)   Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)   Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)   Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)   Land impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - O O O 31 Accelerate regeneration (1000 hectares)   Land impacted for carbon sink potential - Low - O O O O O O O O O O O O O O O O O O		0	0	0	0
Increase trees outside forests (1000 hectares)   Inditingated for carbon sink potential - High - Reforest cropland (1000 hectares)   Inditingated for carbon sink potential - High - Reforest pasture (1000 hectares)   Inditingated for carbon sink potential - High - Restore productivity (1000 hectares)   Inditingated for carbon sink potential - High - Restore productivity (1000 hectares)   Inditingated for carbon sink potential - High - Inditingated for carbon sink potential - High - Inditingated for carbon sink potential - Low - Inditingated for carbon sink potential - In					
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)   Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)   Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)   Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)   Land impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Avoid deforestation (0ver 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Low - December (1000 hectares)   Land impacted for carbon sink potential - Mid - December (1000 hectares)   Land impacted for carbon sink potential - Mid - December (1000 hectares)   Land impacted for carbon sink potential - Mid - December (1000 hectares)   Land impacted for carbon sink potential - Mid - December (1000 hectares)   Land impacted for carbon sink potential - Mid - December (10000 hectares)   Land impacted	Land impacted for carbon sink potential - High -	0	0	0	229
Reforest cropland (1000 hectares)	Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)   Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)   Land impacted for carbon sink potential - High - O O O O O O O O O O O O O O O O O O	Land impacted for carbon sink potential - High -	0	0	0	302
Reforest pasture (1000 hectares)					
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)   Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)   Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)   Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential		0	0	0	135
Restore productivity (1000 hectares)   Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low -					
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)   Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for carbon sink potential - Mid - Land impacted for ca		0	0	0	218
Total impacted (over 30 years) (1000 hectares)   Land impacted for carbon sink potential - Low -					
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low - O O O O O O O O O O O O O O O O O O		0	0	0	1,219
Accelerate regeneration (1000 hectares)   Land impacted for carbon sink potential - Low -					
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low - O O O O O O O O O O O O O O O O O O		0	0	0	31
Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low - 0 0 0 7.63  Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Low - 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)   Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)   Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)   Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)   Land impacted for carbon sink		0	0	0	98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Increase productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Increase regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)	, , , , , , , , , , , , , , , , , , , ,				
Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Low -		0	0	0	F0.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)		U	U	U	58.7
Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Low -		0	0	0	742
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO		U	U	U	1.63
Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase trees outside for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)		n	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO		0	0	U	0
Increase trees outside forests (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO		n	0	n	121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO	·	o	ŭ	o	121
Reforest cropland (1000 hectares)  Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO		0	0	0	151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO					
Reforest pasture (1000 hectares)  Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO		0	0	0	23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO				-	
Restore productivity (1000 hectares)  Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)		0	0	0	132
Total impacted (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid -					
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO	Land impacted for carbon sink potential - Low -	0	0	0	622
Accelerate regeneration (1000 hectares)  Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - O O O O O O O O O O O O O O O O O O O	Total impacted (over 30 years) (1000 hectares)				
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - O O O O O O O O O O O O O O O O O O O	Land impacted for carbon sink potential - Mid -	0	0	0	46.4
Avoid deforestation (over 30 years) (1000 hectares)  Land impacted for carbon sink potential - Mid -					
hectares)  Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid -  0 0 0 0 175		0	0	0	101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - Increase rotention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid -  0 0 0 0 175	Avoid deforestation (over 30 years) (1000				
Extend rotation length (1000 hectares)  Land impacted for carbon sink potential - Mid -					
Land impacted for carbon sink potential - Mid - 0 0 0 11.5  Improve plantations (1000 hectares)  Land impacted for carbon sink potential - Mid - 0 0 0 0 0  Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - 0 0 0 175		0	0	0	106
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 0 175					
Land impacted for carbon sink potential - Mid - 0 0 0 0 0 Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - 0 0 0 175		0	0	0	11.5
Increase retention of HWP (1000 hectares)  Land impacted for carbon sink potential - Mid - 0 0 175					
Land impacted for carbon sink potential - Mid - 0 0 175		0	0	0	0
					4
Increase trees outside forests (1000 nectares)		U	U	U	1/5
	increase trees outside forests (1000 nectares)				

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	227
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	169
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	266
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	1,102
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	132	64.2	41	32.2	28	26.9
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	13.9	12.9	13.6	9.38	7.66	6.65
Monetary damages from air pollution - Transportation (million 2019\$)	0	38.5	38.8	39.2	39.8	40.4	41
Premature deaths from air pollution - Coal (deaths)	0	14.8	7.2	4.6	3.61	3.14	3.02
Premature deaths from air pollution - Natural Gas (deaths)	0	1.57	1.46	1.54	1.06	0.865	0.751
Premature deaths from air pollution - Transportation (deaths)	0	4.33	4.37	4.41	4.48	4.54	4.61