Net-Zero America - idaho state report

Larson et al. 2020

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

Notes

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.25	1.37	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.7	69.9	94.8	99.7	100	100	100
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	9.46	20.4	40.3	80.7	88.3	89	88.8
(%)							
Sales of space heating units - Electric Resistance	10.7	17	13.5	5.83	4.48	4.43	4.48
(%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric Heat Pump	0	0.814	11.1	33.7	37.7	38	38
(%)							
Sales of water heating units - Electric Resistance	21.3	36.7	43.2	57.2	59.8	59.9	59.9
(%)							
Sales of water heating units - Gas Furnace (%)	76.7	60.4	43.6	6.97	0.411	0	0
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	361	924	1,498	2,269	2,469	2,354
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.066	0	0.688	0	3.02	0	4.88
Public EV charging plugs - L2 (1000 units)	0.128	0	16.6	0	72.7	0	118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.36	0.233	0.074	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	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)	49	49.1	48.2	46	43.3	41.4	40.7
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	4,239	4,716	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump	3.53	8.34	31.3	81.3	90.2	90.7	90.8
(%)							
Sales of space heating units - Electric Resistance	3.3	3.52	4.98	8.12	8.7	8.74	8.73
(%)							
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	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 (%)	92.1	87.9	63.7	10.6	1.11	0.511	0.508
Sales of water heating units - Electric Heat Pump	0.03	1.08	14.4	43.7	48.9	49.2	49.2
(%)							
Sales of water heating units - Electric Resistance	1.46	2.52	15.8	44.9	50.1	50.4	50.4
(%)							
Sales of water heating units - Gas Furnace (%)	98.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.28	1.35	2.22	2.38	2.18	2.3
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion	0	0	0	0	0	0	0
\$2018)							
Capital invested - Biomass w/ccu allam power	0	0	0	0	0	0	0
plant (billion \$2018)							
Capital invested - Biomass w/ccu power plant	0	0	0	0	0	0	0
(billion \$2018)							
Capital invested - Solar PV - Base (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion	0	0.002	0	0	0	0	0
\$2018)							
Capital invested - Wind - Base (billion \$2018)	0	0	17.1	6.28	5.04	5.17	0.609
Capital invested - Wind - Constrained (billion	0	0	14.8	7.01	7.45	5.78	0.297
\$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	4.27	0	0	0	0	0	0
Wind - Base land use assumptions (GWh)	3,041	0	38,530	14,351	11,517	12,398	1,517
Wind - Constrained land use assumptions (GWh)	3,306	0	34,477	14,575	15,964	12,081	476

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	55.2
Conversion capital investment - Cumulative 5-yr	0	0	0	0	0	0	871
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	3
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	1.08

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - BECCS (MMT)	0	0	0	0	0	0	1.08
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	1.08
Cumulative - BECCS (MMT)	0	0	0	0	0	0	1.08
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	177	177	177	508
Cumulative investment - All (million \$2018)	0	0	0	423	423	423	606
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	183
Cumulative investment - Trunk (million \$2018)	0	0	0	423	423	423	423
Spur (km)	0	0	0	0	0	0	332
Trunk (km)	0	0	0	177	177	177	177

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,914
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-62.8
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,976
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-972
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-31.4
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,003
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,284
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	104
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,387
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink - Moderate	0	0	1,168
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	51.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,220
deployment - Total (1000 hectares)			

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	rests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	4,423
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	31,032
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	793
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	4,659
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	290
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y)	0	0	4,259
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)	0	0	812
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	5,953
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	3,080
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	6,761
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	2,216
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,479
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	132
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	1,790
Carbon sink potential - Low - Improve plantations (1000 tC02e/y)	0	0	148
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)	0	0	1,420
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)	0	0	284
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	2,977
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	233
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	2,279
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,320
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)	0	0	21,253
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	463
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	3,224
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)	0	0	217
Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y)	0	0	2,839

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	rests (contin	ued)	
Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees	0	0	548
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	4,465
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,656
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	4,520
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	724
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	107
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	2,376
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	107
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	77.2
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	394
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	87.5
Reforest pasture (1000 hectares)			00
Land impacted for carbon sink potential - High -	0	0	2,241
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	6,113
Total impacted (over 30 years) (1000 hectares)			0,110
Land impacted for carbon sink potential - Low -	0	0	362
Accelerate regeneration (1000 hectares)		0	002
Land impacted for carbon sink potential - Low -	0	0	101
Avoid deforestation (over 30 years) (1000		9	101
hectares)			
Land impacted for carbon sink potential - Low -	0	0	910
Extend rotation length (1000 hectares)		0	710
Land impacted for carbon sink potential - Low -	0	0	53.5
Improve plantations (1000 hectares)		0	33.3
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)		0	0
Land impacted for carbon sink potential - Low -	0	0	40.6
Increase trees outside forests (1000 hectares)		0	40.0
Land impacted for carbon sink potential - Low -	0	0	197
Reforest cropland (1000 hectares)	"	0	171
Land impacted for carbon sink potential - Low -	0	0	15.2
Reforest pasture (1000 hectares)	"	0	15.2
Land impacted for carbon sink potential - Low -	0	0	1.057
·	0	0	1,356
Restore productivity (1000 hectares)			0.005
Land impacted for carbon sink potential - Low -	0	0	3,035
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	543
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,643
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	80.5
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	58.9
Increase trees outside forests (1000 hectares)			
		1	

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Mid -	0	0	295
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	110
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,731
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	5,565
Total impacted (over 30 years) (1000 hectares)			

Table 14: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	42.5	0.049	0.049	0.042	0.027	0
(million 2019\$)							
Monetary damages from air pollution - Natural	0	12.5	7.09	5.76	5.23	3.45	1.91
Gas (million 2019\$)							
Monetary damages from air pollution -	0	125	120	93.3	54.7	25	9.4
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	4.77	0.005	0.005	0.005	0.003	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.41	0.8	0.651	0.591	0.39	0.216
Gas (deaths)							
Premature deaths from air pollution -	0	14.1	13.5	10.5	6.15	2.81	1.06
Transportation (deaths)							

Table 15: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	137	143	185	130	77.8	26	66.9
By economic sector - Construction (jobs)	2,854	2,221	7,427	8,396	8,720	9,256	9,387
By economic sector - Manufacturing (jobs)	1,288	1,309	2,451	2,881	2,696	2,467	2,658
By economic sector - Mining (jobs)	731	581	414	265	155	83.3	39.4
By economic sector - Other (jobs)	383	267	741	905	1,047	1,208	1,521
By economic sector - Pipeline (jobs)	126	123	105	133	58.9	37.3	51.3
By economic sector - Professional (jobs)	1,196	1,077	4,833	5,675	6,291	7,026	7,209
By economic sector - Trade (jobs)	973	828	2,548	3,001	3,366	3,831	4,122
By economic sector - Utilities (jobs)	1,314	1,550	5,647	6,258	6,471	7,088	6,824
By education level - All sectors - Associates	2,749	2,479	7,748	8,866	9,295	10,016	10,294
degree or some college (jobs)							
By education level - All sectors - Bachelors	1,845	1,682	5,081	5,777	6,080	6,583	6,749
degree (jobs)							
By education level - All sectors - Doctoral degree	68.3	60.1	214	246	266	293	302
(jobs)							
By education level - All sectors - High school	3,898	3,471	9,990	11,249	11,637	12,374	12,734
diploma or less (jobs)							
By education level - All sectors - Masters or	443	406	1,318	1,506	1,605	1,756	1,800
professional degree (jobs)							
By resource sector - Biomass (jobs)	392	413	459	309	198	99.6	303
By resource sector - CO2 (jobs)	0	0	0	419	0	0	236
By resource sector - Coal (jobs)	3.17	2.46	0.823	0	0	0	0
By resource sector - Grid (jobs)	1,302	1,910	9,465	10,247	11,504	12,808	12,127
By resource sector - Natural Gas (jobs)	1,004	922	775	780	569	462	473
By resource sector - Nuclear (jobs)	308	303	298	173	0	0	0
By resource sector - Oil (jobs)	1,661	1,419	1,118	783	500	302	151
By resource sector - Solar (jobs)	3,603	2,066	2,102	2,734	2,943	3,155	5,306
By resource sector - Wind (jobs)	730	1,063	10,133	12,199	13,170	14,195	13,283
Median wages - Annual - All (\$2019 per job)	53,347	54,810	56,192	56,868	57,799	58,888	59,480
On-Site or In-Plant Training - Total jobs - 1 to 4	1,444	1,297	3,998	4,551	4,755	5,112	5,233
years (jobs)							
On-Site or In-Plant Training - Total jobs - 4 to 10	606	535	1,754	2,002	2,100	2,271	2,311
years (jobs)							
On-Site or In-Plant Training - Total jobs - None	1,486	1,324	4,005	4,560	4,772	5,130	5,291
(jobs)							

Table 15: E+ scenario - IMPACTS - Jobs (continued	Table 15: <i>E</i>	+ scenario -	IMPACTS	Inhs	<i>(continued</i>
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Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10	73.2	66.7	218	250	262	282	288
years (jobs)							
On-Site or In-Plant Training - Total jobs - Up to 1	5,394	4,876	14,376	16,282	16,994	18,226	18,755
year (jobs)							
On-the-Job Training - All sectors - 1 to 4 years	1,850	1,661	5,196	5,925	6,197	6,671	6,820
(jobs)							
On-the-Job Training - All sectors - 4 to 10 years	591	519	1,741	1,991	2,093	2,266	2,308
(jobs)							
On-the-Job Training - All sectors - None (jobs)	516	454	1,325	1,502	1,571	1,690	1,752
On-the-Job Training - All sectors - Over 10 years	94.7	81.6	233	265	272	287	296
(jobs)							
On-the-Job Training - All sectors - Up to 1 year	5,952	5,383	15,856	17,962	18,751	20,108	20,703
(jobs)							
Related work experience - All sectors - 1 to 4	3,208	2,897	8,751	9,935	10,405	11,205	11,506
years (jobs)							
Related work experience - All sectors - 4 to 10	2,064	1,863	5,764	6,570	6,883	7,418	7,590
years (jobs)							
Related work experience - All sectors - None	1,295	1,167	3,475	3,942	4,113	4,416	4,553
(jobs)							
Related work experience - All sectors - Over 10	548	499	1,494	1,699	1,772	1,901	1,944
years (jobs)							
Related work experience - All sectors - Up to 1	1,889	1,673	4,867	5,498	5,710	6,082	6,286
year (jobs)							
Wage income - All (million \$2019)	480	444	1,368	1,572	1,670	1,827	1,896

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	85.2	86.5	72.9	58.5	44	27.7	19.2
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	1,761
Natural gas production - Annual (tcf)	1.92	2.13	2.02	1.76	1.48	1.18	0.915
Oil consumption - Annual (million bbls)	33.9	31.7	27.2	20.5	14.1	9.1	4.81
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	629
Oil production - Annual (million bbls)	0.105	0.114	0.114	0.114	0.091	0.074	0.049

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.25	1.37	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.6	62.6	66.1	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.4	37.4	33.9	24.6	11.7	3.79	1.02
Sales of space heating units - Electric Heat Pump (%)	9.46	19.2	21.1	27.7	43.3	62.6	73.4
Sales of space heating units - Electric Resistance (%)	10.7	17.2	16.8	15.7	12.9	9.42	7.34
Sales of space heating units - Fossil (%)	6.36	10.7	10.8	9.99	8.15	6.52	6.16
Sales of space heating units - Gas (%)	73.4	53	51.3	46.6	35.6	21.5	13.1
Sales of water heating units - Electric Heat Pump (%)	0	0.373	1.39	4.79	13	23.4	29.5
Sales of water heating units - Electric Resistance (%)	21.3	36.4	37.1	39.3	44.4	50.9	54.7
Sales of water heating units - Gas Furnace (%)	76.7	61.1	59.4	53.8	40.4	23.6	13.6
Sales of water heating units - Other (%)	1.97	2.1	2.1	2.11	2.11	2.11	2.11

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	58.3	123	414	1,303	1,898
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.066	0	0.213	0	1.12	0	3.13
Public EV charging plugs - L2 (1000 units)	0.128	0	5.12	0	27	0	75.3
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7

Table 18: E- scenario -	PTI I AR 1: Efficienc	v/Flectrification - `	Transnortation	(continued)

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.92	2.27	2.13	1.71	1.13	0.586	0.249
Vehicle sales - Light-duty - EV (%)	1.46	3.76	9.89	22.7	44.8	69.7	86.6
Vehicle sales - Light-duty - gasoline (%)	93	89.2	82.7	70.7	50.2	27.4	11.9
Vehicle sales - Light-duty - hybrid (%)	3.34	4.23	4.82	4.56	3.59	2.23	1.12
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.391	0.348	0.273	0.2	0.113	0.052
Vehicle sales - Light-duty - other (%)	0.119	0.122	0.114	0.1	0.074	0.041	0.019
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)	49	49.1	48.9	48.7	48	47.1	46.1
Final energy use - Industry (PJ)	165	176	181	184	188	193	197
Final energy use - Residential (PJ)	71.3	68.1	66.1	64.1	61.5	57.8	53.1
Final energy use - Transportation (PJ)	150	142	130	120	112	103	93

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	4,239	4,714	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric Heat Pump	3.53	7.33	9.61	17.1	35.2	58.2	71.6
(%)							
Sales of space heating units - Electric Resistance	3.3	3.45	3.58	4.06	5.22	6.69	7.54
(%)							
Sales of space heating units - Fossil (%)	1.07	0.256	0.242	0.19	0.113	0.063	0.046
Sales of space heating units - Gas Furnace (%)	92.1	89	86.6	78.7	59.5	35.1	20.8
Sales of water heating units - Electric Heat Pump	0.03	0.512	1.83	6.23	16.9	30.4	38.3
(%)							
Sales of water heating units - Electric Resistance	1.46	1.95	3.27	7.65	18.2	31.6	39.5
(%)							
Sales of water heating units - Gas Furnace (%)	98.1	97.2	94.5	85.7	64.5	37.6	21.8
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.09	1.13	1.39	1.45	2.09	2.22
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,914
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-62.8
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,976
Total (1000 tC02e/y)			

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

Table 22. E Scenario I IEEAN O. Edila Siliko 7	igi icaitai c (c	ontinacaj	
Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-972
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-31.4
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,003
Total (1000 tC02e/y)			
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,284
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	104
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,387
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,168
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	51.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,220
deployment - Total (1000 hectares)			

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

Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	Item	2020	2025	2050
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid deforestation (1000 tC02e/y) Carbon sink potential - High - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - High - Improve plantations (1000 tC02e/y) Carbon sink potential - High - Increase retention overlap (1000 tC02e/y) Carbon sink potential - High - Increase retention overlap (1000 tC02e/y) Carbon sink potential - High - Increase trees overlap (1000 tC02e/y) Carbon sink potential - High - Reforest cropland overlap (1000 tC02e/y) Carbon sink potential - High - Reforest pasture overlap (1000 tC02e/y) Carbon sink potential - High - Restore overlap (1000 tC02e/y) Carbon sink potential - High - Restore overlap (1000 tC02e/y) Carbon sink potential - Low - Accelerate overlap (1000 tC02e/y) Carbon sink potential - Low - Accelerate overlap (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y)		0	0	4,423
overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - High - Extend rotation 0 0 4,659 length (1000 tCO2e/y) Carbon sink potential - High - Improve 0 0 0 290 plantations (1000 tCO2e/y) Carbon sink potential - High - Increase retention 0 0 0 4,259 of HWP (1000 tCO2e/y) Carbon sink potential - High - Increase trees 0 0 0 812 outside forests (1000 tCO2e/y) Carbon sink potential - High - Reforest cropland 0 0 5,953 (1000 tCO2e/y) Carbon sink potential - High - Reforest pasture 0 0 3,080 (1000 tCO2e/y) Carbon sink potential - High - Restore 0 0 6,761 productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate 0 0 2,216 regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting 0 0 11,479 overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation 0 132 (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation 0 1,790 length (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation 0 0 148				
Carbon sink potential - High - Avoid deforestation (1000 tC02e/y) Carbon sink potential - High - Extend rotation of the production of the productivity (1000 tC02e/y) Carbon sink potential - High - Improve of the productivity (1000 tC02e/y) Carbon sink potential - High - Increase retention of the productivity (1000 tC02e/y) Carbon sink potential - High - Increase trees of the productivity (1000 tC02e/y) Carbon sink potential - High - Reforest cropland of too tc02e/y) Carbon sink potential - High - Reforest pasture of the productivity (1000 tC02e/y) Carbon sink potential - High - Restore of the productivity (1000 tC02e/y) Carbon sink potential - Low - Accelerate of the productivity (1000 tC02e/y) Carbon sink potential - Low - All (not counting of the productivity (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tC02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tc02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tc02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tc02e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tc02e/y)	Carbon sink potential - High - All (not counting	0	0	31,032
Carbon sink potential - High - Extend rotation length (1000 tC02e/y) Carbon sink potential - High - Improve plantations (1000 tC02e/y) Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - High - Increase trees 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 - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Extend rotation O 0 1,790 Carbon sink potential - Low - Improve O 0 148				
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) 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 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 - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation O 0 1,790 Carbon sink potential - Low - Improve O 0 148	Carbon sink potential - High - Avoid deforestation	0	0	793
length (1000 tCO2e/y) 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 of outside forests (1000 tCO2e/y) Carbon sink potential - High - Reforest cropland of too tcO2e/y) Carbon sink potential - High - Reforest pasture of too tcO2e/y) Carbon sink potential - High - Reforest pasture of too tcO2e/y) Carbon sink potential - High - Restore productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate of the productivity (1000 tCO2e/y) Carbon sink potential - Low - All (not counting of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation of the productivity (1000 tCO2e/y)	(1000 tCO2e/y)			
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 of O O 812 outside forests (1000 tCO2e/y) Carbon sink potential - High - Reforest cropland O O S,953 (1000 tCO2e/y) Carbon sink potential - High - Reforest pasture O O O 3,080 (1000 tCO2e/y) Carbon sink potential - High - Restore D O O O O O O O O O O O O O O O O O O	Carbon sink potential - High - Extend rotation	0	0	4,659
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 outside forest in the productivity (1000 tCO2e/y) Carbon sink potential - High - Reforest pasture outside forest pasture	length (1000 tCO2e/y)			
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 - Reforest pasture (1000 tC02e/y) Carbon sink potential - High - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Accelerate pregeneration (1000 tC02e/y) Carbon sink potential - Low - All (not counting powerlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Improve (148)	Carbon sink potential - High - Improve	0	0	290
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 outside productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate outside 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 - Avoid deforestation outside (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation outside (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation outside (1000 tCO2e/y) Carbon sink potential - Low - Improve outside (1000 tCO2e/y) Carbon sink potential - Low - Improve outside (1000 tCO2e/y)	plantations (1000 tCO2e/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 productivity (1000 tC02e/y) Carbon sink potential - Low - All (not counting poverlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Improve (148)	Carbon sink potential - High - Increase retention	0	0	4,259
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 pregeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting poverlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation powerlap (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation powerlap (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation powerlap (1000 tCO2e/y) Carbon sink potential - Low - Improve powerlap (1000 tCO2e/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 0 0 148	Carbon sink potential - High - Increase trees	0	0	812
(1000 tCO2e/y)03,080Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)003,080Carbon sink potential - High - Restore productivity (1000 tCO2e/y)006,761Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)002,216Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)0011,479Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)00132Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)001,790Carbon sink potential - Low - Improve00148	outside forests (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 - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve 0 0 148	Carbon sink potential - High - Reforest cropland	0	0	5,953
(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 - Avoid deforestation overlap (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tCO2e/y) Carbon sink potential - Low - Improve overlap (148)				
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 - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Improve (1000 tC02e/y)	Carbon sink potential - High - Reforest pasture	0	0	3,080
productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate	(1000 tCO2e/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 - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation (1000 tC02e/y) Carbon sink potential - Low - Improve (1000 tC02e/y) Carbon sink potential - Low - Improve (1000 tC02e/y)	Carbon sink potential - High - Restore	0	0	6,761
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 overlaph (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation overlaph (1000 tCO2e/y) Carbon sink potential - Low - Improve overlaph (1000 tCO2e/y)	productivity (1000 tCO2e/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 overlap (1000 tC02e/y) Carbon sink potential - Low - Extend rotation overlap (1000 tC02e/y) Carbon sink potential - Low - Improve overlap (148)	Carbon sink potential - Low - Accelerate	0	0	2,216
overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation (1000 tCO2e/y) Carbon sink potential - Low - Improve (1000 tCO2e/y) Carbon sink potential - Low - Improve (1000 tCO2e/y)	regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - Avoid deforestation 0 132 (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation 0 1,790 length (1000 tCO2e/y) Carbon sink potential - Low - Improve 0 0 148	Carbon sink potential - Low - All (not counting	0	0	11,479
(1000 tC02e/y)01,790Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)01,790Carbon sink potential - Low - Improve00148	overlap) (1000 tCO2e/y)			
Carbon sink potential - Low - Extend rotation 0 1,790 length (1000 tC02e/y) Carbon sink potential - Low - Improve 0 0 148	Carbon sink potential - Low - Avoid deforestation	0	0	132
length (1000 tC02e/y) Carbon sink potential - Low - Improve 0 0 148	(1000 tCO2e/y)			
Carbon sink potential - Low - Improve 0 0 148	Carbon sink potential - Low - Extend rotation	0	0	1,790
	length (1000 tCO2e/y)			
nlantations (1000 tCO2e/v)	Carbon sink potential - Low - Improve	0	0	148
	plantations (1000 tCO2e/y)			

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

Table 23: E- scenario - PILLAR 6: Land sinks - Fo	rests (contin	uedJ	
Item	2020	2025	2050
Carbon sink potential - Low - Increase retention	0	0	1,420
of HWP (1000 tCO2e/y)			
Carbon sink potential - Low - Increase trees	0	0	284
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	2,977
(1000 tC02e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	233
(1000 tCO2e/y)			
Carbon sink potential - Low - Restore	0	0	2,279
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	3,320
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	21,253
overlap) (1000 tCO2e/y)			
Carbon sink potential - Mid - Avoid deforestation	0	0	463
(1000 tC02e/y)			
Carbon sink potential - Mid - Extend rotation	0	0	3,224
length (1000 tCO2e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	217
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	2,839
of HWP (1000 tCO2e/y)			,
Carbon sink potential - Mid - Increase trees	0	0	548
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	4,465
(1000 tCO2e/y)			.,
Carbon sink potential - Mid - Reforest pasture	0	0	1,656
(1000 tCO2e/y)			1,000
Carbon sink potential - Mid - Restore	0	0	4,520
productivity (1000 tC02e/y)		•	4,020
Land impacted for carbon sink potential - High -	0	0	724
Accelerate regeneration (1000 hectares)		•	127
Land impacted for carbon sink potential - High -	0	0	107
Avoid deforestation (over 30 years) (1000		0	101
hectares)			
Land impacted for carbon sink potential - High -	0	0	2,376
Extend rotation length (1000 hectares)		•	2,010
Land impacted for carbon sink potential - High -	0	0	107
Improve plantations (1000 hectares)		0	101
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)		0	U
Land impacted for carbon sink potential - High -	0	0	77.2
Increase trees outside forests (1000 hectares)		0	11.2
Land impacted for carbon sink potential - High -	0	0	394
Reforest cropland (1000 hectares)		0	374
Land impacted for carbon sink potential - High -	0	0	87.5
	"	0	67.5
Reforest pasture (1000 hectares)	0	0	2,241
Land impacted for carbon sink potential - High -	"	0	2,241
Restore productivity (1000 hectares)		-	/ 110
Land impacted for carbon sink potential - High -	0	0	6,113
Total impacted (over 30 years) (1000 hectares)			0.40
Land impacted for carbon sink potential - Low -	0	0	362
Accelerate regeneration (1000 hectares)			101
Land impacted for carbon sink potential - Low -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	910
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	53.5
	1		
Improve plantations (1000 hectares)			
Improve plantations (1000 hectares) Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	40.6
Increase trees outside forests (1000 hectares)		Ŭ	40.0
Land impacted for carbon sink potential - Low -	0	0	197
Reforest cropland (1000 hectares)		Ŭ	171
Land impacted for carbon sink potential - Low -	0	0	15.2
Reforest pasture (1000 hectares)			10.2
Land impacted for carbon sink potential - Low -	0	0	1,356
Restore productivity (1000 hectares)			1,000
Land impacted for carbon sink potential - Low -	0	0	3,035
Total impacted (over 30 years) (1000 hectares)			0,000
Land impacted for carbon sink potential - Mid -	0	0	543
Accelerate regeneration (1000 hectares)			0.0
Land impacted for carbon sink potential - Mid -	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,643
Extend rotation length (1000 hectares)			,
Land impacted for carbon sink potential - Mid -	0	0	80.5
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	58.9
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	295
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	110
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,731
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	5,565
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	42.5	0.049	0.049	0.042	0.027	0
(million 2019\$)							
Monetary damages from air pollution - Natural	0	13	6.27	4.16	2.62	1.48	1.11
Gas (million 2019\$)							
Monetary damages from air pollution -	0	127	131	131	120	97	67.5
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	4.77	0.005	0.005	0.005	0.003	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.47	0.708	0.47	0.295	0.168	0.125
Gas (deaths)							
Premature deaths from air pollution -	0	14.3	14.8	14.7	13.5	10.9	7.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.25	1.37	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.7	69.9	94.8	99.7	100	100	100
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	9.46	20.4	40.3	80.7	88.3	89	88.8
(%)							
Sales of space heating units - Electric Resistance	10.7	17	13.5	5.83	4.48	4.43	4.48
(%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric Heat Pump	0	0.814	11.1	33.7	37.7	38	38
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance	21.3	36.7	43.2	57.2	59.8	59.9	59.9
(%)							
Sales of water heating units - Gas Furnace (%)	76.7	60.4	43.6	6.97	0.411	0	0
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)	0	361	924	1,498	2,269	2,469	2,354
Public EV charging plugs - DC Fast (1000 units)	0.066	0	0.688	0	3.02	0	4.88
Public EV charging plugs - L2 (1000 units)	0.128	0	16.6	0	72.7	0	118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.36	0.233	0.074	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	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)	49	49.1	48.2	46	43.3	41.4	40.7
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

 ${\it Table~28:~E+RE+~scenario~-~PILLAR~1:~Efficiency/Electrification~-~Commercial}$

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	4,239	4,716	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump	3.53	8.34	31.3	81.3	90.2	90.7	90.8
(%)							
Sales of space heating units - Electric Resistance	3.3	3.52	4.98	8.12	8.7	8.74	8.73
(%)							
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	92.1	87.9	63.7	10.6	1.11	0.511	0.508
Sales of water heating units - Electric Heat Pump	0.03	1.08	14.4	43.7	48.9	49.2	49.2
(%)							
Sales of water heating units - Electric Resistance	1.46	2.52	15.8	44.9	50.1	50.4	50.4
(%)							
Sales of water heating units - Gas Furnace (%)	98.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.28	1.35	2.22	2.38	2.18	2.3
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 - Wind - Base (billion \$2018)	0	0	17.8	9.95	14.3	8.47	14.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	4.27	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	4.27	0	0	0	0	0	11,705
Wind - Base land use assumptions (GWh)	3,041	0	39,970	22,284	32,360	19,424	32,982
Wind - Constrained land use assumptions (GWh)	4,217	0	34,889	24,998	23,075	13,321	34,399

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

Table 62. ETRET Section 10 TILLTIN 6. Land Sinks	rigi icaitai i		
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,914
Cropland measures (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-62.8
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,976
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-972
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-31.4
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,003
Total (1000 tC02e/y)			,
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			· ·
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,284
deployment - Cropland measures (1000			_,
hectares)			
Land impacted for carbon sink - Aggressive	0	0	104
deployment - Permanent conservation cover			_
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,387
deployment - Total (1000 hectares)			,
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			· ·
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,168
deployment - Cropland measures (1000			.,
hectares)			
Land impacted for carbon sink - Moderate	0	0	51.8
deployment - Permanent conservation cover	Ĭ	Ĭ	00
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,220
deployment - Total (1000 hectares)		ŭ	1,220
aspis,			

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

Table 33: E+RE+ scenario - PILLAR 6: Land sinks	s - Forests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	4,423
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	31,032
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	793
(1000 tC02e/y)			
Carbon sink potential - High - Extend rotation	0	0	4,659
length (1000 tC02e/y)			,
Carbon sink potential - High - Improve	0	0	290
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,259
of HWP (1000 tC02e/y)			1,207
Carbon sink potential - High - Increase trees	0	0	812
outside forests (1000 tCO2e/y)	0	9	012
Carbon sink potential - High - Reforest cropland	0	0	5,953
(1000 tCO2e/y)	0	0	3,733
Carbon sink potential - High - Reforest pasture	0	0	3,080
(1000 tC02e/y)	0	0	3,000
	0	0	/ 7/1
Carbon sink potential - High - Restore	0	0	6,761
productivity (1000 tC02e/y)	0		0.017
Carbon sink potential - Low - Accelerate	0	0	2,216
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	11,479
overlap) (1000 tCO2e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	132
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,790
length (1000 tCO2e/y)			
Carbon sink potential - Low - Improve	0	0	148
plantations (1000 tCO2e/y)			
Carbon sink potential - Low - Increase retention	0	0	1,420
of HWP (1000 tCO2e/y)			
Carbon sink potential - Low - Increase trees	0	0	284
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	2,977
(1000 tC02e/y)			•
Carbon sink potential - Low - Reforest pasture	0	0	233
(1000 tC02e/y)		-	
Carbon sink potential - Low - Restore	0	0	2,279
productivity (1000 tCO2e/y)			_,,
Carbon sink potential - Mid - Accelerate	0	0	3,320
regeneration (1000 tCO2e/y)	0	0	0,020
Carbon sink potential - Mid - All (not counting	0	0	21,253
overlap) (1000 tC02e/y)	0	0	21,200
Carbon sink potential - Mid - Avoid deforestation	0	0	463
(1000 tC02e/y)	U	0	403
•	0	0	0.007
Carbon sink potential - Mid - Extend rotation	0	0	3,224
length (1000 tCO2e/y)			047
Carbon sink potential - Mid - Improve plantations	0	0	217
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	2,839
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	548
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	4,465
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,656
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	4,520
our borrount potential i ha itootoro			•
productivity (1000 tCO2e/y) Land impacted for carbon sink potential - High -	0	0	724

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

Table 33: E+RE+ scenario - PILLAR 6: Land sinks	•		
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	107
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	2,376
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	107
Improve plantations (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)			J
Land impacted for carbon sink potential - High -	0	0	77.2
Increase trees outside forests (1000 hectares)	o	0	11.2
	0	0	394
Land impacted for carbon sink potential - High -	U	0	394
Reforest cropland (1000 hectares)	0	0	07.5
Land impacted for carbon sink potential - High -	0	0	87.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	2,241
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	6,113
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	362
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	910
Extend rotation length (1000 hectares)	o	0	710
	0	0	EO E
Land impacted for carbon sink potential - Low -	0	0	53.5
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	40.6
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	197
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.2
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,356
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,035
Total impacted (over 30 years) (1000 hectares)			0,000
Land impacted for carbon sink potential - Mid -	0	0	543
Accelerate regeneration (1000 hectares)	o	0	343
Land impacted for carbon sink potential - Mid -	0	0	104
	U	U	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,643
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	80.5
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	58.9
Increase trees outside forests (1000 hectares)	-	-	-
Land impacted for carbon sink potential - Mid -	0	0	295
Reforest cropland (1000 hectares)	0	9	270
Land impacted for carbon sink potential - Mid -	0	0	110
	U	۱ ۲	110
Reforest pasture (1000 hectares)			0.701
Land impacted for carbon sink potential - Mid -	0	0	2,731
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	L E / E
Total impacted (over 30 years) (1000 hectares)	U	o	5,565

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	42.5	0.049	0.049	0.042	0.027	0
(million 2019\$)							
Monetary damages from air pollution - Natural	0	11.3	5.84	3.22	2.52	1.5	0.778
Gas (million 2019\$)							
Monetary damages from air pollution -	0	125	120	93.3	54.7	25	9.4
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	4.77	0.005	0.005	0.005	0.003	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.28	0.659	0.364	0.285	0.169	0.088
Gas (deaths)							
Premature deaths from air pollution -	0	14.1	13.5	10.5	6.15	2.81	1.06
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.25	1.37	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.7	69.9	94.8	99.7	100	100	100
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric Heat Pump	9.46	20.4	40.3	80.7	88.3	89	88.8
(%)							
Sales of space heating units - Electric Resistance	10.7	17	13.5	5.83	4.48	4.43	4.48
(%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric Heat Pump	0	0.814	11.1	33.7	37.7	38	38
(%)							
Sales of water heating units - Electric Resistance	21.3	36.7	43.2	57.2	59.8	59.9	59.9
(%)							
Sales of water heating units - Gas Furnace (%)	76.7	60.4	43.6	6.97	0.411	0	0
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	361	924	1,498	2,269	2,469	2,354
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.066	0	0.688	0	3.02	0	4.88
Public EV charging plugs - L2 (1000 units)	0.128	0	16.6	0	72.7	0	118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.36	0.233	0.074	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	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)	49	49.1	48.2	46	43.3	41.4	40.7
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	4,239	4,716	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump	3.53	8.34	31.3	81.3	90.2	90.7	90.8
(%)							
Sales of space heating units - Electric Resistance	3.3	3.52	4.98	8.12	8.7	8.74	8.73
(%)							
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	92.1	87.9	63.7	10.6	1.11	0.511	0.508
Sales of water heating units - Electric Heat Pump	0.03	1.08	14.4	43.7	48.9	49.2	49.2
(%)							
Sales of water heating units - Electric Resistance	1.46	2.52	15.8	44.9	50.1	50.4	50.4
(%)							
Sales of water heating units - Gas Furnace (%)	98.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.28	1.35	2.22	2.38	2.18	2.3
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	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	0	0	0	0	0.217	0.57
Capital invested - Wind - Base (billion \$2018)	0	1.28	11	4.77	6.07	2.13	0
Capital invested - Wind - Constrained (billion \$2018)	0	1.72	11.5	2.37	7.03	3.43	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	4.27	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	4.27	0	0	0	0	466	1,304
Wind - Base land use assumptions (GWh)	3,041	2,770	25,082	11,152	14,536	5,157	0
Wind - Constrained land use assumptions (GWh)	4,217	3,660	24,834	5,165	15,737	7,661	0

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

Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,914
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-62.8
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-1,976
Total (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Corn-ethanol to energy grasses (1000 tC02e/y)			

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	0	0	-972
Cropland measures (1000 tCO2e/y)	U	0	-912
Carbon sink potential - Moderate deployment -	0	0	-31.4
Permanent conservation cover (1000 tC02e/y)	U	0	-31.4
	0	0	1 000
Carbon sink potential - Moderate deployment -	U	0	-1,003
Total (1000 tC02e/y)	0		
Land impacted for carbon sink - Aggressive	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,284
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	104
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,387
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	0
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,168
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	51.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	1,220
deployment - Total (1000 hectares)			.,0

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

Thomas Th	0000	0005	0050
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	4,423
regeneration (1000 tCO2e/y)	_	_	
Carbon sink potential - High - All (not counting	0	0	31,032
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	793
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	4,659
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	290
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,259
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	812
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	5,953
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	3,080
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	6,761
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	2,216
regeneration (1000 tCO2e/y)			,
Carbon sink potential - Low - All (not counting	0	0	11,479
overlap) (1000 tC02e/y)			,
Carbon sink potential - Low - Avoid deforestation	0	0	132
(1000 tC02e/y)			.02
Carbon sink potential - Low - Extend rotation	0	0	1,790
length (1000 tC02e/y)	o	0	.,. 70
Carbon sink potential - Low - Improve	0	0	148
plantations (1000 tC02e/y)	0	0	140
Carbon sink potential - Low - Increase retention	0	0	1,420
of HWP (1000 tCO2e/y)	U	0	1,420
01 11VVF (1000 t0026/ y)			

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

Table 43: E+RE- scenario - PILLAR 6: Land sinks	- Forests (C	ontinueaj	
Item	2020	2025	2050
Carbon sink potential - Low - Increase trees	0	0	284
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	2,977
(1000 tC02e/y)			200
Carbon sink potential - Low - Reforest pasture	0	0	233
(1000 tC02e/y)	0	0	0.070
Carbon sink potential - Low - Restore	0	0	2,279
productivity (1000 tC02e/y)	0	0	2 200
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	3,320
Carbon sink potential - Mid - All (not counting	0	0	21,253
overlap) (1000 tC02e/y)	0	0	21,200
Carbon sink potential - Mid - Avoid deforestation	0	0	463
(1000 tC02e/y)			.00
Carbon sink potential - Mid - Extend rotation	0	0	3,224
length (1000 tC02e/y)			-,
Carbon sink potential - Mid - Improve plantations	0	0	217
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	2,839
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	548
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	4,465
(1000 tC02e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	1,656
(1000 tC02e/y)			
Carbon sink potential - Mid - Restore	0	0	4,520
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	724
Accelerate regeneration (1000 hectares)		_	
Land impacted for carbon sink potential - High -	0	0	107
Avoid deforestation (over 30 years) (1000			
hectares)	0	0	0.07/
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	2,376
Land impacted for carbon sink potential - High -	0	0	107
Improve plantations (1000 hectares)	0	0	101
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)	0	0	U
Land impacted for carbon sink potential - High -	0	0	77.2
Increase trees outside forests (1000 hectares)	0	0	11.2
Land impacted for carbon sink potential - High -	0	0	394
Reforest cropland (1000 hectares)			0,1
Land impacted for carbon sink potential - High -	0	0	87.5
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	2,241
Restore productivity (1000 hectares)			•
Land impacted for carbon sink potential - High -	0	0	6,113
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	362
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	910
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	53.5
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 - Increase trees outside forests (1000 hectares)	0	0	40.6

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	197
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.2
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,356
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,035
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	543
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,643
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	80.5
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	58.9
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	295
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	110
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,731
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	5,565
Total impacted (over 30 years) (1000 hectares)			

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	42.5	0.049	0.049	0.042	0.027	0
(million 2019\$)							
Monetary damages from air pollution - Natural	0	12.8	6.81	7.03	8.14	4.25	1.34
Gas (million 2019\$)							
Monetary damages from air pollution -	0	125	120	93.3	54.7	25	9.4
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	4.77	0.005	0.005	0.005	0.003	0
(deaths)							
Premature deaths from air pollution - Natural	0	1.45	0.77	0.794	0.919	0.48	0.151
Gas (deaths)							
Premature deaths from air pollution -	0	14.1	13.5	10.5	6.15	2.81	1.06
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.25	1.37	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.6	62.6	66.1	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.4	37.4	33.9	24.6	11.7	3.79	1.02
Sales of space heating units - Electric Heat Pump	9.46	19.2	21.1	27.7	43.3	62.6	73.4
(%)							
Sales of space heating units - Electric Resistance	10.7	17.2	16.8	15.7	12.9	9.42	7.34
(%)							
Sales of space heating units - Fossil (%)	6.36	10.7	10.8	9.99	8.15	6.52	6.16
Sales of space heating units - Gas (%)	73.4	53	51.3	46.6	35.6	21.5	13.1
Sales of water heating units - Electric Heat Pump	0	0.373	1.39	4.79	13	23.4	29.5
(%)							
Sales of water heating units - Electric Resistance	21.3	36.4	37.1	39.3	44.4	50.9	54.7
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	76.7	61.1	59.4	53.8	40.4	23.6	13.6
Sales of water heating units - Other (%)	1.97	2.1	2.1	2.11	2.11	2.11	2.11

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	58.3	123	414	1,303	1,898
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.066	0	0.213	0	1.12	0	3.13
Public EV charging plugs - L2 (1000 units)	0.128	0	5.12	0	27	0	75.3
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.92	2.27	2.13	1.71	1.13	0.586	0.249
Vehicle sales - Light-duty - EV (%)	1.46	3.76	9.89	22.7	44.8	69.7	86.6
Vehicle sales - Light-duty - gasoline (%)	93	89.2	82.7	70.7	50.2	27.4	11.9
Vehicle sales - Light-duty - hybrid (%)	3.34	4.23	4.82	4.56	3.59	2.23	1.12
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.391	0.348	0.273	0.2	0.113	0.052
Vehicle sales - Light-duty - other (%)	0.119	0.122	0.114	0.1	0.074	0.041	0.019
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)	49	49.1	48.9	48.7	48	47.1	46.1
Final energy use - Industry (PJ)	165	176	181	184	188	193	197
Final energy use - Residential (PJ)	71.3	68.1	66.1	64.1	61.5	57.8	53.1
Final energy use - Transportation (PJ)	150	142	130	120	112	103	93

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

2020	2025	2030	2035	2040	2045	2050
0	4,239	4,714	0	0	0	0
41.9	46.2	50.2	60.8	75.4	84.6	87.8
58.1	53.8	49.8	39.2	24.6	15.4	12.2
3.53	7.33	9.61	17.1	35.2	58.2	71.6
3.3	3.45	3.58	4.06	5.22	6.69	7.54
1.07	0.256	0.242	0.19	0.113	0.063	0.046
92.1	89	86.6	78.7	59.5	35.1	20.8
0.03	0.512	1.83	6.23	16.9	30.4	38.3
1.46	1.95	3.27	7.65	18.2	31.6	39.5
98.1	97.2	94.5	85.7	64.5	37.6	21.8
0.366	0.384	0.383	0.384	0.383	0.384	0.383
	58.1 3.53 3.3 1.07 92.1 0.03 1.46	0 4,239 41.9 46.2 58.1 53.8 3.53 7.33 3.3 3.45 1.07 0.256 92.1 89 0.03 0.512 1.46 1.95 98.1 97.2	0 4,239 4,714 41.9 46.2 50.2 58.1 53.8 49.8 3.53 7.33 9.61 3.3 3.45 3.58 1.07 0.256 0.242 92.1 89 86.6 0.03 0.512 1.83 1.46 1.95 3.27 98.1 97.2 94.5	0 4,239 4,714 0 41.9 46.2 50.2 60.8 58.1 53.8 49.8 39.2 3.53 7.33 9.61 17.1 3.3 3.45 3.58 4.06 1.07 0.256 0.242 0.19 92.1 89 86.6 78.7 0.03 0.512 1.83 6.23 1.46 1.95 3.27 7.65 98.1 97.2 94.5 85.7	0 4,239 4,714 0 0 41.9 46.2 50.2 60.8 75.4 58.1 53.8 49.8 39.2 24.6 3.53 7.33 9.61 17.1 35.2 3.3 3.45 3.58 4.06 5.22 1.07 0.256 0.242 0.19 0.113 92.1 89 86.6 78.7 59.5 0.03 0.512 1.83 6.23 16.9 1.46 1.95 3.27 7.65 18.2 98.1 97.2 94.5 85.7 64.5	0 4,239 4,714 0 0 0 41.9 46.2 50.2 60.8 75.4 84.6 58.1 53.8 49.8 39.2 24.6 15.4 3.53 7.33 9.61 17.1 35.2 58.2 3.3 3.45 3.58 4.06 5.22 6.69 1.07 0.256 0.242 0.19 0.113 0.063 92.1 89 86.6 78.7 59.5 35.1 0.03 0.512 1.83 6.23 16.9 30.4 1.46 1.95 3.27 7.65 18.2 31.6 98.1 97.2 94.5 85.7 64.5 37.6

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

••	•		•				
Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.09	1.13	1.39	1.45	2.09	2.22
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion	0	0	0	0	0	0	0
\$2018)							
Capital invested - Biomass w/ccu allam power	0	0	0	0	0	0	0.041
plant (billion \$2018)							
Capital invested - Biomass w/ccu power plant	0	0	0	0	0	0	0.096
(billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	40.5
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	107

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

•	Ο,						
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	0	0	0	0	0	78.2
Conversion capital investment - Cumulative 5-yr	0	0	0	0	0	0	1,084
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	2
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	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	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0	0	0	0	1.16
Annual - BECCS (MMT)	0	0	0	0	0	0	1.16
Annual - Cement and lime (MMT)	0	0	0	0	0	0	0
Annual - NGCC (MMT)	0	0	0	0	0	0	0
Cumulative - All (MMT)	0	0	0	0	0	0	1.16
Cumulative - BECCS (MMT)	0	0	0	0	0	0	1.16
Cumulative - Cement and lime (MMT)	0	0	0	0	0	0	0
Cumulative - NGCC (MMT)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	0	177	177	177	439
Cumulative investment - All (million \$2018)	0	0	0	423	423	423	573
Cumulative investment - Spur (million \$2018)	0	0	0	0	0	0	150
Cumulative investment - Trunk (million \$2018)	0	0	0	423	423	423	423
Spur (km)	0	0	0	0	0	0	262
Trunk (km)	0	0	0	177	177	177	177

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

Tetem	Table 56: E-B+ scenario - PILLAR 6: Land sinks	- Agriculture		
Corn-ethanol to energy grasses (1000 tC02e/y)		2020	2025	2050
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/v) Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/v) Carbon sink potential - Aggressive deployment - O O O O O O O O O O O O O O O O O O	Carbon sink potential - Aggressive deployment -	0	0	0
Cropland measures (1000 tCO2e/y)	Corn-ethanol to energy grasses (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tC02e/y)	Carbon sink potential - Aggressive deployment -	0	0	-1,913
Carpland to woody energy crops (1000 tCO2e/y)	Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment - 0	Carbon sink potential - Aggressive deployment -	0	0	0
Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Parmanent conservation cover (1000 tC02e/y) Carbon sink potential - Aggressive deployment - Total (1000 tC02e/y) Carbon sink potential - Moderate deployment - Total (1000 tC02e/y) Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland measures (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Carbon sink - Aggressive Carbon sink - Aggressiv	Cropland to woody energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	Carbon sink potential - Aggressive deployment -	0	0	0
Permanent conservation cover (1000 tCO2e/y)	Pasture to energy crops (1000 tC02e/y)			
Permanent conservation cover (1000 tCO2e/y)	Carbon sink potential - Aggressive deployment -	0	0	-62.8
Carbon sink potential - Aggressive deployment - Total (1000 tC02e/y) Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland measures (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - O				
Total (1000 tC02e/y)	Carbon sink potential - Aggressive deployment -	0	0	-1,976
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses [1000 tc02e/y] Carbon sink potential - Moderate deployment - Cropland measures (1000 tc02e/y) Carbon sink potential - Moderate deployment - O O O O O O O O O O O O O O O O O O	Total (1000 tC02e/y)			
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Carbon sink potential - Moderate deployment - Cropland measures (1000 tC02e/y)				
Cropland measures (1000 tC02e/y)		0	0	-972
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - Dermanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - Dermanent conservation cover (1000 tC02e/y) Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cov				
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Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y) Carbon sink potential - Moderate deployment - O O O O O O O O O O O O O O O O O O				
Pasture to energy crops (1000 tC02e/y) Carbon sink potential - Moderate deployment -		0	0	0
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Carbon sink potential - Moderate deployment - Total (1000 tC02e/y) Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate			0	01.4
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Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares) Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)			0	-1,003
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Land impacted for carbon sink - Moderate 0 0 1,224				
				_
deployment - Total (1000 hectares)		0	0	1,224
	deployment - Total (1000 hectares)			

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks -	Forests		
Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	4,423
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	31,032
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	793
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	4,659
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	290
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	4,259
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	812
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	5,953
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	3,080
(1000 tC02e/y)			
Carbon sink potential - High - Restore	0	0	6,761
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	2,216
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	11,479
overlap) (1000 tC02e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	132
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	1,790
length (1000 tC02e/y)			
Carbon sink potential - Low - Improve	0	0	148
plantations (1000 tC02e/y)			1 / 00
Carbon sink potential - Low - Increase retention	0	0	1,420
of HWP (1000 tCO2e/y)		0	007
Carbon sink potential - Low - Increase trees	0	0	284
outside forests (1000 tC02e/y)	0	0	0.077
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	U	2,977
· ·	0	0	233
Carbon sink potential - Low - Reforest pasture	"	U	233
(1000 tC02e/y)	0	0	2,279
productivity (1000 tC02e/y)	0	0	2,219
Carbon sink potential - Mid - Accelerate	0	0	3,320
regeneration (1000 tCO2e/y)		0	3,320
Carbon sink potential - Mid - All (not counting	0	0	21,253
overlap) (1000 tCO2e/y)		U	21,233
Carbon sink potential - Mid - Avoid deforestation	0	0	463
(1000 tC02e/y)		0	403
Carbon sink potential - Mid - Extend rotation	0	0	3,224
length (1000 tC02e/y)		0	3,224
Carbon sink potential - Mid - Improve plantations	0	0	217
(1000 tC02e/y)		0	211
Carbon sink potential - Mid - Increase retention	0	0	2,839
of HWP (1000 tC02e/y)		0	2,009
Carbon sink potential - Mid - Increase trees	0	0	548
outside forests (1000 tCO2e/y)		0	546
Carbon sink potential - Mid - Reforest cropland	0	0	4,465
(1000 tCO2e/y)	"	U	4,400
Carbon sink potential - Mid - Reforest pasture	0	0	1,656
	"	U	1,006
(1000 tC02e/y)		0	/. E00
Carbon sink potential - Mid - Restore	0	0	4,520
productivity (1000 tCO2e/y) Land impacted for carbon sink potential - High -	0	0	724
	0	U	724
Accelerate regeneration (1000 hectares)			

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

Table 57: E-B+ scenario - PILLAR 6: Land sinks -	· Forests (con	tinued)	
Item	2020	2025	2050
Land impacted for carbon sink potential - High -	0	0	107
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	2,376
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	107
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	77.2
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	394
Reforest cropland (1000 hectares)			07.
Land impacted for carbon sink potential - High -	0	0	87.5
Reforest pasture (1000 hectares)		0	01.0
Land impacted for carbon sink potential - High -	0	0	2,241
Restore productivity (1000 hectares)		0	2,241
Land impacted for carbon sink potential - High -	0	0	6,113
Total impacted (over 30 years) (1000 hectares)		0	0,113
	0	0	362
Land impacted for carbon sink potential - Low -	0	0	362
Accelerate regeneration (1000 hectares)		0	101
Land impacted for carbon sink potential - Low -	0	0	101
Avoid deforestation (over 30 years) (1000			
hectares)			010
Land impacted for carbon sink potential - Low -	0	0	910
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	53.5
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	40.6
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	197
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.2
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,356
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,035
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	543
Accelerate regeneration (1000 hectares)			0.0
Land impacted for carbon sink potential - Mid -	0	0	104
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,643
Extend rotation length (1000 hectares)		0	1,043
Land impacted for carbon sink potential - Mid -	0	0	80.5
Improve plantations (1000 hectares)		0	00.5
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)	0	U	U
	0	0	E0.0
Land impacted for carbon sink potential - Mid -	0	U	58.9
Increase trees outside forests (1000 hectares)			005
Land impacted for carbon sink potential - Mid -	0	0	295
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	110
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,731
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	5,565
Total impacted (over 30 years) (1000 hectares)			
		1	

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	1.22	1.24	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	61.2	61.2	61.2	61.2	61.2	61.2	61.2
Sales of cooking units - Gas (%)	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Sales of space heating units - Electric Heat Pump	8.94	22	22.3	22.8	23.5	24.2	24.8
(%)							
Sales of space heating units - Electric Resistance	10.9	16.6	16.4	16.3	16.1	15.6	14.8
(%)							
Sales of space heating units - Fossil (%)	6.39	10.3	10.4	10.2	9.34	8.82	9.31
Sales of space heating units - Gas (%)	73.8	51.2	50.9	50.7	51.1	51.4	51
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
(%)							
Sales of water heating units - Electric Resistance	21.3	36.2	36.3	36.3	36.4	36.4	36.5
(%)							
Sales of water heating units - Gas Furnace (%)	76.7	61.7	61.6	61.6	61.5	61.4	61.4
Sales of water heating units - Other (%)	1.97	2.1	2.11	2.11	2.12	2.12	2.12

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 (%)	1.92	2.27	2.25	2.09	1.9	1.77	1.69
Vehicle sales - Light-duty - EV (%)	2.37	4.07	4.67	5.64	6.94	8.25	9.35
Vehicle sales - Light-duty - gasoline (%)	92.2	89	87.5	86.1	84.4	82.4	80.7
Vehicle sales - Light-duty - hybrid (%)	3.26	4.17	5.13	5.71	6.36	7.09	7.8
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.39	0.367	0.332	0.333	0.337	0.348
Vehicle sales - Light-duty - other (%)	0.118	0.122	0.12	0.121	0.121	0.121	0.124
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)	49	50.1	51.1	51.5	51.9	53.3	55.8
Final energy use - Industry (PJ)	165	182	194	206	220	239	257
Final energy use - Residential (PJ)	71.3	68.6	67.8	67.5	68	68.9	69.7
Final energy use - Transportation (PJ)	150	142	131	124	124	127	132

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	4,185	4,377	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric Heat Pump	3.53	14.1	47	73.9	78.3	78.8	78.8
(%)							
Sales of space heating units - Electric Resistance	3.3	4.34	8.76	15.7	20	20.6	20.7
(%)							
Sales of space heating units - Fossil (%)	1.07	0.24	0.141	0.039	0.005	0	0
Sales of space heating units - Gas Furnace (%)	92.1	81.3	44.1	10.4	1.72	0.57	0.509
Sales of water heating units - Electric Heat Pump	0.03	0.03	0.03	0.03	0.03	0.03	0.03
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance	1.46	1.47	1.47	1.48	1.47	1.48	1.47
(%)							
Sales of water heating units - Gas Furnace (%)	98.1	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	1.18	1.23	1.36	1.42	1.52	1.58
Cumulative 5-yr (billion \$2018)							

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

Table 63: REF scenario - PILLAR 6: Land sinks - F				
Item	2020	2025	2030	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-22	0	4.29	1.23
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.16	0	-2.41	-2.53
Business-as-usual carbon sink - Total (Mt CO2e/y)	-23.1	0	1.88	-1.3
Carbon sink potential - High - Accelerate	0	0	0	4,423
regeneration (1000 tCO2e/y)	0	0	0	•
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	31,032
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	793
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	0	4,659
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	0	290
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	4,259
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	812
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	5,953
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)	0	0	0	3,080
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	0	6,761
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	2,216
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,479
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)	0	0	0	132
Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)	0	0	0	1,790
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	148
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	1,420
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	284
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	2,977
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)	0	0	0	233
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	0	2,279
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	3,320
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	21,253

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

Table 63: REF scenario - PILLAR 6: Land sinks - F	Forests (con	itinued)		
Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation	0	0	0	463
(1000 tC02e/y)			_	
Carbon sink potential - Mid - Extend rotation	0	0	0	3,224
length (1000 tC02e/y)				
Carbon sink potential - Mid - Improve plantations	0	0	0	217
(1000 tC02e/y)			_	
Carbon sink potential - Mid - Increase retention	0	0	0	2,839
of HWP (1000 tCO2e/y)				
Carbon sink potential - Mid - Increase trees	0	0	0	548
outside forests (1000 tCO2e/y)				
Carbon sink potential - Mid - Reforest cropland	0	0	0	4,465
(1000 tC02e/y)				
Carbon sink potential - Mid - Reforest pasture	0	0	0	1,656
(1000 tC02e/y)				
Carbon sink potential - Mid - Restore	0	0	0	4,520
productivity (1000 tCO2e/y)				
Land impacted for carbon sink potential - High -	0	0	0	724
Accelerate regeneration (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	107
Avoid deforestation (over 30 years) (1000				
hectares)				
Land impacted for carbon sink potential - High -	0	0	0	2,376
Extend rotation length (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	107
Improve plantations (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	0
Increase retention of HWP (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	77.2
Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	394
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	87.5
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - High -	0	0	0	2,241
Restore productivity (1000 hectares)				,
Land impacted for carbon sink potential - High -	0	0	0	6,113
Total impacted (over 30 years) (1000 hectares)		_		,,,,,
Land impacted for carbon sink potential - Low -	0	0	0	362
Accelerate regeneration (1000 hectares)		· ·		002
Land impacted for carbon sink potential - Low -	0	0	0	101
Avoid deforestation (over 30 years) (1000		· ·		
hectares)				
Land impacted for carbon sink potential - Low -	0	0	0	910
Extend rotation length (1000 hectares)	· ·	ŭ		710
Land impacted for carbon sink potential - Low -	0	0	0	53.5
Improve plantations (1000 hectares)	O	U	0	33.3
Land impacted for carbon sink potential - Low -	0	0	0	0
Increase retention of HWP (1000 hectares)	U	U	U	U
	0	0	0	/0/
Land impacted for carbon sink potential - Low -	0	0	0	40.6
Increase trees outside forests (1000 hectares)	0	0	0	107
Land impacted for carbon sink potential - Low -	0	0	0	197
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Low -	0	0	0	15.2
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Low -	0	0	0	1,356
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Low -	0	0	0	3,035
Total impacted (over 30 years) (1000 hectares)				
	0	0	0	543
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 -	0	0	0	104
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)		0	0	104

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

Item	2020	2025	2030	2050
Land impacted for carbon sink potential - Mid -	0	0	0	1,643
Extend rotation length (1000 hectares)			Ü	1,040
Land impacted for carbon sink potential - Mid -	0	0	0	80.5
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	58.9
Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	295
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	110
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	2,731
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	5,565
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	70.7	46.5	23	18.1	16.6	15.6
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	13.8	12.6	14.4	10.6	10	8.5
Monetary damages from air pollution - Transportation (million 2019\$)	0	127	133	139	145	152	158
Premature deaths from air pollution - Coal (deaths)	0	7.93	5.22	2.58	2.03	1.87	1.75
Premature deaths from air pollution - Natural Gas (deaths)	0	1.56	1.42	1.63	1.2	1.13	0.961
Premature deaths from air pollution - Transportation (deaths)	0	14.3	15	15.6	16.3	17.1	17.8