Net-Zero America - florida 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	16.2	21.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96.9	99.5	100	100	100	100
Sales of cooking units - Gas (%)	3.99	3.14	0.538	0.027	0	0	0
Sales of space heating units - Electric Heat Pump	51.7	60.3	83.9	89.2	89.3	89.1	89
(%)							
Sales of space heating units - Electric Resistance	40	35.5	15	10.4	10.3	10.5	10.6
(%)							
Sales of space heating units - Fossil (%)	0.822	0.7	0.133	0.006	0	0	0
Sales of space heating units - Gas (%)	7.51	3.51	0.99	0.435	0.414	0.413	0.412
Sales of water heating units - Electric Heat Pump	0	12.3	65.2	77	77.6	77.6	77.6
(%)							
Sales of water heating units - Electric Resistance	88.4	81.8	31.6	20.4	19.9	19.9	19.9
(%)							
Sales of water heating units - Gas Furnace (%)	6.88	3.27	0.619	0.026	0	0	0
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.53

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	3,333	8,621	13,843	21,020	22,822	21,789
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.717	0	5.18	0	21.9	0	35.3
Public EV charging plugs - L2 (1000 units)	3.3	0	124	0	526	0	848
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 (%)	1.29	1.58	1.16	0.367	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.79	17.9	50.4	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.5	75	44.7	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.27	5.16	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.325	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.019	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	434	437	427	413	402	400	406
Final energy use - Industry (PJ)	555	584	599	624	651	665	684
Final energy use - Residential (PJ)	511	493	475	450	430	422	425
Final energy use - Transportation (PJ)	1,917	1,804	1,617	1,384	1,172	1,037	974

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	66,758	74,510	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	23.9	27	70.6	83.8	84.8	85	85.1
Sales of space heating units - Electric Resistance (%)	22.7	8.53	10.3	12.4	13.2	13	12.8
Sales of space heating units - Fossil (%)	0	3.82	0.711	0.031	0	0	0

Table 4: F+ scenario	DILLAD 1. Efficience	V/Flootnification	Commonoial	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	53.5	60.7	18.4	3.73	1.99	2	2.02
Sales of water heating units - Electric Heat Pump (%)	0.849	10.5	54.3	64	64.4	64.5	64.5
Sales of water heating units - Electric Resistance (%)	20.9	11.5	28.7	32.5	32.7	32.7	32.7
Sales of water heating units - Gas Furnace (%)	69.5	73.9	14	0.589	0	0	0
Sales of water heating units - Other (%)	8.69	4.13	3.09	2.85	2.86	2.83	2.82

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	7.9	7.56	13.5	13.9	16.3	17
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0.003	0.163	0.013	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.02	0.005	0.002	0.019
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.043	0	0.006	2.06	0.012
Capital invested - Offshore Wind - Base (billion \$2018)	0	0.266	0	0	1.43	0.916	9.44
Capital invested - Solar PV - Base (billion \$2018)	0	12.2	26.3	41.1	26.3	22	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	13.8	28.1	31.2	32.4	20.3	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	5.92	326	351	351	351	351
Biomass w/ccu allam power plant (GWh)	0	0	0	20.2	24.9	26.9	45.8
Biomass w/ccu power plant (GWh)	0	0	48.5	48.5	55.5	2,368	2,382
OffshoreWind - Base land use assumptions (GWh)	0	285	0	0	2,505	1,891	22,906
OffshoreWind - Constrained land use	0	285	0	0	2,505	1,891	22,906
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	6,248	18,703	44,400	74,681	50,683	44,441	0
Solar - Constrained land use assumptions (GWh)	6,093	13,691	47,564	56,861	53,880	50,462	99,591

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	7.28	21.8	58.6	333	579	700
Conversion capital investment - Cumulative 5-yr	0	3.4	221	785	5,743	5,424	2,560
(million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	2	3	4
(quantity)							
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	7	9	12
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	2	3	4
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	1	1	2	4	5
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	2	3	4
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.08	3.73	14.5	24.6	31.4
Annual - BECCS (MMT)	0	0	0.05	0.98	8.35	15.1	18.4
Annual - Cement and lime (MMT)	0	0	0	0	3.32	6.84	7.07
Annual - NGCC (MMT)	0	0	0.03	2.75	2.87	2.62	5.94
Cumulative - All (MMT)	0	0	0.08	3.81	18.3	42.9	74.3
Cumulative - BECCS (MMT)	0	0	0.05	1.03	9.38	24.5	42.8
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	10.2	17.2
Cumulative - NGCC (MMT)	0	0	0.03	2.78	5.65	8.27	14.2

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	4.39	10.6	19.9	31	42.9
Injection wells (wells)	0	0	8	32	56	92	116
Resource characterization, appraisal, permitting	0	159	552	785	785	785	785
costs (million \$2020)							
Wells and facilities construction costs (million	0	0	245	955	1,702	2,846	3,533
\$2020)							

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)	0	0	739	1,095	1,533	2,279	3,321
Cumulative investment - All (million \$2018)	0	0	3,102	3,325	3,600	4,157	4,755
Cumulative investment - Spur (million \$2018)	0	0	55	278	553	1,109	1,708
Cumulative investment - Trunk (million \$2018)	0	0	3,047	3,047	3,047	3,047	3,047
Spur (km)	0	0	104	460	897	1,644	2,685
Trunk (km)	0	0	636	636	636	636	636

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

Cropland measures (1000 tC02e/y)	0,077
Carbon sink potential - Aggressive deployment - 0 0 -2 Cropland measures (1000 tCO2e/y)	
Cropland measures (1000 tC02e/y)	
	29.6
Carbon sink potential - Aggressive deployment - 0 0 -	29.6
	27.0
Permanent conservation cover (1000 tCO2e/y)	
Carbon sink potential - Aggressive deployment - 0 0 -2	2,107
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 -1,	,066
Cropland measures (1000 tCO2e/y)	
	-14.8
Permanent conservation cover (1000 tCO2e/y)	
	,081
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 1	,091
deployment - Cropland measures (1000	
hectares)	
Land impacted for carbon sink - Aggressive 0 0	53.8
deployment - Permanent conservation cover	
(1000 hectares)	
Land impacted for carbon sink - Aggressive 0 0 1	1,144
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	559
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	26.9
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	586
deployment - Total (1000 hectares)			

Item	rests 2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	1,328
regeneration (1000 tCO2e/y)	5	١ .	1,020
Carbon sink potential - High - All (not counting	0	0	38,862
overlap) (1000 tC02e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,923
(1000 tC02e/y)			•
Carbon sink potential - High - Extend rotation	0	0	6,195
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	3,791
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	9,304
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	983
outside forests (1000 tC02e/y)	_		
Carbon sink potential - High - Reforest cropland	0	0	462
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	8,095
(1000 tC02e/y)			/ 701
Carbon sink potential - High - Restore	0	0	4,781
productivity (1000 tC02e/y)	0	0	//-
Carbon sink potential - Low - Accelerate	0	0	665
regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting	0	0	11,529
overlap) (1000 tC02e/y)	0	U	11,529
Carbon sink potential - Low - Avoid deforestation	0	0	654
(1000 tC02e/y)	0	0	034
Carbon sink potential - Low - Extend rotation	0	0	2,380
length (1000 tC02e/y)	0	0	2,000
Carbon sink potential - Low - Improve	0	0	1,929
plantations (1000 tCO2e/y)			.,, = ,
Carbon sink potential - Low - Increase retention	0	0	3,101
of HWP (1000 tC02e/y)			-,
Carbon sink potential - Low - Increase trees	0	0	344
outside forests (1000 tCO2e/y)			
Carbon sink potential - Low - Reforest cropland	0	0	231
(1000 tCO2e/y)			
Carbon sink potential - Low - Reforest pasture	0	0	613
(1000 tC02e/y)			
Carbon sink potential - Low - Restore	0	0	1,612
productivity (1000 tCO2e/y)			
Carbon sink potential - Mid - Accelerate	0	0	997
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	25,162
overlap) (1000 tCO2e/y)	_		
Carbon sink potential - Mid - Avoid deforestation	0	0	2,289
(1000 tC02e/y)			,
Carbon sink potential - Mid - Extend rotation	0	0	4,287
length (1000 tC02e/y)			0.00=
Carbon sink potential - Mid - Improve plantations	0	0	2,827
(1000 tC02e/y)			/ 000
Carbon sink potential - Mid - Increase retention	0	0	6,203

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

Table 13: E+ scenario - PILLAR 6: Land sinks - Fo	•	ued)	
Item	2020	2025	2050
Carbon sink potential - Mid - Increase trees	0	0	664
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	346
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	4,354
(1000 tCO2e/y)			
Carbon sink potential - Mid - Restore	0	0	3,196
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	217
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	531
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,159
Extend rotation length (1000 hectares)		•	0,.07
Land impacted for carbon sink potential - High -	0	0	1,397
Improve plantations (1000 hectares)		0	1,071
Land impacted for carbon sink potential - High -	0	0	0
Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High -	0	0	93.4
	0	0	93.4
Increase trees outside forests (1000 hectares)		0	00.5
Land impacted for carbon sink potential - High -	0	0	30.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	230
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,585
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	7,243
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	109
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	499
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,210
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	698
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	49.2
Increase trees outside forests (1000 hectares)			.,
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest cropland (1000 hectares)		Ŭ	10.0
Land impacted for carbon sink potential - Low -	0	0	39.9
Reforest pasture (1000 hectares)		0	37.7
Land impacted for carbon sink potential - Low -	0	0	959
·	0	0	709
Restore productivity (1000 hectares)		0	0.570
Land impacted for carbon sink potential - Low -	0	0	3,579
Total impacted (over 30 years) (1000 hectares)		0	1/0
Land impacted for carbon sink potential - Mid -	0	0	163
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	515
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,185
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,051
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	71.3
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	22.9
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	288
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,931
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	6,227
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	527	2.34	1.72	0.789	0.371	0.022
(million 2019\$)							
Monetary damages from air pollution - Natural	0	741	691	577	515	242	48.8
Gas (million 2019\$)							
Monetary damages from air pollution -	0	5,828	5,517	4,260	2,502	1,148	438
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	59.2	0.262	0.193	0.088	0.042	0.002
(deaths)							
Premature deaths from air pollution - Natural	0	83.7	78.1	65.2	58.1	27.3	5.51
Gas (deaths)							
Premature deaths from air pollution -	0	655	621	479	281	129	49.3
Transportation (deaths)							

Table 15: E+ scenario - IMPACTS - Jobs

Table 13. L+ Scellal 10 - IMPACTS - Jubs							
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)	383	441	914	474	917	1,127	1,077
By economic sector - Construction (jobs)	17,674	23,021	35,821	49,347	48,665	48,605	43,930
By economic sector - Manufacturing (jobs)	14,086	24,447	45,256	46,005	37,098	42,104	34,014
By economic sector - Mining (jobs)	7,181	5,402	3,987	2,732	1,719	1,176	734
By economic sector - Other (jobs)	1,513	2,780	5,563	9,110	9,284	9,894	8,443
By economic sector - Pipeline (jobs)	1,370	1,350	1,447	948	737	544	481
By economic sector - Professional (jobs)	8,726	10,172	14,469	19,882	20,821	21,996	21,481
By economic sector - Trade (jobs)	7,004	7,298	9,870	13,623	13,902	14,675	13,914
By economic sector - Utilities (jobs)	21,985	21,345	26,089	33,401	37,627	39,598	39,980
By education level - All sectors - Associates degree or some college (jobs)	25,131	30,512	45,799	56,567	55,218	58,114	53,112
By education level - All sectors - Bachelors degree (jobs)	16,784	19,613	28,143	33,852	32,816	34,634	31,824
By education level - All sectors - Doctoral degree (jobs)	522	601	834	1,066	1,065	1,112	1,047
By education level - All sectors - High school diploma or less (jobs)	33,519	41,000	62,278	76,175	73,863	77,628	70,372
By education level - All sectors - Masters or professional degree (jobs)	3,966	4,531	6,361	7,863	7,810	8,231	7,700
By resource sector - Biomass (jobs)	1,586	1,893	2,520	1,351	2,761	4,109	4,599
By resource sector - CO2 (jobs)	0	82	2,816	892	1,078	1,646	2,234
By resource sector - Coal (jobs)	3,478	1,089	0	0	0	0	0
By resource sector - Grid (jobs)	26,752	25,278	35,441	55,390	65,497	70,923	74,895
By resource sector - Natural Gas (jobs)	16,154	16,891	14,613	12,227	11,292	9,629	6,185
By resource sector - Nuclear (jobs)	1,948	1,917	1,707	1,058	520	302	0.792
By resource sector - Oil (jobs)	13,563	11,673	9,194	6,500	4,263	2,686	1,516
By resource sector - Solar (jobs)	16,429	37,316	75,398	96,770	80,832	79,408	58,456
By resource sector - Wind (jobs)	12	117	1,727	1,334	4,528	11,015	16,170
Median wages - Annual - All (\$2019 per job)	54,325	53,711	53,020	53,538	54,596	55,319	56,620
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)	13,069	15,713	23,361	28,856	28,205	29,563	27,056
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)	5,330	6,192	8,882	11,382	11,417	11,790	10,959
On-Site or In-Plant Training - Total jobs - None (jobs)	12,820	15,682	23,565	28,751	27,791	29,270	26,568

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - Total jobs - Over 10	677	814	1,210	1,516	1,503	1,577	1,459
years (jobs)							
On-Site or In-Plant Training - Total jobs - Up to 1	48,025	57,855	86,398	105,017	101,854	107,518	98,013
year (jobs)							
On-the-Job Training - All sectors - 1 to 4 years	16,829	20,187	29,911	37,029	36,265	37,968	34,809
_(jobs)							
On-the-Job Training - All sectors - 4 to 10 years	5,165	6,024	8,699	11,283	11,375	11,734	10,921
(jobs)							
On-the-Job Training - All sectors - None (jobs)	4,276	5,170	7,689	9,484	9,179	9,645	8,745
On-the-Job Training - All sectors - Over 10 years	765	1,000	1,561	1,867	1,738	1,821	1,605
_(jobs)							
On-the-Job Training - All sectors - Up to 1 year	52,887	63,876	95,555	115,859	112,215	118,551	107,975
_(jobs)							
Related work experience - All sectors - 1 to 4	28,991	34,489	50,873	62,242	60,724	63,879	58,467
_years (jobs)							
Related work experience - All sectors - 4 to 10	18,737	22,355	32,886	40,298	39,289	41,252	37,817
_years (jobs)							
Related work experience - All sectors - None	11,515	13,844	20,624	25,395	24,891	26,193	23,942
_(jobs)							
Related work experience - All sectors - Over 10	5,043	6,133	9,149	10,989	10,544	11,139	10,136
years (jobs)							
Related work experience - All sectors - Up to 1	15,636	19,435	29,884	36,599	35,324	37,257	33,693
year (jobs)							
Wage income - All (million \$2019)	4,342	5,170	7,605	9,398	9,325	9,943	9,290

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)	1,127	1,143	964	773	582	366	254
Natural gas consumption - Cumulative (tcf)	0	0	0	0	0	0	23,282
Natural gas production - Annual (tcf)	0.634	0.703	0.665	0.579	0.49	0.388	0.302
Oil consumption - Annual (million bbls)	267	251	213	161	113	74.7	44.5
Oil consumption - Cumulative (million bbls)	0	0	0	0	0	0	4,994
Oil production - Annual (million bbls)	2.2	2.38	2.39	2.39	1.89	1.54	1.02

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	16	20	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96.1	96.5	97.4	98.8	99.6	99.9
Sales of cooking units - Gas (%)	4.01	3.91	3.54	2.57	1.23	0.395	0.106
Sales of space heating units - Electric Heat Pump (%)	51.7	55.7	58.3	66.2	77.9	85.5	88.2
Sales of space heating units - Electric Resistance (%)	40	39.5	37.2	30.4	20.2	13.6	11.3
Sales of space heating units - Fossil (%)	0.822	0.81	0.749	0.558	0.266	0.083	0.021
Sales of space heating units - Gas (%)	7.51	3.99	3.69	2.89	1.63	0.801	0.513
Sales of water heating units - Electric Heat Pump (%)	0	2.12	8.14	25.5	52.1	69.4	75.5
Sales of water heating units - Electric Resistance (%)	88.4	91.5	85.8	69.3	44.1	27.6	21.9
Sales of water heating units - Gas Furnace (%)	6.88	3.79	3.49	2.63	1.29	0.412	0.107
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.52

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	553	1,131	3,850	12,021	17,546
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.717	0	1.71	0	8.21	0	22.6
Public EV charging plugs - L2 (1000 units)	3.3	0	41.1	0	197	0	543
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 (%)	1.3	1.76	2.01	1.59	0.995	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.19	5.36	13.2	28	50.7	73.5	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.2	77.5	63.9	43.6	23.3	10.3
Vehicle sales - Light-duty - hybrid (%)	5.48	6.25	6.9	6.15	4.49	2.58	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.373	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.092	0.095	0.085	0.073	0.052	0.028	0.013
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)	434	438	434	430	423	419	420
Final energy use - Industry (PJ)	555	584	600	630	661	675	696
Final energy use - Residential (PJ)	511	494	487	477	464	448	440
Final energy use - Transportation (PJ)	1,919	1,820	1,686	1,572	1,479	1,369	1,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	66,742	74,583	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump	23.9	18.7	23.8	38	60.4	76.6	82.8
(%)							
Sales of space heating units - Electric Resistance	22.7	8.23	8.33	9.11	10.8	11.9	12.5
(%)							
Sales of space heating units - Fossil (%)	0	4.41	4	3.07	1.56	0.485	0.126
Sales of space heating units - Gas Furnace (%)	53.5	68.6	63.8	49.8	27.3	11	4.53
Sales of water heating units - Electric Heat Pump	0.849	2.05	7.03	21.4	43.4	57.8	62.8
(%)							
Sales of water heating units - Electric Resistance	20.9	8.16	9.94	15.6	24.4	30	32
(%)							
Sales of water heating units - Gas Furnace (%)	69.5	85.5	78.7	59.1	28.9	9.24	2.41
Sales of water heating units - Other (%)	8.69	4.32	4.29	3.91	3.39	3	2.87

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	6.42	5.91	9.28	9.23	14.5	15.1
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	-2,077
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-29.6
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-2,107
Total (1000 tC02e/y)			

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

Table 22. E Scenario i IEEAN O. Eana Siliko A	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	-1,066
Cropland measures (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-14.8
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,081
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	1,091
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	53.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	1,144
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	559
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	26.9
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	586
deployment - Total (1000 hectares)			
	1		

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate	0	0	1,328
regeneration (1000 tCO2e/y)			
Carbon sink potential - High - All (not counting	0	0	38,862
overlap) (1000 tCO2e/y)			
Carbon sink potential - High - Avoid deforestation	0	0	3,923
(1000 tCO2e/y)			
Carbon sink potential - High - Extend rotation	0	0	6,195
length (1000 tCO2e/y)			
Carbon sink potential - High - Improve	0	0	3,791
plantations (1000 tCO2e/y)			
Carbon sink potential - High - Increase retention	0	0	9,304
of HWP (1000 tCO2e/y)			
Carbon sink potential - High - Increase trees	0	0	983
outside forests (1000 tCO2e/y)			
Carbon sink potential - High - Reforest cropland	0	0	462
(1000 tC02e/y)			
Carbon sink potential - High - Reforest pasture	0	0	8,095
(1000 tCO2e/y)			
Carbon sink potential - High - Restore	0	0	4,781
productivity (1000 tCO2e/y)			
Carbon sink potential - Low - Accelerate	0	0	665
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	11,529
overlap) (1000 tCO2e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	654
(1000 tC02e/y)			
Carbon sink potential - Low - Extend rotation	0	0	2,380
length (1000 tCO2e/y)			
Carbon sink potential - Low - Improve	0	0	1,929
plantations (1000 tCO2e/y)			

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

Table 23: E- scenario - PILLAR 6: Land sinks - Fo			2050
Item	2020	2025	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	3,101
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	344
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y)	0	0	231
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)	0	0	613
Carbon sink potential - Low - Restore productivity (1000 tC02e/y)	0	0	1,612
Carbon sink potential - Mid - Accelerate	0	0	997
regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting	0	0	25,162
overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid deforestation	0	0	2,289
(1000 tCO2e/y) Carbon sink potential - Mid - Extend rotation	0	0	4,287
length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations	0	0	2,827
(1000 tC02e/y) Carbon sink potential - Mid - Increase retention	0	0	6,203
of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees	0	0	664
outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland	0	0	346
(1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture	0	0	4,354
(1000 tCO2e/y) Carbon sink potential - Mid - Restore	0	0	3,196
productivity (1000 tCO2e/y) Land impacted for carbon sink potential - High -	0	0	217
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High -	0	0	531
Avoid deforestation (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)	0	0	3,159
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)	0	0	1,397
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)	0	0	0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)	0	0	93.4
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)	0	0	30.5
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)	0	0	230
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)	0	0	1,585
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)	0	0	7,243
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	109
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000	0	0	499
hectares) Land impacted for carbon sink potential - Low -	0	0	1,210
Extend rotation length (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	698
Improve plantations (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			

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

Thom	•		2050
Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	49.2
Increase trees outside forests (1000 hectares)			45.0
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	39.9
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	959
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,579
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	163
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	515
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,185
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,051
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	71.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.9
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	288
Reforest pasture (1000 hectares)			200
Land impacted for carbon sink potential - Mid -	0	0	1,931
Restore productivity (1000 hectares)		ŭ	1,701
Land impacted for carbon sink potential - Mid -	0	0	6,227
Total impacted (over 30 years) (1000 hectares)		٦	0,221
Total impacted (over 50 years) (1000 liectal es)			

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	527	2.34	1.72	0.789	0.371	0.022
(million 2019\$)							
Monetary damages from air pollution - Natural	0	742	586	329	119	26	12.1
Gas (million 2019\$)							
Monetary damages from air pollution -	0	5,938	6,110	6,052	5,549	4,499	3,142
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	59.2	0.262	0.193	0.088	0.042	0.002
(deaths)							
Premature deaths from air pollution - Natural	0	83.8	66.2	37.2	13.5	2.94	1.37
Gas (deaths)							
Premature deaths from air pollution -	0	668	687	681	624	506	353
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	16.2	21.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96.9	99.5	100	100	100	100
Sales of cooking units - Gas (%)	3.99	3.14	0.538	0.027	0	0	0
Sales of space heating units - Electric Heat Pump	51.7	60.3	83.9	89.2	89.3	89.1	89
(%)							
Sales of space heating units - Electric Resistance	40	35.5	15	10.4	10.3	10.5	10.6
(%)							
Sales of space heating units - Fossil (%)	0.822	0.7	0.133	0.006	0	0	0
Sales of space heating units - Gas (%)	7.51	3.51	0.99	0.435	0.414	0.413	0.412
Sales of water heating units - Electric Heat Pump	0	12.3	65.2	77	77.6	77.6	77.6
(%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Resistance	88.4	81.8	31.6	20.4	19.9	19.9	19.9
(%)							
Sales of water heating units - Gas Furnace (%)	6.88	3.27	0.619	0.026	0	0	0
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.53

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	3,333	8,621	13,843	21,020	22,822	21,789
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.717	0	5.18	0	21.9	0	35.3
Public EV charging plugs - L2 (1000 units)	3.3	0	124	0	526	0	848
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 (%)	1.29	1.58	1.16	0.367	0.07	0.013	0
Vehicle sales - Light-duty - EV (%)	4.79	17.9	50.4	83.4	96.5	99.3	100
Vehicle sales - Light-duty - gasoline (%)	88.5	75	44.7	14.9	3.08	0.584	0
Vehicle sales - Light-duty - hybrid (%)	5.27	5.16	3.5	1.27	0.314	0.07	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.325	0.182	0.055	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.09	0.085	0.053	0.019	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	434	437	427	413	402	400	406
Final energy use - Industry (PJ)	555	584	599	624	651	665	684
Final energy use - Residential (PJ)	511	493	475	450	430	422	425
Final energy use - Transportation (PJ)	1,917	1,804	1,617	1,384	1,172	1,037	974

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	66,758	74,510	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump	23.9	27	70.6	83.8	84.8	85	85.1
(%)							
Sales of space heating units - Electric Resistance	22.7	8.53	10.3	12.4	13.2	13	12.8
(%)							
Sales of space heating units - Fossil (%)	0	3.82	0.711	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	53.5	60.7	18.4	3.73	1.99	2	2.02
Sales of water heating units - Electric Heat Pump	0.849	10.5	54.3	64	64.4	64.5	64.5
(%)							
Sales of water heating units - Electric Resistance	20.9	11.5	28.7	32.5	32.7	32.7	32.7
(%)							
Sales of water heating units - Gas Furnace (%)	69.5	73.9	14	0.589	0	0	0
Sales of water heating units - Other (%)	8.69	4.13	3.09	2.85	2.86	2.83	2.82

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	7.9	7.56	13.5	13.9	16.3	17
Cumulative 5-yr (billion \$2018)							

 ${\it Table 30: E+RE+ scenario - PILLAR 2: Clean Electricity - Generating \ capacity}$

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion \$2018)	0	0.266	0	1.45	8.16	5.68	5.24
Capital invested - Solar PV - Base (billion \$2018)	0	5.09	34.1	59.5	23.6	0	136

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	285	0	2,145	14,243	11,728	12,695
OffshoreWind - Constrained land use	0	0	0	0	0	0	27,587
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	6,248	7,766	57,586	108,121	44,951	0	297,773
Solar - Constrained land use assumptions (GWh)	6,248	9,837	70,530	108,090	30,111	0	308,278

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

	2222	0005	0050
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	-2,077
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-29.6
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-2,107
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	-1,066
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-14.8
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,081
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	1,091
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	53.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	1,144
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	559
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	26.9
deployment - Permanent conservation cover		-	
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	586
deployment - Total (1000 hectares)		-	

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

Item 20 Carbon sink potential - High - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid deforestation (1000 tC02e/y) Carbon sink potential - High - Extend rotation length (1000 tC02e/y) Carbon sink potential - High - Improve	20 0 0 0	2025 0 0	2050 1,328
regeneration (1000 tCO2e/y) Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	_	
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 length (1000 tC02e/y)		0	
overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid deforestation (1000 tC02e/y) Carbon sink potential - High - Extend rotation length (1000 tC02e/y)		0	000
Carbon sink potential - High - Avoid deforestation (1000 tC02e/y) Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0		38,862
(1000 tC02e/y) Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0		
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)		0	3,923
length (1000 tCO2e/y)			
length (1000 tCO2e/y)	0	0	6,195
			•
OBLUULI SIIIN DULGIILIGI - TIUII - TIIIDI UVE	0	0	3,791
plantations (1000 tCO2e/y)		-	-,
Carbon sink potential - High - Increase retention	0	0	9,304
of HWP (1000 tC02e/y)			7,00
Carbon sink potential - High - Increase trees	0	0	983
outside forests (1000 tCO2e/y)		0	700
Carbon sink potential - High - Reforest cropland	0	0	462
(1000 tCO2e/y)	0	0	402
Carbon sink potential - High - Reforest pasture	0	0	8,095
· · · · · · · · · · · · · · · · · · ·	U	0	0,095
(1000 tC02e/y)	0	0	/ 701
Carbon sink potential - High - Restore	0	0	4,781
productivity (1000 tC02e/y)			
Carbon sink potential - Low - Accelerate	0	0	665
regeneration (1000 tCO2e/y)			
Carbon sink potential - Low - All (not counting	0	0	11,529
overlap) (1000 tCO2e/y)			
Carbon sink potential - Low - Avoid deforestation	0	0	654
(1000 tCO2e/y)			
Carbon sink potential - Low - Extend rotation	0	0	2,380
length (1000 tCO2e/y)			
Carbon sink potential - Low - Improve	0	0	1,929
plantations (1000 tCO2e/y)			
Carbon sink potential - Low - Increase retention	0	0	3,101
of HWP (1000 tCO2e/y)			·
Carbon sink potential - Low - Increase trees	0	0	344
outside forests (1000 tCO2e/y)			• • • • • • • • • • • • • • • • • • • •
Carbon sink potential - Low - Reforest cropland	0	0	231
(1000 tC02e/y)		0	201
Carbon sink potential - Low - Reforest pasture	0	0	613
(1000 tCO2e/y)	0	0	013
Carbon sink potential - Low - Restore	0	0	1,612
	U	0	1,012
productivity (1000 tC02e/y)	_	0	007
Carbon sink potential - Mid - Accelerate	0	0	997
regeneration (1000 tC02e/y)			
Carbon sink potential - Mid - All (not counting	0	0	25,162
overlap) (1000 tCO2e/y)			
Carbon sink potential - Mid - Avoid deforestation	0	0	2,289
(1000 tC02e/y)			
Carbon sink potential - Mid - Extend rotation	0	0	4,287
length (1000 tCO2e/y)			
Carbon sink potential - Mid - Improve plantations	0	0	2,827
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	6,203
of HWP (1000 tC02e/y)			
Carbon sink potential - Mid - Increase trees	0	0	664
outside forests (1000 tCO2e/y)	-		30-
Carbon sink potential - Mid - Reforest cropland	0	0	346
(1000 tC02e/y)		0	340
Carbon sink potential - Mid - Reforest pasture	0	0	4,354
	U	0	4,354
(1000 tC02e/y)			0.107
Carbon sink potential - Mid - Restore	0	0	3,196
productivity (1000 tC02e/y)			
Land impacted for carbon sink potential - High -	0	0	217
Accelerate regeneration (1000 hectares)			

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	531
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,159
Extend rotation length (1000 hectares)			-,
Land impacted for carbon sink potential - High -	0	0	1,397
	U	U	1,391
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	93.4
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	30.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	230
	o	o	230
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,585
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	7,243
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	109
Accelerate regeneration (1000 hectares)	0	0	107
Land impacted for carbon sink potential - Low -	0	0	499
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,210
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	698
	0	0	070
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	49.2
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	39.9
	o	o	37.7
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	959
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,579
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	163
Accelerate regeneration (1000 hectares)	0	0	100
	0	0	F1F
Land impacted for carbon sink potential - Mid -	0	0	515
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,185
Extend rotation length (1000 hectares)			•
Land impacted for carbon sink potential - Mid -	0	0	1,051
Improve plantations (1000 hectares)	0	0	1,001
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	71.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.9
Reforest cropland (1000 hectares)		<u> </u>	
	0	0	000
Land impacted for carbon sink potential - Mid -	0	0	288
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,931
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	6,227
Total impacted (over 30 years) (1000 hectares)		-	-,

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal	0	527	2.34	1.72	0.789	0.371	0.022
(million 2019\$)							
Monetary damages from air pollution - Natural	0	739	642	468	288	58.6	24.8
Gas (million 2019\$)							
Monetary damages from air pollution -	0	5,828	5,517	4,260	2,502	1,148	438
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	59.2	0.262	0.193	0.088	0.042	0.002
(deaths)							
Premature deaths from air pollution - Natural	0	83.4	72.5	52.9	32.5	6.61	2.8
Gas (deaths)							
Premature deaths from air pollution -	0	655	621	479	281	129	49.3
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	16.2	21.3	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96.9	99.5	100	100	100	100
Sales of cooking units - Gas (%)	3.99	3.14	0.538	0.027	0	0	0
Sales of space heating units - Electric Heat Pump	51.7	60.3	83.9	89.2	89.3	89.1	89
(%)							
Sales of space heating units - Electric Resistance	40	35.5	15	10.4	10.3	10.5	10.6
(%)							
Sales of space heating units - Fossil (%)	0.822	0.7	0.133	0.006	0	0	0
Sales of space heating units - Gas (%)	7.51	3.51	0.99	0.435	0.414	0.413	0.412
Sales of water heating units - Electric Heat Pump	0	12.3	65.2	77	77.6	77.6	77.6
(%)							
Sales of water heating units - Electric Resistance	88.4	81.8	31.6	20.4	19.9	19.9	19.9
(%)							
Sales of water heating units - Gas Furnace (%)	6.88	3.27	0.619	0.026	0	0	0
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.53

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

rooti ijioati	on manop	or tation				
2020	2025	2030	2035	2040	2045	2050
0	3,333	8,621	13,843	21,020	22,822	21,789
0.717	0	5.18	0	21.9	0	35.3
3.3	0	124	0	526	0	848
97.2	92.1	67	23.3	4.22	0.628	0
0.588	3.81	19	45.6	57.4	59.6	60
0.227	0.227	0.176	0.066	0.013	0.002	0
0.082	0.09	0.077	0.031	0.007	0.001	0
0.392	2.54	12.7	30.4	38.2	39.7	40
1.5	1.23	1.07	0.568	0.163	0.038	0
1.29	1.58	1.16	0.367	0.07	0.013	0
4.79	17.9	50.4	83.4	96.5	99.3	100
88.5	75	44.7	14.9	3.08	0.584	0
5.27	5.16	3.5	1.27	0.314	0.07	0
0.109	0.325	0.182	0.055	0.011	0.002	0
0.09	0.085	0.053	0.019	0.004	0.001	0
64.7	59.7	42.3	14.4	2.59	0.384	0
0.784	5.07	25.3	60.8	76.5	79.5	80
33.7	33.3	25.5	9.32	1.77	0.277	0
0.363	0.402	0.341	0.14	0.03	0.005	0
0.196	1.27	6.33	15.2	19.1	19.9	20
0.253	0.255	0.205	0.083	0.019	0.004	0
	2020 0 0.717 3.3 97.2 0.588 0.227 0.082 0.392 1.5 1.29 4.79 88.5 5.27 0.109 0.09 64.7 0.784 33.7 0.363 0.196	2020 2025 0 3,333 0.717 0 3.3 0 97.2 92.1 0.588 3.81 0.227 0.227 0.082 0.09 0.392 2.54 1.5 1.23 1.29 1.58 4.79 17.9 88.5 75 5.27 5.16 0.109 0.325 0.09 0.085 64.7 59.7 0.784 5.07 33.7 33.3 0.363 0.402 0.196 1.27	0 3,333 8,621 0.717 0 5.18 3.3 0 124 97.2 92.1 67 0.588 3.81 19 0.227 0.227 0.176 0.082 0.09 0.077 0.392 2.54 12.7 1.5 1.23 1.07 1.29 1.58 1.16 4.79 17.9 50.4 88.5 75 44.7 5.27 5.16 3.5 0.109 0.325 0.182 0.09 0.085 0.053 64.7 59.7 42.3 0.784 5.07 25.3 33.7 33.3 25.5 0.363 0.402 0.341 0.196 1.27 6.33	2020 2025 2030 2035 0 3,333 8,621 13,843 0.717 0 5.18 0 3.3 0 124 0 97.2 92.1 67 23.3 0.588 3.81 19 45.6 0.227 0.227 0.176 0.066 0.082 0.09 0.077 0.031 0.392 2.54 12.7 30.4 1.5 1.23 1.07 0.568 1.29 1.58 1.16 0.367 4.79 17.9 50.4 83.4 88.5 75 44.7 14.9 5.27 5.16 3.5 1.27 0.109 0.325 0.182 0.055 0.09 0.085 0.053 0.019 64.7 59.7 42.3 14.4 0.784 5.07 25.3 60.8 33.7 33.3 25.5 9.32	2020 2025 2030 2035 2040 0 3,333 8,621 13,843 21,020 0.717 0 5.18 0 21.9 3.3 0 124 0 526 97.2 92.1 67 23.3 4.22 0.588 3.81 19 45.6 57.4 0.227 0.227 0.176 0.066 0.013 0.082 0.09 0.077 0.031 0.007 0.392 2.54 12.7 30.4 38.2 1.5 1.23 1.07 0.568 0.163 1.29 1.58 1.16 0.367 0.07 4.79 17.9 50.4 83.4 96.5 88.5 75 44.7 14.9 3.08 5.27 5.16 3.5 1.27 0.314 0.109 0.325 0.182 0.055 0.011 0.09 0.085 0.053 0.019	2020 2025 2030 2035 2040 2045 0 3,333 8,621 13,843 21,020 22,822 0.717 0 5.18 0 21.9 0 3.3 0 124 0 526 0 97.2 92.1 67 23.3 4.22 0.628 0.588 3.81 19 45.6 57.4 59.6 0.227 0.227 0.176 0.066 0.013 0.002 0.082 0.09 0.077 0.031 0.007 0.001 0.392 2.54 12.7 30.4 38.2 39.7 1.5 1.23 1.07 0.568 0.163 0.038 1.29 1.58 1.16 0.367 0.07 0.013 4.79 17.9 50.4 83.4 96.5 99.3 88.5 75 44.7 14.9 3.08 0.584 5.27 5.16 3.5 <

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	434	437	427	413	402	400	406
Final energy use - Industry (PJ)	555	584	599	624	651	665	684
Final energy use - Residential (PJ)	511	493	475	450	430	422	425
Final energy use - Transportation (PJ)	1,917	1,804	1,617	1,384	1,172	1,037	974

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	66,758	74,510	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump	23.9	27	70.6	83.8	84.8	85	85.1
(%)							
Sales of space heating units - Electric Resistance	22.7	8.53	10.3	12.4	13.2	13	12.8
(%)							
Sales of space heating units - Fossil (%)	0	3.82	0.711	0.031	0	0	0
Sales of space heating units - Gas Furnace (%)	53.5	60.7	18.4	3.73	1.99	2	2.02
Sales of water heating units - Electric Heat Pump	0.849	10.5	54.3	64	64.4	64.5	64.5
(%)							
Sales of water heating units - Electric Resistance	20.9	11.5	28.7	32.5	32.7	32.7	32.7
(%)							
Sales of water heating units - Gas Furnace (%)	69.5	73.9	14	0.589	0	0	0
Sales of water heating units - Other (%)	8.69	4.13	3.09	2.85	2.86	2.83	2.82

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	7.9	7.56	13.5	13.9	16.3	17
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 - Offshore Wind - Base (billion \$2018)	0	0.266	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	14.6	17.6	1.46	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)	0	14.8	16.7	1.56	0	0.104	0

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

Item	2020	2025	2030	2035	2045
OffshoreWind - Base land use assumptions (GWh)	0	285	0	0	0
Solar - Base land use assumptions (GWh)	6,248	22,303	29,753	2,681	0
Solar - Constrained land use assumptions (GWh)	6,248	22,584	28,301	2,824	212

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	-2,077
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-29.6
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-2,107
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	-1,066
Cropland measures (1000 tCO2e/y)			

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

Item	2020	2025	2050
Carbon sink potential - Moderate deployment -	2020	2023 N	-14.8
	U	U	-14.0
Permanent conservation cover (1000 tC02e/y)	0	0	1.001
Carbon sink potential - Moderate deployment -	0	0	-1,081
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	1,091
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	53.8
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	1,144
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	559
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	26.9
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	586
deployment - Total (1000 hectares)			
acpicymone rotal (1000 Hootal ob)			

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

Item	2020	2025	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)	0	0	1,328
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	38,862
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	3,923
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)	0	0	6,195
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)	0	0	3,791
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	9,304
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	983
Carbon sink potential - High - Reforest cropland (1000 tC02e/y)	0	0	462
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)	0	0	8,095
Carbon sink potential - High - Restore productivity (1000 tC02e/y)	0	0	4,781
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	665
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	11,529
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	654
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	2,380
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	1,929
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	3,101
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	344

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

Table 43: E+RE- scenario - PILLAR 6: Land sinks	- Forests (co	ntinueaj	
Item	2020	2025	2050
Carbon sink potential - Low - Reforest cropland	0	0	231
(1000 tC02e/y)	-	-	
Carbon sink potential - Low - Reforest pasture	0	0	613
(1000 tCO2e/y)	0	0	010
Carbon sink potential - Low - Restore	0	0	1,612
	U	U	1,012
productivity (1000 tC02e/y)			
Carbon sink potential - Mid - Accelerate	0	0	997
regeneration (1000 tCO2e/y)			
Carbon sink potential - Mid - All (not counting	0	0	25,162
overlap) (1000 tCO2e/y)			
Carbon sink potential - Mid - Avoid deforestation	0	0	2,289
(1000 tCO2e/y)			•
Carbon sink potential - Mid - Extend rotation	0	0	4,287
length (1000 tC02e/y)			1,201
Carbon sink potential - Mid - Improve plantations	0	0	2,827
	U	0	2,021
(1000 tC02e/y)			
Carbon sink potential - Mid - Increase retention	0	0	6,203
of HWP (1000 tCO2e/y)			
Carbon sink potential - Mid - Increase trees	0	0	664
outside forests (1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest cropland	0	0	346
(1000 tCO2e/y)			
Carbon sink potential - Mid - Reforest pasture	0	0	4,354
(1000 tCO2e/y)	0	0	4,004
	0	0	0.107
Carbon sink potential - Mid - Restore	0	0	3,196
productivity (1000 tCO2e/y)			
Land impacted for carbon sink potential - High -	0	0	217
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	531
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,159
Extend rotation length (1000 hectares)			07.07
Land impacted for carbon sink potential - High -	0	0	1,397
	o	0	1,371
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	93.4
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	30.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	230
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,585
•	o	0	1,565
Restore productivity (1000 hectares)			70/0
Land impacted for carbon sink potential - High -	0	0	7,243
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	109
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	499
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,210
Extend rotation length (1000 hectares)	0	١ -	1,210
	0	0	/00
Land impacted for carbon sink potential - Low -	U	υ	698
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	49.2
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	15.3
	U	0	
Reforest cropland (1000 hectares)			

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

Item	2020	2025	2050
Land impacted for carbon sink potential - Low -	0	0	39.9
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	959
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	3,579
Total impacted (over 30 years) (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	163
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	515
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,185
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,051
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	71.3
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	22.9
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	288
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	1,931
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	6,227
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	527	2.34	1.72	0.789	0.371	0.022
(million 2019\$)							
Monetary damages from air pollution - Natural	0	731	705	535	481	218	32.3
Gas (million 2019\$)							
Monetary damages from air pollution -	0	5,828	5,517	4,260	2,502	1,148	438
Transportation (million 2019\$)							
Premature deaths from air pollution - Coal	0	59.2	0.262	0.193	0.088	0.042	0.002
(deaths)							
Premature deaths from air pollution - Natural	0	82.6	79.6	60.5	54.3	24.6	3.65
Gas (deaths)							
Premature deaths from air pollution -	0	655	621	479	281	129	49.3
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	16	20	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96.1	96.5	97.4	98.8	99.6	99.9
Sales of cooking units - Gas (%)	4.01	3.91	3.54	2.57	1.23	0.395	0.106
Sales of space heating units - Electric Heat Pump	51.7	55.7	58.3	66.2	77.9	85.5	88.2
(%)							
Sales of space heating units - Electric Resistance	40	39.5	37.2	30.4	20.2	13.6	11.3
(%)							
Sales of space heating units - Fossil (%)	0.822	0.81	0.749	0.558	0.266	0.083	0.021
Sales of space heating units - Gas (%)	7.51	3.99	3.69	2.89	1.63	0.801	0.513
Sales of water heating units - Electric Heat Pump	0	2.12	8.14	25.5	52.1	69.4	75.5
(%)							
Sales of water heating units - Electric Resistance	88.4	91.5	85.8	69.3	44.1	27.6	21.9
(%)							
Sales of water heating units - Gas Furnace (%)	6.88	3.79	3.49	2.63	1.29	0.412	0.107
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.52

Table / 6. F-R+	. crenario -	DTII AR 1.	Efficiency	/Flectrification	- Transportation
14UIC 40. C-DT	. ยกราเกา เก -	PILIARI	FILLIEN V	/ F18.1.1 1111.111111111	- 11 1111511111 111111111

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr	0	0	553	1,131	3,850	12,021	17,546
(million \$2018)							
Public EV charging plugs - DC Fast (1000 units)	0.717	0	1.71	0	8.21	0	22.6
Public EV charging plugs - L2 (1000 units)	3.3	0	41.1	0	197	0	543
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 (%)	1.3	1.76	2.01	1.59	0.995	0.506	0.218
Vehicle sales - Light-duty - EV (%)	2.19	5.36	13.2	28	50.7	73.5	88.2
Vehicle sales - Light-duty - gasoline (%)	90.8	86.2	77.5	63.9	43.6	23.3	10.3
Vehicle sales - Light-duty - hybrid (%)	5.48	6.25	6.9	6.15	4.49	2.58	1.22
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.373	0.311	0.232	0.161	0.088	0.041
Vehicle sales - Light-duty - other (%)	0.092	0.095	0.085	0.073	0.052	0.028	0.013
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)	434	438	434	430	423	419	420
Final energy use - Industry (PJ)	555	584	600	630	661	675	696
Final energy use - Residential (PJ)	511	494	487	477	464	448	440
Final energy use - Transportation (PJ)	1,919	1,820	1,686	1,572	1,479	1,369	1,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	66,742	74,583	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric Heat Pump	23.9	18.7	23.8	38	60.4	76.6	82.8
(%)							
Sales of space heating units - Electric Resistance	22.7	8.23	8.33	9.11	10.8	11.9	12.5
(%)							
Sales of space heating units - Fossil (%)	0	4.41	4	3.07	1.56	0.485	0.126
Sales of space heating units - Gas Furnace (%)	53.5	68.6	63.8	49.8	27.3	11	4.53
Sales of water heating units - Electric Heat Pump (%)	0.849	2.05	7.03	21.4	43.4	57.8	62.8
Sales of water heating units - Electric Resistance (%)	20.9	8.16	9.94	15.6	24.4	30	32
Sales of water heating units - Gas Furnace (%)	69.5	85.5	78.7	59.1	28.9	9.24	2.41
Sales of water heating units - Other (%)	8.69	4.32	4.29	3.91	3.39	3	2.87

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	6.42	5.91	9.28	9.23	14.5	15.1
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	0.004	0.523	0	0	0	0
\$2018)							

Table 50: E-B+ scenario - PILLAR 2: Clean Electro	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.038	0.007	0.016	0.021
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.049	11.5	2.18	5.85	0
(5111011 \$2010)							
Table 51: E-B+ scenario - PILLAR 2: Clean Electri	•		0000	2005	2010	2015	
Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	7.52	1,035	1,035	1,035	1,035	1,035
Biomass w/ccu allam power plant (GWh)	0	0	0	37.7	44.2	60.6	81.5
Biomass w/ccu power plant (GWh)	0	0	55.3	12,921	15,365	21,928	21,928
Table 52: E-B+ scenario - PILLAR 3: Clean fuels -	Bioenergy						
Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)	0	1.01	80.4	1,065	1,523	2,465	2,875
Conversion capital investment - Cumulative 5-yr (million \$2018)	0	4.32	629	12,720	5,513	11,510	4,739
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	2	3	4
Number of facilities - Beccs hydrogen (quantity)	0	0	0	2	6	13	18
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	2	3	3
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	1	10	12	17	17
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	2	4	5
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Table 53: E-B+ scenario - PILLAR 4: CCUS - CO2 o	capture						
Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)	0	0	0.07	17.3	27.8	45.3	53
Annual - BECCS (MMT)	0	0	0.06	15.5	22.4	36.8	42.7
Annual - Cement and lime (MMT)	0	0	0	0	3.32	6.84	7.07
Annual - NGCC (MMT)	0	0	0.02	1.74	2.06	1.65	3.24
Cumulative - All (MMT)	0	0	0.07	17.3	45.1	90.4	144
Cumulative - BECCS (MMT)	0	0	0.06	15.6	38	74.8	118
Cumulative - Cement and lime (MMT)	0	0	0	0	3.32	10.2	17.2
Cumulative - NGCC (MMT)	0	0	0.02	1.76	3.82	5.47	8.71
Table 54: E-B+ scenario - PILLAR 4: CCUS - CO2 s	storage						
Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)	0	0	3.69	15	33.3	45.3	48.5
Injection wells (wells)	0	0	8	34	62	102	128
Resource characterization, appraisal, permitting costs (million \$2020)	0	159	625	906	906	906	906
Wells and facilities construction costs (million \$2020)	0	0	270	1,053	1,877	3,138	3,896
	. ,						
Table 55: E-B+ scenario - PILLAR 4: CCUS - CO2 p	oipelines						
<u> </u>	•						
Item	2020	2025	2030	2035	2040	2045	2050
Item All (km)	2020	0	886	1,358	1,622	2,448	3,203
Item All (km) Cumulative investment - All (million \$2018)	2020	0	886 3,177	1,358 3,655	1,622 4,152	2,448 4,884	3,203 5,383
Item All (km)	2020	0	886	1,358	1,622	2,448	2050 3,203 5,383 2,133

0

0

0

3,047

251

636

3,047

722

636

3,250

986

636

3,250

1,813

636

3,250

2,568

636

0

0

0

Cumulative investment - Trunk (million \$2018)

Spur (km)

Trunk (km)

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

Table 56: E-B+ scenario - PILLAR 6: Land sinks		,	
Item	2020	2025	2050
Carbon sink potential - Aggressive deployment -	0	0	-12.5
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-2,056
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	0
Cropland to woody energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	0
Pasture to energy crops (1000 tCO2e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-29.1
Permanent conservation cover (1000 tC02e/y)			
Carbon sink potential - Aggressive deployment -	0	0	-2,098
Total (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-12.5
Corn-ethanol to energy grasses (1000 tC02e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,055
Cropland measures (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Cropland to woody energy crops (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	0
Pasture to energy crops (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-14.6
Permanent conservation cover (1000 tCO2e/y)			
Carbon sink potential - Moderate deployment -	0	0	-1,082
Total (1000 tCO2e/y)			
Land impacted for carbon sink - Aggressive	0	0	7.89
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	2,674
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	5.31
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	365
deployment - Pasture to energy crops (1000			
hectares)			
Land impacted for carbon sink - Aggressive	0	0	52.9
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Aggressive	0	0	3,105
deployment - Total (1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	7.89
deployment - Corn-ethanol to energy grasses			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	555
deployment - Cropland measures (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	5.31
deployment - Cropland to woody energy crops			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	365
deployment - Pasture to energy crops (1000			
hectares)			
Land impacted for carbon sink - Moderate	0	0	26.5
deployment - Permanent conservation cover			
(1000 hectares)			
Land impacted for carbon sink - Moderate	0	0	960
deployment - Total (1000 hectares)			

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

2020 0 0 0 0	2025 0 0 0	2050 1,328 38,862 3,923
0 0	0	38,862
0	0	
0	0	
0		3,923
0		3,923
	0	
	U	6,195
n	-	6,195
	0	3,791
	0	3,171
0	0	9,304
		7,001
0	0	983
0	0	462
0	0	8,095
0	0	4,781
		=
0	0	665
		11 500
U	U	11,529
0		654
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0	0	2,380
		_,000
0	0	1,929
0	0	3,101
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		004
U	U	231
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0		1,612
0		1,012
0	0	997
-	-	
0	0	25,162
0	0	2,289
0	0	4,287
0	0	2,827
		/ 000
U	U	6,203
0		2.71
U	U	664
<u> </u>	n	346
U	U	340
0	0	4,354
U	U	4,354
	I	
0	0	3 196
0	0	3,196
0	0	3,196

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

Item Land impacted for carbon sink potential - High -	2020	0000	
Land impacted for carbon sink notential - High -		2025	2050
	0	0	531
Avoid deforestation (over 30 years) (1000			
hectares)			
Land impacted for carbon sink potential - High -	0	0	3,159
Extend rotation length (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,397
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	93.4
Increase trees outside forests (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	30.5
Reforest cropland (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	230
Reforest pasture (1000 hectares)			
Land impacted for carbon sink potential - High -	0	0	1,585
Restore productivity (1000 hectares)			,
Land impacted for carbon sink potential - High -	0	0	7,243
Total impacted (over 30 years) (1000 hectares)			, -
Land impacted for carbon sink potential - Low -	0	0	109
Accelerate regeneration (1000 hectares)			
Land impacted for carbon sink potential - Low -	0	0	499
Avoid deforestation (over 30 years) (1000			177
hectares)			
Land impacted for carbon sink potential - Low -	0	0	1,210
Extend rotation length (1000 hectares)			1,210
Land impacted for carbon sink potential - Low -	0	0	698
Improve plantations (1000 hectares)			070
Land impacted for carbon sink potential - Low -	0	0	0
Increase retention of HWP (1000 hectares)			Ū
Land impacted for carbon sink potential - Low -	0	0	49.2
Increase trees outside forests (1000 hectares)			77.2
Land impacted for carbon sink potential - Low -	0	0	15.3
Reforest cropland (1000 hectares)		0	10.0
Land impacted for carbon sink potential - Low -	0	0	39.9
Reforest pasture (1000 hectares)			07.7
Land impacted for carbon sink potential - Low -	0	0	959
Restore productivity (1000 hectares)		0	707
Land impacted for carbon sink potential - Low -	0	0	3,579
Total impacted (over 30 years) (1000 hectares)		0	0,017
Land impacted for carbon sink potential - Mid -	0	0	163
Accelerate regeneration (1000 hectares)	0	0	103
Land impacted for carbon sink potential - Mid -	0	0	515
Avoid deforestation (over 30 years) (1000	0	0	010
hectares)			
Land impacted for carbon sink potential - Mid -	0	0	2,185
Extend rotation length (1000 hectares)	0	0	2,100
Land impacted for carbon sink potential - Mid -	0	0	1,051
Improve plantations (1000 hectares)	0	0	1,001
Land impacted for carbon sink potential - Mid -	0	0	0
Increase retention of HWP (1000 hectares)	0	0	U
Land impacted for carbon sink potential - Mid -	0	0	71.3
Increase trees outside forests (1000 hectares)	U	U	11.3
Land impacted for carbon sink potential - Mid -	0	0	22.0
	U	0	22.9
Reforest cropland (1000 hectares)			000
Land impacted for carbon sink potential - Mid -	0	0	288
Reforest pasture (1000 hectares)			4.004
Land impacted for carbon sink potential - Mid -	0	0	1,931
Restore productivity (1000 hectares)			
Land impacted for carbon sink potential - Mid -	0	0	6,227
Total impacted (over 30 years) (1000 hectares)			

Table EQ. DEF according	PILLAR 1: Efficiency/Electrification -	Dooidontial
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Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF -	0	15.8	16.2	0	0	0	0
Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric Resistance (%)	96	96	96	96	96	96	96
Sales of cooking units - Gas (%)	4.04	4.04	4.04	4.04	4.04	4.04	4.04
Sales of space heating units - Electric Heat Pump	51.1	66.6	66.9	67.9	68.8	70.5	73.6
(%)							
Sales of space heating units - Electric Resistance	40.4	30.3	30.1	29.2	28.4	26.7	23.6
(%)							
Sales of space heating units - Fossil (%)	0.826	0.333	0.334	0.332	0.321	0.314	0.316
Sales of space heating units - Gas (%)	7.6	2.83	2.7	2.57	2.51	2.48	2.48
Sales of water heating units - Electric Heat Pump	0	0	0	0	0	0	0
(%)							
Sales of water heating units - Electric Resistance	88.4	93.5	93.5	93.5	93.5	93.5	93.5
(%)							
Sales of water heating units - Gas Furnace (%)	6.88	3.89	3.9	3.92	3.93	3.93	3.93
Sales of water heating units - Other (%)	4.69	2.6	2.57	2.58	2.57	2.54	2.53

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 (%)	1.29	1.74	2.14	2	1.79	1.66	1.58
Vehicle sales - Light-duty - EV (%)	4.42	6.72	7.55	9.34	11.3	12.8	14.1
Vehicle sales - Light-duty - gasoline (%)	88.8	85	82.5	80.4	78.1	76.3	74.8
Vehicle sales - Light-duty - hybrid (%)	5.29	6.1	7.39	7.93	8.43	8.88	9.17
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.367	0.331	0.29	0.285	0.285	0.294
Vehicle sales - Light-duty - other (%)	0.09	0.094	0.09	0.091	0.09	0.088	0.09
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)	434	444	452	461	471	489	515
Final energy use - Industry (PJ)	555	597	628	656	683	707	739
Final energy use - Residential (PJ)	511	502	512	530	554	579	605
Final energy use - Transportation (PJ)	1,917	1,833	1,727	1,667	1,682	1,736	1,802

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	65,779	68,382	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric Heat Pump	23.9	29.3	65.2	72.1	72.1	72.3	72.4
(%)							
Sales of space heating units - Electric Resistance	22.7	9.78	14.9	20.3	25.2	25.6	25.6
(%)							
Sales of space heating units - Fossil (%)	0	4.02	2.38	1.17	0.182	0.016	0
Sales of space heating units - Gas Furnace (%)	53.5	56.8	17.5	6.48	2.56	2.06	2.02
Sales of water heating units - Electric Heat Pump	0.849	0.3	0.292	0.292	0.293	0.29	0.29
(%)							

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	20.9	7.47	7.27	7.29	7.31	7.22	7.19
(%)							
Sales of water heating units - Gas Furnace (%)	69.5	87.9	88	88	87.9	88	88.1
Sales of water heating units - Other (%)	8.69	4.37	4.46	4.43	4.48	4.48	4.46

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -	0	8.36	8.08	14.3	14.8	14.9	15.4
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)	-24.6	0	-13.3	-10.8
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-2.53	0	-4.22	-4.44
Business-as-usual carbon sink - Total (Mt CO2e/y)	-27.1	0	-17.5	-15.2
Carbon sink potential - High - Accelerate	0	0	0	1,328
regeneration (1000 tCO2e/y)				
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)	0	0	0	38,862
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)	0	0	0	3,923
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)	0	0	0	6,195
Carbon sink potential - High - Improve plantations (1000 tC02e/y)	0	0	0	3,791
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)	0	0	0	9,304
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)	0	0	0	983
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)	0	0	0	462
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)	0	0	0	8,095
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)	0	0	0	4,781
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)	0	0	0	665
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)	0	0	0	11,529
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)	0	0	0	654
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)	0	0	0	2,380
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)	0	0	0	1,929
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)	0	0	0	3,101
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)	0	0	0	344
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)	0	0	0	231
Carbon sink potential - Low - Reforest pasture	0	0	0	613
(1000 tCO2e/y) Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)	0	0	0	1,612
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)	0	0	0	997
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)	0	0	0	25,162

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

Table 63: REF scenario - PILLAR 6: Land sinks -	Forests (coi	ntinued)		
Item	2020	2025	2030	2050
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)	0	0	0	2,289
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)	0	0	0	4,287
Carbon sink potential - Mid - Improve plantations (1000 tC02e/y)	0	0	0	2,827
Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y)	0	0	0	6,203
Carbon sink potential - Mid - Increase trees	0	0	0	664
outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland	0	0	0	346
(1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture	0	0	0	4,354
(1000 tCO2e/y) Carbon sink potential - Mid - Restore	0	0	0	3,196
productivity (1000 tCO2e/y) Land impacted for carbon sink potential - High -	0	0	0	217
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	531
Avoid deforestation (over 30 years) (1000	0	U	U	331
hectares) Land impacted for carbon sink potential - High -	0	0	0	3,159
Extend rotation length (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	1,397
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	93.4
Increase trees outside forests (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	30.5
Reforest cropland (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	230
Reforest pasture (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	1,585
Restore productivity (1000 hectares) Land impacted for carbon sink potential - High -	0	0	0	7,243
Total impacted (over 30 years) (1000 hectares)				
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)	0	0	0	109
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)	0	0	0	499
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)	0	0	0	1,210
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)	0	0	0	698
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)	0	0	0	0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)	0	0	0	49.2
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)	0	0	0	15.3
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)	0	0	0	39.9
Land impacted for carbon sink potential - Low -	0	0	0	959
Restore productivity (1000 hectares) Land impacted for carbon sink potential - Low -	0	0	0	3,579
Total impacted (over 30 years) (1000 hectares) Land impacted for carbon sink potential - Mid -	0	0	0	163
Accelerate regeneration (1000 hectares) Land impacted for carbon sink potential - Mid -	0	0	0	515
Avoid deforestation (over 30 years) (1000 hectares)				

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	2,185
Extend rotation length (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	1,051
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	71.3
Increase trees outside forests (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	22.9
Reforest cropland (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	288
Reforest pasture (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	1,931
Restore productivity (1000 hectares)				
Land impacted for carbon sink potential - Mid -	0	0	0	6,227
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	2,010	1,390	991	866	790	773
Monetary damages from air pollution - Natural Gas (million 2019\$)	0	785	831	884	1,027	1,024	985
Monetary damages from air pollution - Transportation (million 2019\$)	0	5,924	6,179	6,441	6,746	7,065	7,402
Premature deaths from air pollution - Coal (deaths)	0	226	156	111	97.2	88.6	86.7
Premature deaths from air pollution - Natural Gas (deaths)	0	88.6	93.9	99.9	116	116	111
Premature deaths from air pollution - Transportation (deaths)	0	666	695	724	759	795	832