

Net-Zero America - ohio state report

2021-03-15

These data underlie graphs and tables presented in the Princeton Net-Zero America study:

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Notes

- These data are all data from the study available at https://netzeroamerica.prince-ton.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 statelevel 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.)
- For Pillar 6 (Land sinks), values shown are maximum carbon storage potentials.

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		36,680	40,065				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	1.41	8.43	35.7	81.1	89	89.5	89.5
Heat Pump (%)							
Sales of space heating units - Electric	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Resistance (%)							
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace	88.8	85.5	58.5	9.54	0.892	0.356	0.356
(%)							
Sales of water heating units - Electric	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Heat Pump (%)							
Sales of water heating units - Electric	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Resistance (%)							
Sales of water heating units - Gas Furnace	95	92.6	61.9	9.69	0.569	0	0
(%)							
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.24	6.43	13.3	14.2	13.1	13.8
Cumulative 5-yr (billion \$2018)							

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		9.7	12.8				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.8	69.9	94.9	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Heat Pump (%)							
Sales of space heating units - Electric	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Resistance (%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric	0	1.79	15.1	34.7	38	38.3	38.3
Heat Pump (%)							
Sales of water heating units - Electric	32.2	48.8	51.7	60	61.5	61.6	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	67.7	49.3	33	5.17	0.303	0	0
(%)							
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,095	5,367	8,700	13,178	14,344	13,675
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.326		3.65		16		25.9
units)							
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0.621	12.5	9.71	12.6	4.83
Capital invested - Solar PV - Constrained (billion \$2018)		1.55	0.276	10.4	9.72	11.5	5.9
Capital invested - Wind - Base (billion \$2018)		0	5.07	13.6	21.4	2.52	3.08
Capital invested - Wind - Constrained (billion \$2018)		0	12.9	11.3	0	0	0.2
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	820	820	1,428	14,669	25,604	40,600	46,709
Installed renewables - Solar - Constrained land use assumptions (MW)	751	751	2,585	13,936	27,481	42,657	51,286
Installed renewables - Wind - Base land use assumptions (MW)	827	827	4,636	15,584	33,653	35,902	38,809
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	9,867	19,628	19,628	19,628	19,628

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
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	1,454	1,454	2,369	22,189	38,393	60,473	69,347
Solar - Constrained land use assumptions	1,334	1,334	4,096	21,004	41,108	63,417	76,016
(GWh)							
Wind - Base land use assumptions (GWh)	2,973	2,973	14,885	48,163	98,677	104,614	112,056
Wind - Constrained land use assumptions	2,973	2,973	28,568	53,532	53,532	53,532	53,532
(GWh)							

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	402	1,858
Conversion capital investment -		0	0	0	0	6,167	22,362
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	7	30
(quantity)							
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	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
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	7.93	36.7
Annual - BECCS (MMT)		0	0	0	0	7.93	36.7
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	7.93	44.6
Cumulative - BECCS (MMT)		0	0	0	0	7.93	44.6
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

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

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

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

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

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

Table 12: E+ Scenario - PILLAR 6: Land Sini	ks - Agricu. 2020	iture 2025	2030	2035	2040	2045	2050
Item Carbon sink potential - Aggressive	2020	2025	2030	2035	2040	2045	-1,255
							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							-5,463
Carbon sink potential - Aggressive							-5,463
deployment - Cropland measures (1000							
tCO2e/y)							01/
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,932
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,883
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-4,245
deployment - Total (1000 tC02e/y)							•
Land impacted for carbon sink -							523
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,526
Aggressive deployment - Cropland							-,
measures (1000 hectares)							
Land impacted for carbon sink -							390
Aggressive deployment - Permanent							070
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,439
Aggressive deployment - Total (1000							4,437
hectares)							
Land impacted for carbon sink - Moderate							523
							523
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							1.0/1
Land impacted for carbon sink - Moderate							1,861
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							195
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,578
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-180
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,474
counting overlap) (1000 tC02e/y)							
Carbon sink potential - High - Avoid							-3,130
deforestation (1000 tC02e/y)							0.101
Carbon sink potential - High - Extend							-3,434
rotation length (1000 tCO2e/y)							010
Carbon sink potential - High - Improve							-219
plantations (1000 tCO2e/y)							. 7.0
Carbon sink potential - High - Increase							-4,749
retention of HWP (1000 tC02e/y)							1000
Carbon sink potential - High - Increase							-1,920
trees outside forests (1000 tC02e/y)							11//
Carbon sink potential - High - Reforest							-1,166
cropland (1000 tC02e/y)							/ /05
Carbon sink potential - High - Reforest							-4,605
pasture (1000 tC02e/y)							0.070
Carbon sink potential - High - Restore							-2,070
productivity (1000 tC02e/y)							00.0
Carbon sink potential - Low - Accelerate							-90.3
regeneration (1000 tC02e/y)							F 007
Carbon sink potential - Low - All (not							-5,927
counting overlap) (1000 tC02e/y)							500
Carbon sink potential - Low - Avoid							-522
deforestation (1000 tC02e/y)							1.010
Carbon sink potential - Low - Extend							-1,319
rotation length (1000 tC02e/y)							440
Carbon sink potential - Low - Improve							-112
plantations (1000 tC02e/y)							4.500
Carbon sink potential - Low - Increase							-1,583
retention of HWP (1000 tC02e/y)							(70
Carbon sink potential - Low - Increase							-672
trees outside forests (1000 tC02e/y)							500
Carbon sink potential - Low - Reforest							-583
cropland (1000 tC02e/y)							0/0
Carbon sink potential - Low - Reforest							-349
pasture (1000 tC02e/y)							(00
Carbon sink potential - Low - Restore							-698
productivity (1000 tC02e/y)							10.5
Carbon sink potential - Mid - Accelerate							-135
regeneration (1000 tC02e/y)							10 / 00
Carbon sink potential - Mid - All (not							-13,699
counting overlap) (1000 tC02e/y)							1.007
Carbon sink potential - Mid - Avoid							-1,826
deforestation (1000 tC02e/y)							0.077
Carbon sink potential - Mid - Extend							-2,377
rotation length (1000 tCO2e/y)							1/0
Carbon sink potential - Mid - Improve							-163
plantations (1000 tCO2e/y)							04//
Carbon sink potential - Mid - Increase							-3,166
retention of HWP (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-1,296
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-874
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,477
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-1,384
productivity (1000 tCO2e/y)							

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

lable 13: E+ scenario - PILLAR 6: Land sink		·					
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							29.5
High - Accelerate regeneration (1000							
hectares)							101
Land impacted for carbon sink potential -							424
High - Avoid deforestation (over 30 years)							
(1000 hectares)							4 754
Land impacted for carbon sink potential -							1,751
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							80.7
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							182
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							77.1
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							131
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							686
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,362
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							14.7
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							398
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							671
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							38.5
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							415
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,696
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							22.1
Mid - Accelerate regeneration (1000							
					1		

					_
Table 13: F+:	scenaria -	PTII AR 6.	I and sinks -	. Forests i	(continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							411
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,211
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							60.8
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							57.8
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							164
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							836
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,902
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 14: E+ scenario - IMPACTS - Fossil fuel industries

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

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		2,185	5.74	5.72	5.49	4.18	0.407
Monetary damages from air pollution - Natural Gas (million 2019\$)		382	309	197	163	88.6	34.3
Monetary damages from air pollution - Transportation (million 2019\$)		3,979	3,697	2,802	1,624	753	313
Premature deaths from air pollution - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Natural Gas (deaths)		43.2	34.9	22.2	18.4	10	3.88
Premature deaths from air pollution - Transportation (deaths)		448	416	315	183	84.6	35.2

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		991	1,049	946	522	572	1,838
By economic sector - Construction (jobs)		9,969	11,487	23,730	28,313	28,695	27,060
By economic sector - Manufacturing		18,228	21,175	27,550	26,341	21,459	26,714
(jobs)							
By economic sector - Mining (jobs)		11,133	8,438	6,292	4,037	2,522	1,363

Table 16: E+ scenario - IMPACTS - Jobs (continued)

Table 16: E+ scenario - IMPACTS - Jobs (co	ntinueaj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		431	631	2,989	3,778	4,619	4,316
By economic sector - Pipeline (jobs)		1,603	1,561	1,101	823	555	476
By economic sector - Professional (jobs)		5,422	5,881	12,178	16,070	16,982	18,364
By economic sector - Trade (jobs)		5,336	5,040	8,351	9,996	10,432	10,368
By economic sector - Utilities (jobs)		12,259	12,458	19,950	24,333	23,209	23,300
By education level - All sectors -		19,760	20,727	32,380	36,393	34,853	36,016
Associates degree or some college (jobs)							
By education level - All sectors -		14,492	14,596	21,253	23,462	22,280	23,250
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		420	419	681	807	810	847
degree (jobs)							
By education level - All sectors - High		27,390	28,670	43,786	47,886	45,610	47,970
school diploma or less (jobs)							
By education level - All sectors - Masters		3,311	3,307	4,987	5,665	5,492	5,715
or professional degree (jobs)							
By resource sector - Biomass (jobs)		2,429	2,442	2,131	1,241	2,132	8,003
By resource sector - CO2 (jobs)		0	1,539	0	0	131	1,132
By resource sector - Coal (jobs)		1,710	216	18	13.3	10.4	8.76
By resource sector - Grid (jobs)		10,491	12,032	29,799	39,082	39,898	42,049
By resource sector - Natural Gas (jobs)		18,143	15,108	12,583	10,498	6,865	3,994
By resource sector - Nuclear (jobs)		662	651	641	631	366	0
By resource sector - Oil (jobs)		19,280	16,571	13,779	9,722	6,954	4,254
By resource sector - Solar (jobs)		6,458	8,175	23,990	24,898	28,191	28,184
By resource sector - Wind (jobs)		6,200	10,985	20,146	28,128	24,499	26,172
						I	
Median wages - Annual - All (\$2019 per		59,967	60,097	60,244	61,374	62,277	62,669
job)		10.000	10.000	1/71/	10 (01	17.050	10.005
On-Site or In-Plant Training - Total jobs - 1		10,393	10,820	16,714	18,681	17,853	18,325
to 4 years (jobs)		0.047		, 500	7.504	7.000	7005
On-Site or In-Plant Training - Total jobs - 4		3,916	4,051	6,532	7,521	7,323	7,285
to 10 years (jobs)		12 (21		11.500	10 = 01		
On-Site or In-Plant Training - Total jobs -		10,491	10,907	16,728	18,591	17,806	18,682
None (jobs)							
On-Site or In-Plant Training - Total jobs -		516	548	872	993	954	981
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		40,057	41,394	62,240	68,427	65,110	68,525
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		13,258	13,803	21,420	24,058	23,014	23,535
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		3,634	3,793	6,314	7,357	7,217	7,153
years (jobs)							
On-the-Job Training - All sectors - None		3,513	3,596	5,508	6,090	5,862	6,104
(jobs)							
On-the-Job Training - All sectors - Over 10		661	703	1,062	1,150	1,074	1,115
years (jobs)				•	-		
On-the-Job Training - All sectors - Up to 1		44,308	45,825	68,782	75,558	71,879	75,890
year (jobs)		,	-,		-,	, -	-,-
Related work experience - All sectors - 1		23,759	24,437	36,940	40,984	39,168	40,692
to 4 years (jobs)			,	00/1	,.	51,100	,
Related work experience - All sectors - 4		15,181	15,678	23,869	26,667	25,442	26,263
to 10 years (jobs)		10,101	10,010	20,007	20,001	20,442	20,200
Related work experience - All sectors -		9,280	9,636	14,744	16,343	15,666	16,368
None (jobs)		7,200	7,000	17,144	10,040	15,000	10,000
Related work experience - All sectors -		4,310	4,458	6,604	7,250	6,813	7,112
		4,310	4,436	0,004	1,250	0,813	1,112
Over 10 years (jobs)		10.07.0	10 F10	00.000	00.070	01.057	00.070
Related work experience - All sectors - Up		12,843	13,510	20,929	22,969	21,957	23,363
to 1 year (jobs)		0.000	/ 070	/ 011	7.010	7700	7100
Wage income - All (million \$2019)		3,920	4,070	6,211	7,010	6,792	7,132

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		36,676	40,057				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Heat Pump (%)							
Sales of space heating units - Electric	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Resistance (%)							
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of space heating units - Gas Furnace	88.8	87.3	84.2	74.1	51.1	23.6	7.9
(%)							
Sales of water heating units - Electric	0.454	1.05	3.02	9.27	22.8	38.3	47
Heat Pump (%)							
Sales of water heating units - Electric	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Resistance (%)							
Sales of water heating units - Gas Furnace	95	94.9	91.4	80	54.7	25	8.07
(%)							
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

Table 18: E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.04	5.08	6.88	7.14	11.1	11.9
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		9.67	12.6				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.7	62.7	66.2	75.4	88.3	96.2	99
Resistance (%)							
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Heat Pump (%)							
Sales of space heating units - Electric	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Resistance (%)							
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric	0	0.549	2.08	6.92	17.2	28.8	35.3
Heat Pump (%)							
Sales of water heating units - Electric	32.2	48.8	49	50.1	53.4	57.7	60.3
Resistance (%)							
Sales of water heating units - Gas Furnace	67.7	50.5	48.8	42.8	29.2	13.3	4.31
(%)							
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17

Table 21: E- scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	338	712	2,404	7,567	11,023
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.326		1.12		5.95		16.6
units)							
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,463
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,932
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							0.000
Carbon sink potential - Moderate							-2,883
deployment - Cropland measures (1000							
tCO2e/y) Carbon sink potential - Moderate							-107
deployment - Permanent conservation							-107
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-4,245
deployment - Total (1000 tC02e/y)							-4,243
Land impacted for carbon sink -							523
Aggressive deployment - Corn-ethanol to							020
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,526
Aggressive deployment - Cropland							0,020
measures (1000 hectares)							
Land impacted for carbon sink -							390
Aggressive deployment - Permanent							270
conservation cover (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							4,439
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							523
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,861
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							195
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,578
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-180
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,474
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,130
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-3,434
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-219
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,749
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,920
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,166
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,605
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-2,070
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-90.3
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-5,927
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-522
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,319
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-112
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,583
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-672
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-583
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-349
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-698
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-135
regeneration (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not							-13,699
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,826
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-2,377
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							-163
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-3,166
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,296
trees outside forests (1000 tC02e/y)							07/
Carbon sink potential - Mid - Reforest							-874
cropland (1000 tCO2e/y)							0 / 77
Carbon sink potential - Mid - Reforest							-2,477
pasture (1000 tC02e/y)							1.00/
Carbon sink potential - Mid - Restore							-1,384
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							29.5
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							424
High - Avoid deforestation (over 30 years)							
(1000 hectares)							1 751
Land impacted for carbon sink potential -							1,751
High - Extend rotation length (1000							
hectares)							007
Land impacted for carbon sink potential -							80.7
High - Improve plantations (1000							
hectares)							0
Land impacted for carbon sink potential -							U
High - Increase retention of HWP (1000							
hectares) Land impacted for carbon sink potential -							182
							102
High - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							77.1
High - Reforest cropland (1000 hectares)							7 7.1
Land impacted for carbon sink potential -							131
							131
High - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							686
High - Restore productivity (1000							000
hectares)							
Land impacted for carbon sink potential -							3,362
High - Total impacted (over 30 years)							3,302
(1000 hectares)							
Land impacted for carbon sink potential -						+	14.7
Low - Accelerate regeneration (1000							14.1
hectares)							
Land impacted for carbon sink potential -				-			398
Low - Avoid deforestation (over 30 years)							370
(1000 hectares)							
Land impacted for carbon sink potential -							671
Low - Extend rotation length (1000							011
hectares)							
Land impacted for carbon sink potential -					-		40.4
Low - Improve plantations (1000							40.4
hectares)							
Land impacted for carbon sink potential -					-	+	0
Low - Increase retention of HWP (1000							U
		1	1		1	I	

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							38.5
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							415
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,696
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							22.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							411
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,211
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							60.8
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							57.8
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							164
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							836
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,902
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Table 24. L Scenario Initiation Treatm							
Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		2,185	5.74	5.72	5.49	4.18	0.407
Coal (million 2019\$)							
Monetary damages from air pollution -		350	226	86.9	38.1	12.7	7.67
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,048	4,080	3,966	3,572	2,847	1,959
Transportation (million 2019\$)							
Premature deaths from air pollution -		247	0.648	0.646	0.62	0.473	0.046
Coal (deaths)							
Premature deaths from air pollution -		39.5	25.5	9.81	4.31	1.44	0.866
Natural Gas (deaths)							
Premature deaths from air pollution -		455	459	446	402	320	220
Transportation (deaths)							

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

•	•					
2020	2025	2030	2035	2040	2045	2050
	36,680	40,065				
41	54.2	82.9	88.6	88.9	88.9	88.9
59	45.8	17.1	11.4	11.1	11.1	11.1
1.41	8.43	35.7	81.1	89	89.5	89.5
4.39	3.49	5.31	9.37	10.1	10.2	10.2
5.44	2.58	0.487	0.021	0	0	0
88.8	85.5	58.5	9.54	0.892	0.356	0.356
0.454	2.53	19.6	46.2	50.8	51.1	51.1
4.26	4.67	18.3	43.9	48.4	48.7	48.7
95	92.6	61.9	9.69	0.569	0	0
0.252	0.187	0.187	0.189	0.188	0.188	0.189
	59 1.41 4.39 5.44 88.8 0.454 4.26	36,680 41 54.2 59 45.8 1.41 8.43 4.39 3.49 5.44 2.58 88.8 85.5 0.454 2.53 4.26 4.67 95 92.6	36,680 40,065 41 54.2 82.9 59 45.8 17.1 1.41 8.43 35.7 4.39 3.49 5.31 5.44 2.58 0.487 88.8 85.5 58.5 0.454 2.53 19.6 4.26 4.67 18.3 95 92.6 61.9	36,680 40,065 41 54.2 82.9 88.6 59 45.8 17.1 11.4 1.41 8.43 35.7 81.1 4.39 3.49 5.31 9.37 5.44 2.58 0.487 0.021 88.8 85.5 58.5 9.54 0.454 2.53 19.6 46.2 4.26 4.67 18.3 43.9 95 92.6 61.9 9.69	36,680 40,065 41 54.2 82.9 88.6 88.9 59 45.8 17.1 11.4 11.1 1.41 8.43 35.7 81.1 89 4.39 3.49 5.31 9.37 10.1 5.44 2.58 0.487 0.021 0 88.8 85.5 58.5 9.54 0.892 0.454 2.53 19.6 46.2 50.8 4.26 4.67 18.3 43.9 48.4 95 92.6 61.9 9.69 0.569	36,680 40,065 41 54.2 82.9 88.6 88.9 88.9 59 45.8 17.1 11.4 11.1 11.1 1.41 8.43 35.7 81.1 89 89.5 4.39 3.49 5.31 9.37 10.1 10.2 5.44 2.58 0.487 0.021 0 0 88.8 85.5 58.5 9.54 0.892 0.356 0.454 2.53 19.6 46.2 50.8 51.1 4.26 4.67 18.3 43.9 48.4 48.7 95 92.6 61.9 9.69 0.569 0

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.24	6.43	13.3	14.2	13.1	13.8
Cumulative 5-yr (billion \$2018)							

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		9.7	12.8				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.8	69.9	94.9	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Heat Pump (%)							
Sales of space heating units - Electric	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Resistance (%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric	0	1.79	15.1	34.7	38	38.3	38.3
Heat Pump (%)							
Sales of water heating units - Electric	32.2	48.8	51.7	60	61.5	61.6	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	67.7	49.3	33	5.17	0.303	0	0
(%)							
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,095	5,367	8,700	13,178	14,344	13,675
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.326		3.65		16		25.9
units)							
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 30: E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		1.49	2.39	24.4	14.9	8.53	10.3
\$2018)							
Capital invested - Wind - Base (billion		0	11.4	22	18.4	0.135	0
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	820	2,125	4,465	30,363	47,114	57,295	70,300
use assumptions (MW)							
Installed renewables - Solar -	1,640	2,450	11,765	59,848	82,550	87,433	124,198
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	827	827	9,413	27,115	42,706	42,827	42,827
use assumptions (MW)							
Installed renewables - Wind - Constrained	1,654	1,654	36,590	39,256	39,256	39,256	90,057
land use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	1,454	3,430	6,952	45,355	69,898	84,697	104,264
Solar - Constrained land use assumptions	2,908	4,131	18,119	88,835	121,824	128,925	184,223
(GWh)							
Wind - Base land use assumptions (GWh)	2,973	2,973	29,483	80,929	121,652	121,927	121,927
Wind - Constrained land use assumptions	5,947	5,947	100,657	107,064	107,064	107,064	258,045
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,463
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-6,932
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,883
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-4,245
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							523
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,526
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							390
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,439
Aggressive deployment - Total (1000							•
hectares)							
Land impacted for carbon sink - Moderate							523
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,861
deployment - Cropland measures (1000							.,
hectares)							
Land impacted for carbon sink - Moderate							195
deployment - Permanent conservation							.,0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,578
deployment - Total (1000 hectares)							2,010
aspisymonic rotal (1000 hostal ca)							

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

2020	2025	2030	2035	2040	2045	2050
						-180
						-21,474
						-3,130
						-3,434
						-219
						-4,749
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	2020 2025 2030 2035 2040 2045

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-1,920
trees outside forests (1000 tC02e/y)							11//
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)							-90.3
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-5,927
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-13
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y)							-13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,37
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-16
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,16
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,29
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-87
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,47
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,38
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							42
(1000 hectares) Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,75
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80

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

Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							182
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							77.
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							13
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							686
High - Restore productivity (1000							
hectares)							0.076
Land impacted for carbon sink potential -							3,362
High - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							14.
Low - Accelerate regeneration (1000							14.1
hectares)							
Land impacted for carbon sink potential -							398
Low - Avoid deforestation (over 30 years)							0,0
(1000 hectares)							
Land impacted for carbon sink potential -							67
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							0.
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							38.5
Low - Reforest cropland (1000 hectares)							30.0
Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							22.
Land impacted for carbon sink potential -							415
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,696
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							22.
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							41
Mid - Avoid deforestation (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							1,21
Mid - Extend rotation length (1000							1,21
hectares)							
Land impacted for carbon sink potential -							60.8
Mid - Improve plantations (1000 hectares)							00.0
Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							139
Mid - Increase trees outside forests (1000							
hectares)							

Table 33: E+RE+	. cronario -	DTII AD A.	I and cinke -	Forests	(continued)
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Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							57.8
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							164
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							836
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,902
Mid - 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 -		2,185	5.74	5.72	5.49	4.18	0.407
Coal (million 2019\$)							
Monetary damages from air pollution -		316	231	136	90.6	30.2	7.22
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,979	3,697	2,802	1,624	753	313
Transportation (million 2019\$)							
Premature deaths from air pollution -		247	0.648	0.646	0.62	0.473	0.046
Coal (deaths)							
Premature deaths from air pollution -		35.7	26	15.4	10.2	3.41	0.815
Natural Gas (deaths)							
Premature deaths from air pollution -		448	416	315	183	84.6	35.2
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,680	40,065				
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of space heating units - Gas Furnace (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas Furnace (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.24	6.43	13.3	14.2	13.1	13.8
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		9.7	12.8				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.8	69.9	94.9	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Sales of space heating units - Electric	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Heat Pump (%)							
Sales of space heating units - Electric	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Resistance (%)							
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of water heating units - Electric	0	1.79	15.1	34.7	38	38.3	38.3
Heat Pump (%)							
Sales of water heating units - Electric	32.2	48.8	51.7	60	61.5	61.6	61.5
Resistance (%)							
Sales of water heating units - Gas Furnace	67.7	49.3	33	5.17	0.303	0	0
(%)							
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		2,095	5,367	8,700	13,178	14,344	13,675
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.326		3.65		16		25.9
units)							
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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	0.381	0.599	1.35	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.265	2.47	1.43	0
Capital invested - Wind - Base (billion \$2018)		0	0.252	0	0.132	0	0.036
Capital invested - Wind - Constrained (billion \$2018)		0	0.873	0	0.71	0.217	0.157
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	820	820	820	1,225	1,900	3,509	3,509
Installed renewables - Solar - Constrained land use assumptions (MW)	820	820	820	1,101	3,880	5,590	5,590
Installed renewables - Wind - Base land use assumptions (MW)	827	827	1,016	1,016	1,127	1,127	1,162
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	1,482	1,482	2,083	2,277	2,425

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	1,454	1,454	1,454	2,065	3,079	5,499	5,499
Solar - Constrained land use assumptions	1,454	1,454	1,454	1,879	6,066	8,628	8,628
(GWh)							
Wind - Base land use assumptions (GWh)	2,973	2,973	3,579	3,579	3,937	3,937	4,045
Wind - Constrained land use assumptions	2,973	2,973	4,979	4,979	6,794	7,356	7,799
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,463
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-6,932
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,255
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,883
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-4,245
deployment - Total (1000 tC02e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							523
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,526
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							390
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,439
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							523
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,861
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							195
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,578
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-180
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,474
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-3,130
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-3,434
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-219
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,749
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,920
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-1,166
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,605
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-2,070
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-90.3
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-5,927
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-522
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,319
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-112
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,583
retention of HWP (1000 tCO2e/y)							•
Carbon sink potential - Low - Increase							-672
trees outside forests (1000 tC02e/y)							

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Reforest							-58
cropland (1000 tCO2e/y)							0.1
Carbon sink potential - Low - Reforest							-34
pasture (1000 tCO2e/y) Carbon sink potential - Low - Restore							-69
productivity (1000 tCO2e/y)							-09
Carbon sink potential - Mid - Accelerate							-13
regeneration (1000 tCO2e/y)							-13
Carbon sink potential - Mid - All (not							-13,69
counting overlap) (1000 tC02e/y)							-13,07
Carbon sink potential - Mid - Avoid							-1,82
deforestation (1000 tC02e/y)							-1,02
Carbon sink potential - Mid - Extend	+						-2,37
rotation length (1000 tCO2e/y)							-2,01
Carbon sink potential - Mid - Improve	+						-16
plantations (1000 tCO2e/y)							-10
Carbon sink potential - Mid - Increase							-3,16
retention of HWP (1000 tCO2e/y)							0,10
Carbon sink potential - Mid - Increase							-1,29
trees outside forests (1000 tCO2e/y)							1,27
Carbon sink potential - Mid - Reforest							-87
cropland (1000 tCO2e/y)							O.
Carbon sink potential - Mid - Reforest							-2,47
pasture (1000 tC02e/y)							۷,٦١
Carbon sink potential - Mid - Restore	+						-1,38
productivity (1000 tC02e/y)							1,00
Land impacted for carbon sink potential -							29.
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							42
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,75
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							80
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							18
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							77
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							13
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							68
High - Restore productivity (1000							
nectares)							
Land impacted for carbon sink potential -							3,36
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							14
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							39
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							671
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							38.5
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							415
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,696
Low - Total impacted (over 30 years)							1,070
(1000 hectares)							
Land impacted for carbon sink potential -		+					22.1
Mid - Accelerate regeneration (1000							22.1
hectares)							
Land impacted for carbon sink potential -							411
Mid - Avoid deforestation (over 30 years)							411
(1000 hectares)							
Land impacted for carbon sink potential -							1,211
							1,211
Mid - Extend rotation length (1000							
hectares)							(0.0
Land impacted for carbon sink potential -							60.8
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							139
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							57.8
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							164
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							836
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,902
Mid - 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 -		2,185	5.74	5.72	5.49	4.18	0.407
Coal (million 2019\$)							
Monetary damages from air pollution -		358	286	365	271	94.9	28.9
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		3,979	3,697	2,802	1,624	753	313
Transportation (million 2019\$)							
Premature deaths from air pollution -		247	0.648	0.646	0.62	0.473	0.046
Coal (deaths)							

Table 44: E+RE- scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		40.4	32.3	41.2	30.5	10.7	3.26
Natural Gas (deaths)							
Premature deaths from air pollution -		448	416	315	183	84.6	35.2
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		36,676	40,057				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Heat Pump (%)							
Sales of space heating units - Electric	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Resistance (%)							
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of space heating units - Gas Furnace	88.8	87.3	84.2	74.1	51.1	23.6	7.9
(%)							
Sales of water heating units - Electric	0.454	1.05	3.02	9.27	22.8	38.3	47
Heat Pump (%)							
Sales of water heating units - Electric	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Resistance (%)							
Sales of water heating units - Gas Furnace	95	94.9	91.4	80	54.7	25	8.07
(%)							
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

Table 46: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.04	5.08	6.88	7.14	11.1	11.9
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		9.67	12.6				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.7	62.7	66.2	75.4	88.3	96.2	99
Resistance (%)							
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Sales of space heating units - Electric	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Heat Pump (%)							
Sales of space heating units - Electric	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Resistance (%)							
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of water heating units - Electric	0	0.549	2.08	6.92	17.2	28.8	35.3
Heat Pump (%)							
Sales of water heating units - Electric	32.2	48.8	49	50.1	53.4	57.7	60.3
Resistance (%)							

Table 48: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

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

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

•••	,.		•				
Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	338	712	2,404	7,567	11,023
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.326		1.12		5.95		16.6
units)							
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant	0	0	0	0	0	0	0
(billion \$2018)							
Capital invested - Biomass w/ccu allam	0	0	0	0	0	0	0
power plant (billion \$2018)							
Capital invested - Biomass w/ccu power	0	0	0	0	0	0	0
plant (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	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0.179	0.179

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	1,897	5,611
Conversion capital investment -		0	0	0	0	19,240	37,955
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							

Table 52: <i>E-B+ scenario</i>	- PTI I AR 3º Clean tuels -	Rineneray (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Beccs hydrogen	0	0	0	0	0	23	65
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	1	2
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	24.7	72.9
Annual - BECCS (MMT)		0	0	0	0	24.7	72.9
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	24.7	97.6
Cumulative - BECCS (MMT)		0	0	0	0	24.7	97.6
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

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

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

Table 55: 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
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,772
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-4,907
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							

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

Item Carbon sink potential - Aggressive	2020	2025	2030	2035	2040	2045	2050 0
deployment - Pasture to energy crops							U
(1000 tC02e/y) Carbon sink potential - Aggressive							-193
deployment - Permanent conservation cover (1000 tC02e/y)							170
Carbon sink potential - Aggressive deployment - Total (1000 tC02e/y)							-6,872
Carbon sink potential - Moderate deployment - Corn-ethanol to energy							-1,772
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,589
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tC02e/y)							-96.4
Carbon sink potential - Moderate deployment - Total (1000 tC02e/y)							-4,458
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							7,832
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							351
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							9,381
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,674
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							175
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							3,047

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

Carbon sink potential High - Accelerate regeneration (1000 t002e/y) Carbon sink potential - High - All (not counting overlap) (1000 t002e/y) Carbon sink potential - High - All (not counting overlap) (1000 t002e/y) Carbon sink potential - High - Extend rotation length (1000 t002e/y) Carbon sink potential - High - Extend rotation length (1000 t002e/y) Carbon sink potential - High - Improve plantations (1000 t002e/y) Carbon sink potential - High - Improve plantations (1000 t002e/y) Carbon sink potential - High - Improve plantations (1000 t002e/y) Carbon sink potential - High - Increase retention of Hwe (1000 t002e/y) Carbon sink potential - High - Increase retending the forests (1000 t002e/y) Carbon sink potential - High - Referest recognistic forests (1000 t002e/y) Carbon sink potential - High - Referest recognistic forests (1000 t002e/y) Carbon sink potential - High - Referest recognistic forests (1000 t002e/y) Carbon sink potential - High - Referest recognistic forests (1000 t002e/y) Carbon sink potential - High - Restore productivity (1000 t002e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t002e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t002e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t002e/y) Carbon sink potential - Low - All (Inot counting overlap) (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - Low - Fixtend rotation length (1000 t002e/y) Carbon sink potential - High - Fixtend rotation length (1000 t002e/y) Carbon sink potentia	Iable 57: E-B+ scenario - PILLAR 6: Land 8 Item	2020	2025	2030	2035	2040	2045	2050
regeneration (1000 t002e/v) Carbon sink potential - High- All (not counting overlap) (1000 t002e/v) Carbon sink potential - High- Avoid deforestation (1000 t002e/v) Carbon sink potential - High- Avoid deforestation (1000 t002e/v) Carbon sink potential - High- Extend rotation length (1000 t002e/v) Carbon sink potential - High- Improve plantations (1000 t002e/v) Carbon sink potential - High- Increase retention of HWP (1000 t002e/v) Carbon sink potential - High- Increase retention of HWP (1000 t002e/v) Carbon sink potential - High- Increase retention of HWP (1000 t002e/v) Carbon sink potential - High- Increase retention of HWP (1000 t002e/v) Carbon sink potential - High- Reforest continuous potential - High- Reforest responsibility of the Potential - High- Reforest pasture (1000 t002e/v) Carbon sink potential - High- Reforest pasture (1000 t002e/v) Carbon sink potential - Low - All (Inot Carbon sink potential - Low - All (Inot Counting overlap) (1000 t002e/v) Carbon sink potential - Low - All (Inot Counting overlap) (1000 t002e/v) Carbon sink potential - Low - All (Inot Counting overlap) (1000 t002e/v) Carbon sink potential - Low - All (Inot Counting overlap) (1000 t002e/v) Carbon sink potential - Low - Low - All (Inot Counting overlap) (1000 t002e/v) Carbon sink potential - Low - Extend rotation length (1000 t002e/v) Carbon sink potential - Low - Improve plantations (1000 t002e/v) Carbon sink potential - Low - Increase retention of HWP (1000 t002e/v) Carbon sink potential - Low - Increase retention of HWP (1000 t002e/v) Carbon sink potential - Low - Reforest pasture (1000 t002e/v) Carbon sink potential - Low - Reforest pasture (1000 t002e/v) Carbon sink potential - Low - Reforest pasture (1000 t002e/v) Carbon sink potential - Low - Reforest pasture (1000 t002e/v) Carbon sink potential - Mid Accelerate regeneration (1000 t002e/v) Carbon sink potential - Mid Febreat podential - Mid Carbon sink potential - Mid Febreat podential - Mid Febreat podential - Mid Febreat podential - Mid Febreat podent		2020	2023	2030	2000	2040	2043	
Carbon sink potential + High - All (not counting overlap) (1000 CO26/N) .3,130								100
Carbon sink potential - High - Avoid Carbon sink potential - High - Avoid Carbon sink potential - High - Extend Carbon sink potential - High - Extend Carbon sink potential - High - Extend Carbon sink potential - High - Improve Carbon sink potential - High - Reforest Carbon sink potential - Low - Accelerate Carbon sink potential - Low - Avoid Carbon sink potential - Low - Avoid Carbon sink potential - Low - Avoid Carbon sink potential - Low - Extend Carbon sink potential - Low - Extend Carbon sink potential - Low - Improve Carbon sink potential - Low - Reforest Carbon sink potential - Low - Reforest Carbon sink potential - Low - Reforest Carbon sink potential - Mid - Accelerate Carbo			+					-91 /.7/.
Garbon sink potential High - Avoid deforestation (1000 t002e/v) Garbon sink potential - High - Extend rotation length (1000 t002e/v) Garbon sink potential - High - Improve plantations (1000 t002e/v) Garbon sink potential - High - Improve plantations (1000 t002e/v) Garbon sink potential - High - Improve plantations (1000 t002e/v) Garbon sink potential - High - Improve plantations (1000 t002e/v) Garbon sink potential - High - Improve plantations (1000 t002e/v) Garbon sink potential - High - Reforest repland (1000 t002e/v) Garbon sink potential - High - Reforest repland (1000 t002e/v) Garbon sink potential - High - Reforest repland (1000 t002e/v) Garbon sink potential - High - Reforest repland (1000 t002e/v) Garbon sink potential - High - Restore productivity (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Extend rotation length (1000 t002e/v) Garbon sink potential - Low - Improve plantations (1000 t002e/v) Garbon sink potential - Mid - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Mid - Accelerate regeneration (1000 t002e/v) Garbon sink potential - Mid - Extend rota								21,717
deforestation (1000 CC02e/v) Carbon sink potential + ligh - Extend S,3,434 cotation length (1000 CC02e/v) Carbon sink potential + ligh - Improve plantations (1000 CC02e/v) Carbon sink potential - ligh - Improve plantations (1000 CC02e/v) Carbon sink potential - ligh - Improves retention of HWP (1000 CC02e/v) Carbon sink potential - ligh - Improves trees outside forests (1000 CC02e/v) Carbon sink potential - ligh - Reforest crepland (1000 CC02e/v) Carbon sink potential - ligh - Reforest crepland (1000 CC02e/v) Carbon sink potential - ligh - Reforest productivity (1000 CC02e/v) Carbon sink potential - ligh - Restore productivity (1000 CC02e/v) Carbon sink potential - ligh - Restore productivity (1000 CC02e/v) Carbon sink potential - ligh - Restore productivity (1000 CC02e/v) Carbon sink potential - ligh - Restore productivity (1000 CC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 CC02e/v) Carbon sink potential - Low - All (Inot counting overlap) (1000 CC02e/v) Carbon sink potential - Low - All (Inot counting overlap) (1000 CC02e/v) Carbon sink potential - Low - Extend rotation length (1000 CC02e/v) Carbon sink potential - Low - Extend rotation length (1000 CC02e/v) Carbon sink potential - Low - Improve plantations (1000 CC02e/v) Carbon sink potential - Low - Improve plantations (1000 CC02e/v) Carbon sink potential - Low - Improve plantations (1000 CC02e/v) Carbon sink potential - Low - Improve plantations (1000 CC02e/v) Carbon sink potential - Low - Reforest productivity (1000 CC02e/v) Carbon sink potential - Low - Reforest productivity (1000 CC02e/v) Carbon sink potential - Low - Reforest productivity (1000 CC02e/v) Carbon sink potential - Mid - Aul (not counting overlap) (1000 CC02e/v) Carbon sink potential - Mid - Aul (not counting overlap) (1000 CC02e/v) Carbon sink potential - Mid - Aul (not counting overlap) (1000 CC02e/v) Carbon sink potential - Mid - Reforest productivity (1000 CC02e/v) Carbon sink potential - Mid - Refore			+		+			-3 130
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rotation length (1000 tC02e/v)								2 /.2/.
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plantations (1000 t002e/v)	,,							010
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - High - Reforest -1,166 -1								-219
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Carbon sink potential - High - Increase trees outside forests (1000 tC02e/v) Carbon sink potential - High - Reforest cropland (1000 tC02e/v)								-4,749
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Carbon sink potential - High - Reforest -4,605	· · · · · · · · · · · · · · · · · · ·							
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 - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Reforest crease sutside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Reforest resounting overlapp (1000 tC02e/y) Carbon sink potential - Mid - Reforest resounting overlapp (1000 tC02e/y) Carbon sink potential - Mid - Reforest resounting overlapp (1000 tC02e	•							-1,166
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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) -1,319 rotation length (1000 tCO2e/y) -1,319 rotation length (1000 tCO2e/y) -1,319 rotation length (1000 tCO2e/y) -1,3583 retention (1000 tCO2e/y) -1,3583 retention of HWP (1000 tCO2e/y) -1,349 retention of HWP (1000 tCO2e/y) -1,349 retention of HWP (1000 tCO2e/y) -1,349 retention of HWP (1000 tCO2e/y) -1,3699 retention of HWP (1000 tCO2e/y) -1,3699 retention of HWP (1000 tCO2e/y) -1,3699 retention of HWP (1000 tCO2e/y) -1,826 retention of HWP (1000 tCO2e/y) -1,826 retention of HWP (1000 tCO2e/y) -1,296 retention of H	regeneration (1000 tCO2e/y)							
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Carbon sink potential - Low - Improve plantations (1000 tC02e/y) -1,583	•							1,017
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Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid -								-672
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)								
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tc02e/y) Carbon sink potential - Mid - Reforest								-583
Dasture (1000 tC02e/y) Carbon sink potential - Low - Restore Productivity (1000 tC02e/y) Production Productio								
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productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Imcrease retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y)								
Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y)	Carbon sink potential - Low - Restore							-698
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest ropland (1000 tCO2e/y) Carbon sink potential - Mid - Restore ropland (1000 tCO2e/y)	productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend - 2,377 rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase resolution of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore - 1,384	Carbon sink potential - Mid - Accelerate							-135
counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore -1,384	regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -2,477 pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore	Carbon sink potential - Mid - All (not							-13,699
Carbon sink potential - Mid - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (1000 tC02e/y) Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -2,477 pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore	counting overlap) (1000 tCO2e/y)							
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Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore -2,477 pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore	•							,
rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore -1,384								-2 377
Carbon sink potential - Mid - Improve plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384	•							2,011
plantations (1000 tC02e/y) Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -2,477								-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -2,477 Carbon sink potential - Mid - Restore								-100
retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore -1,384								2166
Carbon sink potential - Mid - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384								-3,100
trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384								1.007
Carbon sink potential - Mid - Reforest -874 cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest -2,477 pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384								-1,296
cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest -2,477 pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384								
Carbon sink potential - Mid - Reforest -2,477 pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384	•							-874
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -1,384								
Carbon sink potential - Mid - Restore								-2,477
productivity (1000 tCO2e/y)	Carbon sink potential - Mid - Restore							-1,384
p((((((((((((productivity (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Accelerate regeneration (1000							29.5
hectares)							424
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							424
(1000 hectares) Land impacted for carbon sink potential -							1,751
High - Extend rotation length (1000 hectares)							1,131
Land impacted for carbon sink potential -							80.7
High - Improve plantations (1000 hectares)							3 0
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							182
High - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							77.1
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential -							686
High - Restore productivity (1000							
hectares) Land impacted for carbon sink potential -							3,362
High - Total impacted (over 30 years)							3,362
(1000 hectares)							
Land impacted for carbon sink potential -							14.7
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							398
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							671
Low - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							40.4
Low - Improve plantations (1000							40.4
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							38.5
Low - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							22.1
Land impacted for carbon sink potential -						+	415
Low - Restore productivity (1000							410
hectares)							
Land impacted for carbon sink potential -							1,696
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							22.1
Mid - Accelerate regeneration (1000							
hectares)							

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

2020	2025	2030	2035	2040	2045	2050
						411
						1,211
						60.8
						0
						139
						57.8
						164
						836
						2,902
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	2020 2025 2030 2035 2040 2045

Table 58: E-B+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		2,185	5.74	5.72	5.49	4.18	0.407
Coal (million 2019\$)							
Monetary damages from air pollution -		339	196	109	70.8	36.1	11.7
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,048	4,080	3,966	3,572	2,847	1,959
Transportation (million 2019\$)							
Premature deaths from air pollution -		247	0.648	0.646	0.62	0.473	0.046
Coal (deaths)							
Premature deaths from air pollution -		38.3	22.1	12.3	7.99	4.07	1.32
Natural Gas (deaths)							
Premature deaths from air pollution -		455	459	446	402	320	220
Transportation (deaths)							

Table 59: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		36,280	37,607				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	44.2	44.3	44.3	44.3	44.4	44.5
Resistance (%)							
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Sales of space heating units - Electric	1.41	12.6	44.7	71.1	75.4	75.9	75.9
Heat Pump (%)							
Sales of space heating units - Electric	4.39	4.3	8.91	17.1	22.8	23.6	23.7
Resistance (%)							
Sales of space heating units - Fossil (%)	5.44	2.76	1.39	0.243	0.027	0.001	0
Sales of space heating units - Gas Furnace	88.8	80.4	45	11.5	1.77	0.436	0.356
(%)							
Sales of water heating units - Electric	0.454	0.344	0.348	0.348	0.342	0.344	0.345
Heat Pump (%)							
Sales of water heating units - Electric	4.26	3.24	3.2	3.21	3.19	3.18	3.18
Resistance (%)							

Table 59: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	95	96.2	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

Table 60: REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	372	372	369	360	351	351	360
Final energy use - Industry (PJ)	602	634	654	668	689	709	731
Final energy use - Residential (PJ)	555	517	496	481	472	466	461
Final energy use - Transportation (PJ)	953	894	818	774	775	799	830

Table 62: REF scenario - PILLAR 1: Efficiency/Electrification - Residential

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

Table 63: REF scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC	0.119	0.138	0.16	0.186	0.216	0.25	0.29
(%)							
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.4	1.84	2.16	2.01	1.81	1.68	1.6
Vehicle sales - Light-duty - EV (%)	4.06	6.25	7.06	8.72	10.6	12.1	13.3
Vehicle sales - Light-duty - gasoline (%)	89.4	85.7	83.3	81.3	79.2	77.2	75.7
Vehicle sales - Light-duty - hybrid (%)	4.93	5.76	7	7.56	8.09	8.59	8.95
Vehicle sales - Light-duty - hydrogen FC	0.11	0.371	0.337	0.297	0.293	0.293	0.303
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.099	0.095	0.096	0.095	0.094	0.096
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7

Table 63: REF scenario - PILLAR 1: Efficiency/Electrification - Transportation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
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 64: REF scenario - PILLAR 6: Land sinks - Forests

lable 64: REF Scenario - PILLAR 6: Land Si			0000	0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-180
regeneration (1000 tC02e/y)							04 / 7/
Carbon sink potential - High - All (not							-21,474
counting overlap) (1000 tC02e/y)							0.100
Carbon sink potential - High - Avoid							-3,130
deforestation (1000 tC02e/y)							0.101
Carbon sink potential - High - Extend							-3,434
rotation length (1000 tCO2e/y)							040
Carbon sink potential - High - Improve							-219
plantations (1000 tC02e/y)							
Carbon sink potential - High - Increase							-4,749
retention of HWP (1000 tC02e/y)							1000
Carbon sink potential - High - Increase							-1,920
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-1,166
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,605
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-2,070
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-90.3
regeneration (1000 tC02e/y)							
Carbon sink potential - Low - All (not							-5,927
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-522
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,319
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							-112
plantations (1000 tC02e/y)							
Carbon sink potential - Low - Increase							-1,583
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-672
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-583
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-349
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-698
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-135
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-13,699
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,826
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-2,377
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-163
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase						T	-3,166
retention of HWP (1000 tCO2e/y)							

Table 64: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest							-874
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y)							-2,477
Carbon sink potential - Mid - Restore							-1,384
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							29.5
High - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -							424
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,751
High - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							80.7
High - Improve plantations (1000							00.1
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							182
High - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							77.1
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							131
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							686
High - Restore productivity (1000 hectares)							
Land impacted for carbon sink potential -							3,362
High - Total impacted (over 30 years)							0,002
(1000 hectares)							
Land impacted for carbon sink potential -							14.7
Low - Accelerate regeneration (1000							
hectares)							200
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years)							398
(1000 hectares)							
Land impacted for carbon sink potential -							671
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							40.4
Low - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							Ü
hectares)							
Land impacted for carbon sink potential -							96
Low - Increase trees outside forests							
(1000 hectares)							20.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential -							22.7
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							415
Low - Restore productivity (1000							
hectares)							

Table 64: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902

Table 65: REF scenario - PILLAR 6: Land sinks - Forests - REF only

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	0.94		-7.03				-6.29
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.29		-2.32				-2.42
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.352		-9.35				-8.7

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		5,580	3,705	3,251	3,017	2,925	2,742
Coal (million 2019\$)							
Monetary damages from air pollution -		287	334	430	450	426	367
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,043	4,133	4,226	4,344	4,463	4,584
Transportation (million 2019\$)							
Premature deaths from air pollution -		630	419	367	341	330	310
Coal (deaths)							
Premature deaths from air pollution -		32.4	37.8	48.5	50.8	48	41.5
Natural Gas (deaths)							
Premature deaths from air pollution -		455	465	475	489	502	516
Transportation (deaths)							