

Net-Zero America - colorado state report

2021-03-18

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 -		14,374	15,990				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	54.6	83	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	2.64	8.18	30.6	79.8	90	90.8	90.8
Heat Pump (%)							
Sales of space heating units - Electric	2.48	3.49	4.92	8.08	8.66	8.7	8.7
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace	94.9	88.1	64.4	12.2	1.37	0.522	0.498
(%)							
Sales of water heating units - Electric	0.022	1.12	14.3	42.9	48.9	49.4	49.4
Heat Pump (%)							
Sales of water heating units - Electric	1.1	2.5	15.4	43.8	49.7	50.2	50.2
Resistance (%)							
Sales of water heating units - Gas Furnace	98.6	96	69.9	12.9	0.972	0.027	0
(%)							
Sales of water heating units - Other (%)	0.269	0.383	0.382	0.383	0.382	0.383	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.81	2.93	5.73	6.16	6.1	6.47
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)	162	162	159	152	144	138	135
Final energy use - Industry (PJ)	171	180	187	200	221	233	246
Final energy use - Residential (PJ)	237	229	221	199	170	148	133
Final energy use - Transportation (PJ)	472	443	394	334	279	243	226

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.42	4.7				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.5	61	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.5	39	6.67	0.336	0	0	0
Sales of space heating units - Electric	5.62	14.5	37.2	82.6	92	92.7	92.7
Heat Pump (%)							
Sales of space heating units - Electric	7.65	13.8	11	4.91	3.67	3.58	3.63
Resistance (%)							
Sales of space heating units - Fossil (%)	3.24	5.67	4.53	2.12	1.56	1.5	1.52
Sales of space heating units - Gas (%)	83.5	66	47.3	10.4	2.8	2.21	2.19
Sales of water heating units - Electric	0	0.93	12.1	36.4	41.4	41.7	41.8
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.9	34.2	52.7	56.7	57	57
Resistance (%)							
Sales of water heating units - Gas Furnace	85.7	72	52.4	9.64	0.728	0.02	0
(%)							
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.21	1.21	1.21

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,014	2,644	4,211	6,408	6,943	6,637
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.303		1.77		7.25		11.6
units)							
Public EV charging plugs - L2 (1000 units)	2.12		42.5		174		280
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 (%)	1.78	2.01	1.35	0.434	0.078	0.013	0
Vehicle sales - Light-duty - EV (%)	3.16	12.9	42.9	80.4	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.6	52.5	18	3.48	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.68	4.01	2.95	1.12	0.269	0.057	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.353	0.221	0.07	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.112	0.108	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	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	0.01	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0.041	0.399
Capital invested - Solar PV - Base (billion \$2018)		0.669	0.644	2.54	2.97	3.43	2.48
Capital invested - Solar PV - Constrained (billion \$2018)		1.95	1.04	2.19	2.61	2.02	0.721
Capital invested - Wind - Base (billion \$2018)		0.226	1.91	0.621	2.45	2.98	1.38
Capital invested - Wind - Constrained (billion \$2018)		1.32	2.22	2.91	6.72	6.61	3.73
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)	895	1,362	1,825	2,410	3,134	4,018	5,120
Installed renewables - Solar - Base land use assumptions (MW)	497	1,082	1,712	4,412	7,753	11,848	14,987
Installed renewables - Solar - Constrained land use assumptions (MW)	370	370	1,596	4,881	9,550	11,170	14,208
Installed renewables - Wind - Base land use assumptions (MW)	4,732	4,886	6,317	6,818	8,895	11,556	12,854
Installed renewables - Wind - Constrained land use assumptions (MW)	4,732	4,905	5,667	7,069	12,061	17,295	20,840

Table 7: E	aaanaania	יר מאווזח	Cloan Electrici	tv - Generation
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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	9.89	9.89
Biomass w/ccu power plant (GWh)	0	0	0	0	0	46.2	494
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)	1,142	2,233	3,442	8,566	14,947	22,796	28,849
Solar - Constrained land use assumptions	856	856	3,149	9,300	18,183	21,314	27,135
(GWh)							
Wind - Base land use assumptions (GWh)	16,760	17,332	22,431	24,110	31,262	40,168	44,490
Wind - Constrained land use assumptions	16,760	17,346	19,845	24,217	39,633	55,075	65,061
(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	23.6	190	345
Conversion capital investment -		0	0	0	330	2,342	2,221
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	1	3	5
(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	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	2	3
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.02	3.38	3.77	6.87	9.81
Annual - BECCS (MMT)		0	0	0	0.42	3.41	6.22
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0.02	0.02	0.03	0.03	0.05
Cumulative - All (MMT)		0	0.02	3.4	7.17	14	23.9
Cumulative - BECCS (MMT)		0	0	0	0.42	3.83	10.1
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6
Cumulative - NGCC (MMT)		0	0.02	0.04	0.07	0.1	0.15

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	256	556	861	1,099	2,219
Cumulative investment - All (million \$2018)		0	1,225	1,484	1,687	1,902	2,649
Cumulative investment - Spur (million \$2018)		0	0.3	259	463	677	1,424
Cumulative investment - Trunk (million \$2018)		0	1,225	1,225	1,225	1,225	1,225
Spur (km)		0	0.5	301	605	843	1,963
Trunk (km)		0	255	255	255	255	255

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	0.88	0.9	1.72	2.8
Injection wells (wells)		0	0	2	3	5	6
Resource characterization, appraisal, permitting costs (million \$2020)		36	86.3	101	101	101	101
Wells and facilities construction costs (million \$2020)		0	12	46.7	83.2	139	173

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-173
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,661
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,048
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-173
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,384
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,664
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							172
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,977
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							329
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,478
Aggressive deployment - Total (1000							, -
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,071
deployment - Cropland measures (1000							_,
hectares)							
Land impacted for carbon sink - Moderate							164
deployment - Permanent conservation							104
cover (1000 hectares)							
Land impacted for carbon sink - Moderate		+		+			2,407
deployment - Total (1000 hectares)							۷,401
deployment - Total (1000 nectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,620
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-48,148
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,559
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-9,233
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-26.8
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-174
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,273
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-24,902
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,239
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-6,121
productivity (1000 tCO2e/y)							•
Carbon sink potential - Low - Accelerate							-812
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-19,895
counting overlap) (1000 tC02e/y)							17,070
Carbon sink potential - Low - Avoid							-260
deforestation (1000 tC02e/y)							200
Carbon sink potential - Low - Extend							-3,547
rotation length (1000 tCO2e/y)							0,041
Carbon sink potential - Low - Improve							-13.7
plantations (1000 tCO2e/y)							-10.1
Carbon sink potential - Low - Increase							-58.1
retention of HWP (1000 tCO2e/y)							-36.1
Carbon sink potential - Low - Increase							-446
							-440
trees outside forests (1000 tC02e/y)							10 / E1
Carbon sink potential - Low - Reforest							-12,451
cropland (1000 tC02e/y)							0/ 5
Carbon sink potential - Low - Reforest							-245
pasture (1000 tC02e/y)							0.070
Carbon sink potential - Low - Restore							-2,063
productivity (1000 tC02e/y)							1.01/
Carbon sink potential - Mid - Accelerate							-1,216
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-34,021
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-909
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-6,390
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-20
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-116
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-859
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-18,676
cropland (1000 tCO2e/y)							•
Carbon sink potential - Mid - Reforest							-1,742
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-4,092

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							265
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							211
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,708
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							9.89
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 -							121
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							1,646
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							92
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,029
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							9,083
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							133
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							198
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,804
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							4.95
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 -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,228
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,270
Low - Total impacted (over 30 years)							,=:0
(1000 hectares)							
Land impacted for carbon sink potential -							199
			1				1,,,
Mid - Accelerate regeneration (1000							

Tahla 13. Fx	econario -	DTIIAP 6.	Land sinks -	Forests	(continued)
Table 15. E+	scenuro -	PILLAR O.	Luiiu Siiiks -	Furests	lconunueur

205
3,256
7.44
0
92.3
1,235
115
2,472
7,582

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		377	318	255	192	121	83.7
Natural gas consumption - Cumulative (tcf)							7,678
Natural gas production - Annual (tcf)		2,061	1,948	1,697	1,435	1,138	884
Oil consumption - Annual (million bbls)		87.6	75.4	57.8	41.6	28.7	18.8
Oil consumption - Cumulative (million bbls)							1,793
Oil production - Annual (million bbls)		230	231	231	183	149	98.9

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		220	0.263	0.262	0.198	0.123	0.001
Monetary damages from air pollution - Natural Gas (million 2019\$)		278	225	189	184	111	26.5
Monetary damages from air pollution - Transportation (million 2019\$)		914	899	717	433	203	77.7
Premature deaths from air pollution - Coal (deaths)		24.8	0.03	0.03	0.022	0.014	0
Premature deaths from air pollution - Natural Gas (deaths)		31.4	25.4	21.3	20.8	12.6	2.99
Premature deaths from air pollution - Transportation (deaths)		103	101	80.7	48.7	22.8	8.74

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		227	238	217	150	226	312
By economic sector - Construction (jobs)		11,496	11,816	13,596	15,058	16,387	17,444
By economic sector - Manufacturing		12,947	16,996	19,901	17,693	15,315	15,730
(jobs)							
By economic sector - Mining (jobs)		14,440	11,148	8,609	5,627	3,632	2,001

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

ntinueaj						
2020	2025	2030	2035	2040	2045	2050
						3,325
						478
						9,641
						6,735
						13,159
	18,679	19,184	20,847	21,005	21,249	21,888
	14,729	14,484	14,975	14,290	13,975	13,963
	491	464	471	461	469	482
	25,997	26,575	28,796	28,463	28,478	29,132
	3,461	3,342	3,437	3,335	3,333	3,359
	553	552	488	376	833	1,367
	18.7	861	190	326	524	982
	1,735	395	82.3	68.3	59.3	51.9
	8,248	9,262	14,112	18,554	22,996	22,700
	14,315	12,133	9,627	8,311	5,968	4,045
	0	0.003	0.007		0.018	0.03
	25,199	22,582	20,059		10,815	6,718
						23,905
			-			9,055
						68,703
		5.,5= .	0.,		00,000	
	9.981	10.136	10.912	10.911	10.988	11,200
	7, 5	,	,		,	,
	3.880	3.854	4.119	4.254	4.400	4,481
	-,	,,,,,	.,	.,	.,	.,
	10.232	10,367	11,085	10.907	10,893	11,212
	,	,	.,,,,,,	,.	,	,
	473	492	542	560	576	592
			0.2		0.0	07-
	38,792	39.199	41.868	40.922	40.646	41,339
	00,. 72	07,177	,000	.0,,	.5,5 .5	,007
	12 708	12 898	13 881	13 945	14 086	14,368
	12,100	12,070	10,001	10,7 10	1 1,000	,000
	3 575	3 568	3 862	4 069	4 269	4,394
	0,010	0,000	0,002	1,007	1,207	1,071
	3 559	3 531	3 730	3 632	3 615	3,720
	0,007	0,001	0,100	0,002	0,010	0,120
	630	657	709	686	668	688
	000	001	107	000	000	000
	42 884	43 394	46 344	45 221	44.865	45,654
	42,004	43,374	40,544	43,221	44,000	45,054
	23 367	23 442	24 915	24.462	24 385	24,708
	20,001	25,442	24,713	24,402	24,303	24,100
	1/, 910	1/, 020	15 977	15 603	15 600	15,915
	14,010	14,920	13,011	13,073	13,000	13,713
	0 0/./.	8 082	0 663	0 621	0 6 8 0	9,925
	0,044	0,702	7,003	7,021	7,007	7,723
	/, 1/.0	/. 010	1. 1.77	J. 91.1.	1. 0/7	4,305
	4,142	4,210	4,411	4,344	4,201	4,303
	10.107	10 /.0/	10 EOE	10 /.0/	10 /.7/	13,971
	12,194	12,474	13,575	13,434	13,474	13,771
	/. OO/.	/, 001	1. 404	/. E00	7. 400	4,729
	4,274	4,331	4,024	4,372	4,030	4,127
		2020 2025 908 1,289 6,910 7,383 7,757 18,679 14,729 491 25,997 3,461 553 18.7 1,735 8,248 14,315	2020 2025 2030 908 996 1,289 1,273 6,910 6,768 7,383 6,697 7,757 8,117 18,679 19,184 14,729 14,484 491 464 25,997 26,575 3,461 3,342 553 552 18,7 861 1,735 395 8,248 9,262 14,315 12,133 0 0.003 25,199 22,582 7,221 8,199 6,068 10,065 67,769 67,624 9,981 10,136 3,880 3,854 10,232 10,367 473 492 38,792 39,199 12,708 12,898 3,559 3,531 630 657 42,884 43,394 23,367 23,442	2020 2025 2030 2035 908 996 1,497 1,289 1,273 1,048 6,910 6,768 7,408 7,383 6,697 6,720 7,757 8,117 9,529 18,679 19,184 20,847 14,729 14,484 14,975 491 464 471 25,997 26,575 28,796 3,461 3,342 3,437 553 552 488 18,7 861 190 1,735 395 82,3 8,248 9,262 14,112 14,315 12,133 9,627 0 0.003 0.007 25,199 22,582 20,059 7,221 8,199 13,796 6,068 10,065 10,172 67,769 67,624 67,470 9,981 10,136 10,912 3,879 39,199 41,868	2020 2025 2030 2035 2040 908 996 1,497 1,953 1,289 1,273 1,048 827 6,910 6,768 7,408 8,021 7,383 6,697 6,720 6,405 7,757 8,117 9,529 11,820 18,679 19,184 20,847 21,005 491 464 471 461 25,997 26,575 28,796 28,463 3,461 3,342 3,437 3,335 553 552 488 376 18,7 861 190 326 18,7 861 190 326 1,735 395 82,3 68,3 8,248 9,262 14,112 18,554 14,315 12,133 9,627 8,311 0 0,003 0,007 0,008 25,199 22,582 20,059 14,539 7,221 8,199	2020 2025 2030 2035 2040 2045 908 996 1,497 1,953 2,417 1,289 1,273 1,048 827 631 6,910 6,768 7,408 8,021 8,895 7,383 6,697 6,720 6,405 6,459 7,757 8,117 9,529 11,820 13,543 18,679 19,184 20,847 21,005 21,249 14,729 14,484 14,975 14,290 13,975 491 464 471 461 469 25,997 26,575 28,796 28,463 28,478 3,461 3,342 3,437 3,335 3,333 18.7 861 190 326 524 1,735 395 82.3 68.3 59.3 8,248 9,262 14,112 18,554 22,996 14,315 12,133 9,627 8,311 59,68 0

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		14,373	15,986				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric	2.64	7.26	9.83	18.3	38.7	64.6	80
Heat Pump (%)							
Sales of space heating units - Electric	2.48	3.43	3.58	4.11	5.42	7.07	8.03
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.241	0.225	0.171	0.089	0.035	0.016
Sales of space heating units - Gas Furnace	94.9	89.1	86.4	77.4	55.8	28.3	12
(%)							
Sales of water heating units - Electric	0.022	0.571	2.07	7.05	19	34.1	43.1
Heat Pump (%)							
Sales of water heating units - Electric	1.1	2	3.47	8.35	20.1	35.1	44
Resistance (%)							
Sales of water heating units - Gas Furnace	98.6	97	94.1	84.2	60.5	30.4	12.5
(%)							
Sales of water heating units - Other (%)	0.269	0.383	0.382	0.383	0.382	0.383	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.32	2.38	3.28	3.43	5.13	5.47
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)	162	162	161	160	158	155	151
Final energy use - Industry (PJ)	171	181	188	203	226	238	250
Final energy use - Residential (PJ)	237	229	225	220	212	196	175
Final energy use - Transportation (PJ)	472	446	410	379	355	326	292

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.41	4.7				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.3	51.6	56.1	68.1	84.8	95.1	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	49.7	48.4	43.9	31.9	15.2	4.9	1.32
Sales of space heating units - Electric	5.62	13.3	15.8	24.3	44	68.4	82.7
Heat Pump (%)							
Sales of space heating units - Electric	7.65	13.9	13.5	12.5	10.1	6.84	4.95
Resistance (%)							
Sales of space heating units - Fossil (%)	3.24	5.74	5.68	5.1	3.9	2.66	2.01
Sales of space heating units - Gas (%)	83.5	67.1	65	58.1	42	22.1	10.3
Sales of water heating units - Electric	0	0.46	1.74	5.96	16.1	28.9	36.5
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.6	26.5	29.7	37.4	47.1	52.9
Resistance (%)							
Sales of water heating units - Gas Furnace	85.7	72.7	70.5	63.1	45.3	22.7	9.32
(%)							
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.22	1.22	1.21

 ${\bf Table~21:}~{\it E-scenario-PILLAR~1:}~{\it Efficiency/Electrification-Transportation}$

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)		0	172	344	1,178	3,652	5,339
Public EV charging plugs - DC Fast (1000 units)	0.303		0.614		2.74		7.45
Public EV charging plugs - L2 (1000 units)	2.12		14.8		65.9		179
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 (%)	1.79	2.16	2.1	1.68	1.1	0.567	0.242
Vehicle sales - Light-duty - EV (%)	1.62	4.1	10.6	23.9	46.2	70.6	87
Vehicle sales - Light-duty - gasoline (%)	92.6	88.6	81.5	69.1	48.7	26.4	11.6
Vehicle sales - Light-duty - hybrid (%)	3.8	4.66	5.29	4.92	3.8	2.31	1.14
Vehicle sales - Light-duty - hydrogen FC (%)	0.113	0.387	0.339	0.264	0.191	0.107	0.05
Vehicle sales - Light-duty - other (%)	0.113	0.116	0.107	0.094	0.069	0.038	0.017
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-173
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,661
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,048
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-173
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,384
deployment - Cropland measures (1000							
tC02e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-1,664
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							172
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,977
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							329
Aggressive deployment - Permanent							
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 -							4,478
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,071
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							164
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,407
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							-1,620
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-48,148
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,559
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-9,233
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-26.8
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-174
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,273
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-24,902
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,239
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,121
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-812
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-19,895
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-260
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,547
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-13.7
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-58.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-446
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-12,451
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-245
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-2,063
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,216
regeneration (1000 tCO2e/y)							

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

2020	2023	2000	2033	2040	2045	2050
						-34,021
						-909
						-6,390
						-20
						-116
						-859
						-18,676
						-1,742
						-4,092
						265
						211
						4,708
						1,100
						9.89
						7.07
						0
						U
						121
						121
						4 () (
						1,646
						92
						2,029
						9,083
						133
						198
						1,804
						,
						4.95
						7.70
					+	0
						U

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,228
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,270
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							199
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							205
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,256
Mid - Extend rotation length (1000							·
hectares)							
Land impacted for carbon sink potential -							7.44
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 -							92.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							1,235
Mid - Reforest cropland (1000 hectares)							,
Land impacted for carbon sink potential -							115
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,472
Mid - Restore productivity (1000							. –
hectares)							
Land impacted for carbon sink potential -							7,582
Mid - Total impacted (over 30 years) (1000							•
hectares)							

Table 24: E- scenario - IMPACTS - Health

2020	2025	2030	2035	2040	2045	2050
	220	0.263	0.262	0.198	0.123	0.001
	275	198	169	121	58.3	16.9
	929	987	1,006	945	783	556
	24.8	0.03	0.03	0.022	0.014	0
	31.1	22.4	19.1	13.7	6.58	1.91
	104	111	113	106	88	62.5
	2020	220 275 929 24.8 31.1	220 0.263 275 198 929 987 24.8 0.03 31.1 22.4	220 0.263 0.262 275 198 169 929 987 1,006 24.8 0.03 0.03 31.1 22.4 19.1	220 0.263 0.262 0.198 275 198 169 121 929 987 1,006 945 24.8 0.03 0.03 0.022 31.1 22.4 19.1 13.7	220 0.263 0.262 0.198 0.123 275 198 169 121 58.3 929 987 1,006 945 783 24.8 0.03 0.03 0.022 0.014 31.1 22.4 19.1 13.7 6.58

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

2050
88.9
88.9
88.9
11.1
90.8
8.7
0
0.498
49.4
50.2
0
0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.81	2.93	5.73	6.16	6.1	6.47
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)	162	162	159	152	144	138	135
Final energy use - Industry (PJ)	171	180	187	200	221	233	246
Final energy use - Residential (PJ)	237	229	221	199	170	148	133
Final energy use - Transportation (PJ)	472	443	394	334	279	243	226

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.42	4.7				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.5	61	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.5	39	6.67	0.336	0	0	0
Sales of space heating units - Electric	5.62	14.5	37.2	82.6	92	92.7	92.7
Heat Pump (%)							
Sales of space heating units - Electric	7.65	13.8	11	4.91	3.67	3.58	3.63
Resistance (%)							
Sales of space heating units - Fossil (%)	3.24	5.67	4.53	2.12	1.56	1.5	1.52
Sales of space heating units - Gas (%)	83.5	66	47.3	10.4	2.8	2.21	2.19
Sales of water heating units - Electric	0	0.93	12.1	36.4	41.4	41.7	41.8
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.9	34.2	52.7	56.7	57	57
Resistance (%)							
Sales of water heating units - Gas Furnace	85.7	72	52.4	9.64	0.728	0.02	0
(%)							
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.21	1.21	1.21

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,014	2,644	4,211	6,408	6,943	6,637
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.303		1.77		7.25		11.6
units)							
Public EV charging plugs - L2 (1000 units)	2.12		42.5		174		280
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 (%)	1.78	2.01	1.35	0.434	0.078	0.013	0
Vehicle sales - Light-duty - EV (%)	3.16	12.9	42.9	80.4	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.6	52.5	18	3.48	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.68	4.01	2.95	1.12	0.269	0.057	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.353	0.221	0.07	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.112	0.108	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	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		0	2.45	2.57	4.26	7.7	35.7
\$2018)							
Capital invested - Wind - Base (billion		0.715	1.61	2.18	6.64	8.39	38.4
\$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	497	497	2,893	5,627	10,431	19,622	64,712
use assumptions (MW)							
Installed renewables - Solar -	994	2,862	9,859	12,469	20,479	34,452	129,919
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	4,732	5,218	6,428	8,188	13,808	21,290	57,595
use assumptions (MW)							
Installed renewables - Wind - Constrained	9,464	9,877	11,686	20,805	45,152	80,486	209,464
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)	1,142	1,142	5,652	10,876	19,953	37,504	123,424
Solar - Constrained land use assumptions	2,284	5,770	18,873	23,815	39,015	66,004	246,102
(GWh)							
Wind - Base land use assumptions (GWh)	16,760	18,526	22,799	28,841	47,644	72,002	183,350
Wind - Constrained land use assumptions	33,520	34,931	40,883	68,991	140,044	236,672	541,171
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-173
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-2,661
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-3,048
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-173
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,384
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,664
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							172
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,977
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							329
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,478
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,071
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							164
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate			+	+			2,407
deployment - Total (1000 hectares)							_,

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,620
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-48,148
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,559
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-9,233
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-26.8
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-174
retention of HWP (1000 tCO2e/y)							

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

Item Contantial High Increase	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-1,273
trees outside forests (1000 tC02e/y)							0/ 000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-24,902
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,239
Carbon sink potential - High - Restore							-6,12
productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate							-812
regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not							-19,895
counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid							-260
deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend							-3,54
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-58.
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-446
Carbon sink potential - Low - Reforest							-12,45
cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest							-24
pasture (1000 tCO2e/y) Carbon sink potential - Low - Restore							-2,06
productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate							-1,21
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not							-34,02
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-90
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,39
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-2
Carbon sink potential - Mid - Increase							-11
retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Increase							-85
trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest							-18,67
cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest							-1,74
pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore							-4,09
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 nectares)							26
and impacted for carbon sink potential -							2
High - Avoid deforestation (over 30 years)							_
(1000 hectares) Land impacted for carbon sink potential - High - Extend rotation length (1000							4,70
hectares) Land impacted for carbon sink potential -							9.8
High - Improve plantations (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							121
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							1,646
High - Reforest cropland (1000 hectares)							00
Land impacted for carbon sink potential -							92
High - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							2,029
High - Restore productivity (1000							2,029
hectares)							
Land impacted for carbon sink potential -						+	9,083
High - Total impacted (over 30 years)							7,000
(1000 hectares)							
Land impacted for carbon sink potential -							133
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							198
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,804
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							4.95
Low - Improve plantations (1000							
hectares) Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.9
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,228
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							4,270
Low - Total impacted (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							199
Mid - Accelerate regeneration (1000							199
hectares)							
Land impacted for carbon sink potential -							205
Mid - Avoid deforestation (over 30 years)							200
(1000 hectares)							
Land impacted for carbon sink potential -							3,256
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.44
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							00.0
Land impacted for carbon sink potential -							92.3
Mid - Increase trees outside forests (1000 hectares)							
Herial 691							

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Table 33: F+RF+ scenario -	PILLAR 6. Land sinks -	- Forests icontinuedi

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1,235
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							115
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,472
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,582
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 -		220	0.263	0.262	0.198	0.123	0.001
Coal (million 2019\$)							
Monetary damages from air pollution -		251	170	108	96.9	46.8	13.5
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		914	899	717	433	203	77.7
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.8	0.03	0.03	0.022	0.014	0
Coal (deaths)							
Premature deaths from air pollution -		28.4	19.2	12.2	10.9	5.28	1.53
Natural Gas (deaths)							
Premature deaths from air pollution -		103	101	80.7	48.7	22.8	8.74
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)		14,374	15,990				
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	2.64	8.18	30.6	79.8	90	90.8	90.8
Sales of space heating units - Electric Resistance (%)	2.48	3.49	4.92	8.08	8.66	8.7	8.7
Sales of space heating units - Fossil (%)	0	0.208	0.04	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	94.9	88.1	64.4	12.2	1.37	0.522	0.498
Sales of water heating units - Electric Heat Pump (%)	0.022	1.12	14.3	42.9	48.9	49.4	49.4
Sales of water heating units - Electric Resistance (%)	1.1	2.5	15.4	43.8	49.7	50.2	50.2
Sales of water heating units - Gas Furnace (%)	98.6	96	69.9	12.9	0.972	0.027	0
Sales of water heating units - Other (%)	0.269	0.383	0.382	0.383	0.382	0.383	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.81	2.93	5.73	6.16	6.1	6.47
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)	162	162	159	152	144	138	135

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	171	180	187	200	221	233	246
Final energy use - Residential (PJ)	237	229	221	199	170	148	133
Final energy use - Transportation (PJ)	472	443	394	334	279	243	226

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.42	4.7				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.5	61	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.5	39	6.67	0.336	0	0	0
Sales of space heating units - Electric	5.62	14.5	37.2	82.6	92	92.7	92.7
Heat Pump (%)							
Sales of space heating units - Electric	7.65	13.8	11	4.91	3.67	3.58	3.63
Resistance (%)							
Sales of space heating units - Fossil (%)	3.24	5.67	4.53	2.12	1.56	1.5	1.52
Sales of space heating units - Gas (%)	83.5	66	47.3	10.4	2.8	2.21	2.19
Sales of water heating units - Electric	0	0.93	12.1	36.4	41.4	41.7	41.8
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.9	34.2	52.7	56.7	57	57
Resistance (%)							
Sales of water heating units - Gas Furnace	85.7	72	52.4	9.64	0.728	0.02	0
(%)							
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.21	1.21	1.21

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,014	2,644	4,211	6,408	6,943	6,637
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.303		1.77		7.25		11.6
units)							
Public EV charging plugs - L2 (1000 units)	2.12		42.5		174		280
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 (%)	1.78	2.01	1.35	0.434	0.078	0.013	0
Vehicle sales - Light-duty - EV (%)	3.16	12.9	42.9	80.4	96.2	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.2	80.6	52.5	18	3.48	0.596	0
Vehicle sales - Light-duty - hybrid (%)	3.68	4.01	2.95	1.12	0.269	0.057	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.353	0.221	0.07	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.112	0.108	0.073	0.026	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	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)		1.75	1.27	0.371	2.34	0.528	2.49
Capital invested - Solar PV - Constrained (billion \$2018)		1.93	1.68	1.09	2.24	1.88	2.36
Capital invested - Wind - Base (billion \$2018)		0.169	1.35	0.606	1.04	1.29	0.427
Capital invested - Wind - Constrained (billion \$2018)		0.254	0.437	0.539	2.97	2.95	1.03
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)	1,611	3,141	4,378	4,772	7,405	8,035	11,185
Installed renewables - Solar - Constrained land use assumptions (MW)	925	2,612	4,255	5,413	7,933	10,172	13,153
Installed renewables - Wind - Base land use assumptions (MW)	4,732	4,847	5,862	6,351	7,231	8,386	8,789
Installed renewables - Wind - Constrained land use assumptions (MW)	4,732	4,905	5,233	5,667	8,180	10,809	11,780

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)	3,250	6,134	8,488	9,238	14,326	15,554	21,505
Solar - Constrained land use assumptions	1,939	5,073	8,204	10,399	15,190	19,483	25,119
(GWh)							
Wind - Base land use assumptions (GWh)	16,760	17,191	20,850	22,536	25,565	29,515	30,892
Wind - Constrained land use assumptions	16,760	17,346	18,438	19,845	27,647	35,817	38,773
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-173
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,661
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-214
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-3,048
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-173
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,384
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-107
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,664
deployment - Total (1000 tCO2e/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 -							172
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,977
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							329
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,478
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,071
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							164
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,407
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							-1,620
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-48,148
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-1,559
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-9,233
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-26.8
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-174
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,273
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-24,902
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,239
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,121
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-812
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-19,895
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-260
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-3,547
rotation length (1000 tCO2e/y)							•
Carbon sink potential - Low - Improve							-13.7
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-58.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase		+					-446
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							-12,45
cropland (1000 tCO2e/y)							0.1
Carbon sink potential - Low - Reforest							-24
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-2,06
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,21
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-34,02
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-90
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-6,39
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-2
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-11
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-85
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-18,67
cropland (1000 tCO2e/y)							,
Carbon sink potential - Mid - Reforest							-1,74
pasture (1000 tCO2e/y)							.,.
Carbon sink potential - Mid - Restore							-4,09
productivity (1000 tC02e/y)							.,0,
Land impacted for carbon sink potential -							26
High - Accelerate regeneration (1000							20
hectares)							
Land impacted for carbon sink potential -						+	2
High - Avoid deforestation (over 30 years)							2
(1000 hectares)							
Land impacted for carbon sink potential -							4,70
The state of the s							4,10
High - Extend rotation length (1000							
hectares) Land impacted for carbon sink potential -							9.8
High - Improve plantations (1000							9.0
•							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
nectares)							
Land impacted for carbon sink potential -							1:
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							1,64
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							ç
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,02
High - Restore productivity (1000							
nectares)							
and impacted for carbon sink potential -							9,08
ligh - Total impacted (over 30 years)							
1000 hectares)							
and impacted for carbon sink potential -							13
Low - Accelerate regeneration (1000							
nectares)							
and impacted for carbon sink potential -							19
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 -							1,804
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							4.95
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 -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -		+					15.9
Low - Reforest pasture (1000 hectares)							10.7
Land impacted for carbon sink potential -		+					1,228
Low - Restore productivity (1000							1,220
hectares)							
Land impacted for carbon sink potential -	+	+					4,270
Low - Total impacted (over 30 years)							4,210
(1000 hectares)							
Land impacted for carbon sink potential -	-						199
Mid - Accelerate regeneration (1000							177
hectares)							
Land impacted for carbon sink potential -							205
							203
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							0.057
Land impacted for carbon sink potential -							3,256
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.44
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 -							92.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -	T	T					1,235
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							115
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,472
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,582
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 -		220	0.263	0.262	0.198	0.123	0.001
Coal (million 2019\$)							
Monetary damages from air pollution -		267	186	193	368	169	19.3
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		914	899	717	433	203	77.7
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.8	0.03	0.03	0.022	0.014	0
Coal (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		30.1	21	21.8	41.5	19	2.18
Natural Gas (deaths)							
Premature deaths from air pollution -		103	101	80.7	48.7	22.8	8.74
Transportation (deaths)							

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

2050 87.8
87.8
87.8
87.8
12.2
80
8.03
0.016
12
43.1
44
12.5
0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.32	2.38	3.28	3.43	5.13	5.47
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)	162	162	161	160	158	155	151
Final energy use - Industry (PJ)	171	181	188	203	226	238	250
Final energy use - Residential (PJ)	237	229	225	220	212	196	175
Final energy use - Transportation (PJ)	472	446	410	379	355	326	292

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.41	4.7				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.3	51.6	56.1	68.1	84.8	95.1	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	49.7	48.4	43.9	31.9	15.2	4.9	1.32
Sales of space heating units - Electric	5.62	13.3	15.8	24.3	44	68.4	82.7
Heat Pump (%)							
Sales of space heating units - Electric	7.65	13.9	13.5	12.5	10.1	6.84	4.95
Resistance (%)							
Sales of space heating units - Fossil (%)	3.24	5.74	5.68	5.1	3.9	2.66	2.01
Sales of space heating units - Gas (%)	83.5	67.1	65	58.1	42	22.1	10.3
Sales of water heating units - Electric	0	0.46	1.74	5.96	16.1	28.9	36.5
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.6	26.5	29.7	37.4	47.1	52.9
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 (%)	85.7	72.7	70.5	63.1	45.3	22.7	9.32
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.22	1.22	1.21

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

	, .	•	•				
Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	172	344	1,178	3,652	5,339
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.303		0.614		2.74		7.45
units)							
Public EV charging plugs - L2 (1000 units)	2.12		14.8		65.9		179
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 (%)	1.79	2.16	2.1	1.68	1.1	0.567	0.242
Vehicle sales - Light-duty - EV (%)	1.62	4.1	10.6	23.9	46.2	70.6	87
Vehicle sales - Light-duty - gasoline (%)	92.6	88.6	81.5	69.1	48.7	26.4	11.6
Vehicle sales - Light-duty - hybrid (%)	3.8	4.66	5.29	4.92	3.8	2.31	1.14
Vehicle sales - Light-duty - hydrogen FC	0.113	0.387	0.339	0.264	0.191	0.107	0.05
(%)							
Vehicle sales - Light-duty - other (%)	0.113	0.116	0.107	0.094	0.069	0.038	0.017
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	0.009	0	0.042
power plant (billion \$2018)							
Capital invested - Biomass w/ccu power	0	0	0	0	0.139	0	0.584
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	9	9	51
Biomass w/ccu power plant (GWh)	0	0	0	0	156	156	812

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	117	458	500
Conversion capital investment -		0	0	0	1,360	3,889	588
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	1	1	2
(quantity)							

Table 52: <i>E-B+</i> 3	ccanaria -	DIII $VD \circ V$	Clean	tuole _	Riceneray	continuedl
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Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Beccs hydrogen	0	0	0	0	1	5	5
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	1	1	2
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	1	1	1
(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 53: E-B+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.38	5.08	10.2	11
Annual - BECCS (MMT)		0	0	0	1.72	6.72	7.4
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0	0.03	0.04	0.04	0.04
Cumulative - All (MMT)		0	0	3.38	8.46	18.6	29.6
Cumulative - BECCS (MMT)		0	0	0	1.72	8.44	15.8
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6
Cumulative - NGCC (MMT)		0	0	0.03	0.07	0.11	0.15

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	256	696	1,003	1,698	2,129
Cumulative investment - All (million \$2018)		0	1,225	1,699	2,013	2,575	2,836
Cumulative investment - Spur (million \$2018)		0	0.299	360	674	1,236	1,497
Cumulative investment - Trunk (million \$2018)		0	1,225	1,339	1,339	1,339	1,339
Spur (km)		0	0.5	441	747	1,442	1,874
Trunk (km)		0	255	255	255	255	255

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	2.14	3.56	4.92	5.02
Injection wells (wells)		0	1	3	6	9	12
Resource characterization, appraisal, permitting costs (million \$2020)		36	101	129	129	129	129
Wells and facilities construction costs (million \$2020)		0	24	93.3	166	278	345

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-376
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-2,573
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	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tCO2e/y)							005
Carbon sink potential - Aggressive							-205
deployment - Permanent conservation							
cover (1000 tC02e/y)							0.450
Carbon sink potential - Aggressive							-3,153
deployment - Total (1000 tCO2e/y)							07/
Carbon sink potential - Moderate							-376
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							4 000
Carbon sink potential - Moderate							-1,338
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-102
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,815
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							313
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							9,486
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							8.67
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							0.404
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							314
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							10,123
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							313
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							2,000
deployment - Cropland measures (1000							_,-,
hectares)							
Land impacted for carbon sink - Moderate							8.67
deployment - Cropland to woody energy							0.0.
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							0.404
deployment - Pasture to energy crops							0.707
(1000 hectares)							
Land impacted for carbon sink - Moderate							157
deployment - Permanent conservation							197
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,479
							2,419
deployment - Total (1000 hectares)							

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

Carbon sink potential High Accelerate regeneration (1000 (1002eV)	Item	2020	2025	2030	2035	2040	2045	2050
regeneration (1000 t002e/y) Carbon sink potential - High - All (not counting overlap) (1000 t002e/y) Carbon sink potential - High - Avoid deforestation (1000 t002e/y) Carbon sink potential - High - Avoid deforestation (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 - Increase retention of HWP (1000 t002e/y) Carbon sink potential - High - Increase retention of HWP (1000 t002e/y) Carbon sink potential - High - Reforest pasture (1000 t002e/y) Carbon sink potential - High - Reforest pasture (1000 t002e/y) Carbon sink potential - High - Reforest pasture (1000 t002e/y) Carbon sink potential - High - Reforest pasture (1000 t002e/y) Carbon sink potential - High - Restore productivity (1000 t002e/y) Carbon sink potential - Liow - Accelerate regeneration (1000 t002e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t002e/y) Carbon sink potential - Low - Avoid deforestation (1000 t002e/y) Carbon sink potential - Low - Avoid deforestation (1000 t002e/y) Carbon sink potential - Low - Avoid deforestation (1000 t002e/y) Carbon sink potential - Low - Fixend rotation length (1000 t002e/y) Carbon sink potential - Low - Improve Jantation Signo (1000 t002e/y) Carbon sink potential - Low - Improve Jantation Signo (1000 t002e/y) Carbon sink potential - Low - Improve Jantation Signo (1000 t002e/y) Carbon sink potential - Low - Improve Jantation (1000 t002e/y) Carbon sink potential - Low - Increase retention of HWP (1000 t002e/y) Carbon sink potential - Low - Increase retention of HWP (1000 t002e/y) Carbon sink potential - Low - Reforest pasture (1000 t002e/y) Carbon sink potential - Hidi - Avoid deforestation (1000 t002e/y) Carbon sink potential - Hidi - Avoid deforestation length (1000 t002e/y) Carbon sink potential - Hidi - Febrest podential - Hi		2020	2023	2030	2033	2040	2043	-1,620
Carbon sink potential + High - All (not counting overlap) (1000 t002e/y) Carbon sink potential + High - Avoid deforestation (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 - Improve plantations (1000 t002e/y) Carbon sink potential - High - Increase retention of HWP (1000 t002e/y) Carbon sink potential - High - Increase resonance in the province of the total resonance in the province of the total resonance in the province in th								1,020
Carbon sink potential - High - Nevold		+	+					-/ ₁ 2 1/ ₁ 2
Carbon sink potential - High - Avoid deforestation (1000 t022e/y) Carbon sink potential - High - Extend rotation length (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Improve plantations (1000 t022e/y) Carbon sink potential - High - Reforest pasture (1000 t022e/y) Carbon sink potential - High - Reforest pasture (1000 t022e/y) Carbon sink potential - High - Restore productivity (1000 t022e/y) Carbon sink potential - Livur - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Livur - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Livur - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Low - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Low - Extend rotation length (1000 t022e/y) Carbon sink potential - Low - Extend rotation length (1000 t022e/y) Carbon sink potential - Low - Extend rotation length (1000 t022e/y) Carbon sink potential - Low - Extend rotation length (1000 t022e/y) Carbon sink potential - Low - Febrest regeneration (1000 t022e/y) Carbon sink potential - Low - Reforest regulated (1000 t022e/y) Carbon sink potential - Low - Reforest regulation (1000 t022e/y) Carbon sink potential - Low - Reforest regulation sink potential - Low - Reforest regulation sink potential - Low - Reforest regulation (1000 t022e/y) Carbon sink potential - Mid - Reforest regeneration (1000 t022e/y) Carbon sink potential - Mid - Reforest regeneration (1000 t022e/y) Carbon sink potential - Mid - Reforest regeneration (1000 t022e/y) Carbon sink potential - Mid - Reforest regeneration of Mid (1000 t022e/y) Carbon sink potentia								40,140
deforestation (1000 tCO2e/v) Carbon sink potential + ligh - Extend	.,,		+					-1 550
Carbon sink potential - High - Extend rotation length (1000 tCD2e/y) Carbon sink potential - High - Improve plantations (1000 tCD2e/y) Carbon sink potential - High - Improve plantations (1000 tCD2e/y) Carbon sink potential - High - Increase retertion of HWP (1000 tCD2e/y) Carbon sink potential - High - Increase retertion of HWP (1000 tCD2e/y) Carbon sink potential - High - Reforest counties outside forests (1000 tCD2e/y) Carbon sink potential - High - Reforest corpland (1000 tCD2e/y) Carbon sink potential - High - Reforest corpland (1000 tCD2e/y) Carbon sink potential - High - Reforest corpland (1000 tCD2e/y) Carbon sink potential - High - Restore productivity (1000 tCD2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCD2e/y) Carbon sink potential - Low - Audi (1000 tCD2e/y) Carbon sink potential - Low - Audi (1000 tCD2e/y) Carbon sink potential - Low - Audi (1000 tCD2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCD2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCD2e/y) Carbon sink potential - Low - Improve plantations (1000 tCD2e/y) Carbon sink potential - Low - Improve plantations (1000 tCD2e/y) Carbon sink potential - Low - Improve plantations (1000 tCD2e/y) Carbon sink potential - Low - Improve plantations (1000 tCD2e/y) Carbon sink potential - Low - Reforest received to the potential - Mid - Accelerate received to the potential - Mid - Reforest received to								-1,557
rotation length (1000 tC02e/v)	* **							0 222
Carbon sink potential - High - Improve plantations (1000 tC02e/v) Carbon sink potential - High - Increase retention of MWP (1000 tC02e/v) Carbon sink potential - High - Increase retention of MWP (1000 tC02e/v) Carbon sink potential - High - Increase trees outside forests (1000 tC02e/v) Carbon sink potential - High - Reforest corpland (1000 tC02e/v) Carbon sink potential - High - Reforest pasture (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Extend rotation length (1000 tC02e/v) Carbon sink potential - Low - Extend rotation length (1000 tC02e/v) Carbon sink potential - Low - Improve plantations (1000 tC02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/v) Carbon sink potential - Low - Reforest pasture (1000 tC02e/v) Carbon sink potential - Low - Reforest pasture (1000 tC02e/v) Carbon sink potential - Low - Reforest pasture (1000 tC02e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Mid - Reforest potential - Mid - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Mid - Reforest regeneration (1000 tC02e/v) Carbon sink potential - Mid - Reforest regenerati								-9,233
plantations (1000 tC02e/y)	• • • • • • • • • • • • • • • • • • • •							0/ 0
Carbon sink potential - High - Increase retention of HWP (1000 CO26/y) Carbon sink potential - High - Tocrease 1,27								-20.8
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Carbon sink potential - High - Increase trees outside forests (1000 t02e/v) Carbon sink potential - High - Reforest cropland (1000 t02e/v) Carbon sink potential - High - Reforest cropland (1000 t02e/v) Carbon sink potential - High - Reforest carbon sink potential - High - Reforest poductivity (1000 t02e/v) Carbon sink potential - High - Restore productivity (1000 t02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 t02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 t02e/v) Carbon sink potential - Low - Avoid deforestation (1000 t02e/v) Carbon sink potential - Low - Avoid deforestation (1000 t02e/v) Carbon sink potential - Low - Extend rotation length (1000 t02e/v) Carbon sink potential - Low - Extend rotation length (1000 t02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 t02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 t02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 t02e/v) Carbon sink potential - Low - Reforest condition of the PWP (1000 t02e/v) Carbon sink potential - Low - Reforest condition of the PWP (1000 t02e/v) Carbon sink potential - Low - Reforest condition (1000 t02e/v) Carbon sink potential - Low - Reforest condition (1000 t02e/v) Carbon sink potential - Low - Reforest condition (1000 t02e/v) Carbon sink potential - Low - Reforest condition (1000 t02e/v) Carbon sink potential - Low - Reforest condition (1000 t02e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 t02e/v) Carbon sink potential - Mid - Avoid deforestation (1000 t02e/v) Carbon sink potential - Mid - Avoid deforestation (1000 t02e/v) Carbon sink potential - Mid - Avoid deforestation (1000 t02e/v) Carbon sink potential - Mid - Reforest condition (1000 t02e/v) Carbon sink potential - Mid - Reforest condition (1000 t02e/v) Carbon sink potential - Mid - Reforest condition (1000 t02e/v) Carbon sink potential - Mid - Reforest condition (1000 t02e/v) Carbon sink potential - Mid -								-174
Trees outside Forests [1000 tC02e/v] Carbon sink potential - High - Reforest -24,90 cropland (1000 tC02e/v) Carbon sink potential - High - Reforest -3,23 apsture (1000 tC02e/v) Carbon sink potential - High - Restore -6,12 cropland sink potential - High - Restore -6,12 cropland sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/v) Carbon sink potential - Low - Avoid -2,60 carbon sink potential - Low - Avoid -2,60 carbon sink potential - Low - Avoid -2,60 carbon sink potential - Low - Avoid -3,54 cropland sink potential - Low - Teresase retention for HWP (1000 tC02e/v) -3,54 cropland sink potential - Low - Increase retention of HWP (1000 tC02e/v) -3,54 cropland sink potential - Low - Increase retention of HWP (1000 tC02e/v) -3,64 cropland sink potential - Low - Reforest repaind sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/v) -2,06 carbon sink potential - Mid - Reforest research sink potential - Mid - Reforest research sink potential - Mi								
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Carbon sink potential - High - Reforest -6,12	* **							
Carbon sink potential - High - Reforest pasture (1000 tC02e/y)	·							-24,902
pasture (1000 tcO2e/y) Carbon sink potential - High - Restore productivity (1000 tcO2e/y) -6.12 pasture (1000 tcO2e/y) -6.								
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productivity (1000 tC02e/y) -81								
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/v) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/v) Carbon sink potential - Low - All (not carbon sink potential - Low - All (not deforestation (1000 tCO2e/v) Carbon sink potential - Low - Extend -3,54	Carbon sink potential - High - Restore							-6,121
regeneration (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend - 3,54 rotation length (1000 tC02e/y) Carbon sink potential - Low - Extend	productivity (1000 tCO2e/y)							
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/v)	Carbon sink potential - Low - Accelerate							-812
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/v)	regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/v) Carbon sink potential - Low - Extend -3,54 rotation length (1000 tC02e/v) -3,55 rotation length (1000 tC02e/v) -3,								-19,895
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y)								,-
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Carbon sink potential - Low - Extend								
rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest productivity (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 - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Mid - Extend rotation length (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 cropland (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)								-3 547
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trees outside forests (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate 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 - 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 retention of HWP (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (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								
Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) -12,45								-446
cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate 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 cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/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 - 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 - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest -18,67 Carbon sink potential - Mid - Reforest -17,74 Carbon sink potential - Mid - Reforest -17,74 Carbon sink potential - Mid - Reforest -17,74 Carbon sink potential - Mid - Restore -4,09 Carbon sink potential - Mid - Restore -24,09								-12,451
Dasture (1000 tC02e/y) Carbon sink potential - Low - Restore -2,06 productivity (1000 tC02e/y) -1,21								
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate 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 trees outside forests (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 - 18,67 Carbon sink potential - Mid - Reforest - 17,74 pasture (1000 tCO2e/y) Carbon sink potential - Mid - Reforest - 1,74 pasture (1000 tCO2e/y) Carbon sink potential - Mid - Reforest - 1,74 pasture (1000 tCO2e/y) Carbon sink potential - Mid - Reforest - 1,74								-245
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 - 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 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 - Restore -4,09								
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 reso outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest ropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest ropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest ropland (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								-2,063
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 trees outside forests (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest -1,74 pasture (1000 tCO2e/y) Carbon sink potential - Mid - Restore -4,09 Carbon sink potential - Mid - Restore -4,09								
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 (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y) Carbon sink potential - Mid - Reforest (1000 tC02e/y)	Carbon sink potential - Mid - Accelerate							-1,216
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 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 - Restore -4,09	regeneration (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 -4,09	Carbon sink potential - Mid - All (not							-34,021
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 pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -4,09	counting overlap) (1000 tCO2e/y)							
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 pasture (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -4,09	Carbon sink potential - Mid - Avoid							-909
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 -1,74 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 -4,09								-6,390
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 - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore								0,070
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 -4,09								-20
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 -4,09	·							20
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 -4,09								-116
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 -4,09								-110
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 -4,09								0.50
Carbon sink potential - Mid - Reforest cropland (1000 tC02e/y) Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -4,09								-859
cropland (1000 tCO2e/y) Carbon sink potential - Mid - Reforest								
Carbon sink potential - Mid - Reforest pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -4,09	·							-18,676
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore -4,09								
Carbon sink potential - Mid - Restore	· ·							-1,742
								-4,092
productivity (1000 tCO2e/y)	productivity (1000 tCO2e/y)							

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

Table 57: E-B+ scenario - PILLAR 6: Land s		•	,	0005	00/0	00/5	0050
Item Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050 265
							200
High - Accelerate regeneration (1000							
hectares) Land impacted for carbon sink potential -							211
High - Avoid deforestation (over 30 years)							211
• • • • • • • • • • • • • • • • • • • •							
(1000 hectares)							/ 700
Land impacted for carbon sink potential -							4,708
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							9.89
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 -							121
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							1,646
High - Reforest cropland (1000 hectares)							, -
Land impacted for carbon sink potential -							92
High - Reforest pasture (1000 hectares)							,_
Land impacted for carbon sink potential -							2,029
High - Restore productivity (1000							2,027
hectares)							
Land impacted for carbon sink potential -							9,083
High - Total impacted (over 30 years)							7,000
(1000 hectares)							
Land impacted for carbon sink potential -							100
							133
Low - Accelerate regeneration (1000							
hectares)							100
Land impacted for carbon sink potential -							198
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,804
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							4.95
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 -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							0_0
Land impacted for carbon sink potential -							15.9
Low - Reforest pasture (1000 hectares)							10.7
Land impacted for carbon sink potential -		-					1,228
Low - Restore productivity (1000							1,220
hectares)							/ 070
Land impacted for carbon sink potential -							4,270
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							199
Mid - Accelerate regeneration (1000							
hectares)	I .						

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 -							205
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							3,256
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.44
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 -							92.3
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							1,235
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							115
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,472
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							7,582
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		220	0.263	0.262	0.198	0.123	0.001
Coal (million 2019\$)							
Monetary damages from air pollution -		270	196	170	148	82.5	20.2
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		929	987	1,006	945	783	556
Transportation (million 2019\$)							
Premature deaths from air pollution -		24.8	0.03	0.03	0.022	0.014	0
Coal (deaths)							
Premature deaths from air pollution -		30.5	22.1	19.2	16.7	9.32	2.28
Natural Gas (deaths)							
Premature deaths from air pollution -		104	111	113	106	88	62.5
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		14,192	14,841				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric	2.64	13.8	46.2	73.2	77.9	78.5	78.5
Heat Pump (%)							
Sales of space heating units - Electric	2.48	4.35	8.94	16	20.3	21	21
Resistance (%)							
Sales of space heating units - Fossil (%)	0	0.226	0.135	0.038	0.005	0	0
Sales of space heating units - Gas Furnace	94.9	81.6	44.8	10.8	1.79	0.573	0.499
(%)							
Sales of water heating units - Electric	0.022	0.03	0.03	0.03	0.03	0.03	0.03
Heat Pump (%)							
Sales of water heating units - Electric	1.1	1.47	1.47	1.48	1.46	1.48	1.47
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 (%)	98.6	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.269	0.383	0.382	0.383	0.382	0.383	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.52	2.6	3.5	3.68	4	4.2
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)	162	165	169	170	172	177	185
Final energy use - Industry (PJ)	171	186	198	211	225	243	262
Final energy use - Residential (PJ)	237	231	230	232	235	240	244
Final energy use - Transportation (PJ)	472	451	423	407	409	422	438

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		4.33	4.39				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	49.8	49.8	49.8	49.8	49.8	49.8	49.8
Resistance (%)							
Sales of cooking units - Gas (%)	50.2	50.2	50.2	50.2	50.2	50.2	50.2
Sales of space heating units - Electric	5.05	16.1	16.5	17	17.5	17.9	18.5
Heat Pump (%)							
Sales of space heating units - Electric	7.73	13.4	13.3	13.2	13.1	12.7	12.1
Resistance (%)							
Sales of space heating units - Fossil (%)	3.28	5.42	5.49	5.36	5.12	5.04	5.13
Sales of space heating units - Gas (%)	83.9	65	64.8	64.4	64.3	64.4	64.2
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	13.2	25.2	25.3	25.3	25.4	25.4	25.4
Resistance (%)							
Sales of water heating units - Gas Furnace	85.7	73.5	73.5	73.5	73.4	73.4	73.4
(%)							
Sales of water heating units - Other (%)	1.07	1.23	1.23	1.23	1.22	1.22	1.22

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 (%)	1.78	2.16	2.22	2.07	1.87	1.75	1.66
Vehicle sales - Light-duty - EV (%)	2.81	4.63	5.31	6.47	7.94	9.34	10.5
Vehicle sales - Light-duty - gasoline (%)	91.5	88.1	86.4	84.8	82.9	81	79.3
Vehicle sales - Light-duty - hybrid (%)	3.7	4.58	5.63	6.22	6.84	7.52	8.12
Vehicle sales - Light-duty - hydrogen FC	0.112	0.385	0.359	0.323	0.322	0.324	0.336
(%)							
Vehicle sales - Light-duty - other (%)	0.112	0.116	0.113	0.114	0.114	0.113	0.116
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

Thomas I Tho			0000	0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-1,620
regeneration (1000 tCO2e/y)							/ 0 1 / 0
Carbon sink potential - High - All (not							-48,148
counting overlap) (1000 tC02e/y)							1.550
Carbon sink potential - High - Avoid							-1,559
deforestation (1000 tC02e/y)							0.000
Carbon sink potential - High - Extend							-9,233
rotation length (1000 tCO2e/y)							0/0
Carbon sink potential - High - Improve							-26.8
plantations (1000 tCO2e/y)							47/
Carbon sink potential - High - Increase							-174
retention of HWP (1000 tCO2e/y)							4.070
Carbon sink potential - High - Increase							-1,273
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest							-24,902
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,239
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,121
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-812
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-19,895
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-260
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-3,547
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-13.7
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-58.1
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-446
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-12,451
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-245
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-2,063
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-1,216
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-34,021
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-909
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend				T		T	-6,390
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-20
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-116
retention of HWP (1000 tCO2e/y)							

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

Item Copper sink notantial, Mid. Increase	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase							-859
trees outside forests (1000 tC02e/y)							10 /7/
Carbon sink potential - Mid - Reforest							-18,676
cropland (1000 tC02e/y)							17/0
Carbon sink potential - Mid - Reforest							-1,742
pasture (1000 tCO2e/y)							,
Carbon sink potential - Mid - Restore							-4,092
productivity (1000 tC02e/y)							
Land impacted for carbon sink potential -							265
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							211
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							4,708
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							9.89
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 -							121
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							1,646
High - Reforest cropland (1000 hectares)							1,040
Land impacted for carbon sink potential -							92
High - Reforest pasture (1000 hectares)							72
Land impacted for carbon sink potential -							2,029
High - Restore productivity (1000							2,029
hectares)							
Land impacted for carbon sink potential -							9,083
							9,003
High - Total impacted (over 30 years)							
(1000 hectares)							100
Land impacted for carbon sink potential -							133
Low - Accelerate regeneration (1000							
hectares)							400
Land impacted for carbon sink potential -							198
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,804
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							4.95
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 -							63.7
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							823
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -	+	-			+		15.9
Low - Reforest pasture (1000 hectares)							10.7
Land impacted for carbon sink potential -							1,228
Low - Restore productivity (1000							1,220
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)							4,270
(1000 hectares)							
Land impacted for carbon sink potential -							199
Mid - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -							205
Mid - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							3,256
Mid - Extend rotation length (1000 hectares)							
Land impacted for carbon sink potential -							7.44
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 -							92.3
Mid - Increase trees outside forests (1000							72.0
hectares)							
Land impacted for carbon sink potential -							1,235
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							115
Mid - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							2,472
Mid - Restore productivity (1000							2,4(2
hectares)							
Land impacted for carbon sink potential -							7,582
Mid - Total impacted (over 30 years) (1000							
hectares)							

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)	6.25		4.02				1.15
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.047		-0.099				-0.104
Business-as-usual carbon sink - Total (Mt CO2e/y)	6.2		3.93				1.05

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		504	245	139	109	95.5	91.7
Coal (million 2019\$)							
Monetary damages from air pollution -		298	312	304	226	187	74
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		927	999	1,069	1,143	1,217	1,293
Transportation (million 2019\$)							
Premature deaths from air pollution -		56.9	27.7	15.7	12.3	10.8	10.4
Coal (deaths)							
Premature deaths from air pollution -		33.6	35.3	34.3	25.5	21.1	8.35
Natural Gas (deaths)							
Premature deaths from air pollution -		104	112	120	129	137	145
Transportation (deaths)							