

Net-Zero America - delaware state report

2021-03-18

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

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

Notes

- These data are 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 -		3,472	3,883				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	1.53	28.2	70.6	83.7	85	85.1	85.1
Heat Pump (%)							
Sales of space heating units - Electric	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of space heating units - Gas Furnace	84.3	59.2	18.1	3.53	1.88	1.85	1.84
(%)							
Sales of water heating units - Electric	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Heat Pump (%)							
Sales of water heating units - Electric	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Resistance (%)							
Sales of water heating units - Gas Furnace	93.3	74.5	14.1	0.593	0	0	0
(%)							
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.526	0.536	0.919	0.973	0.907	0.947
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)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		0.774	0.771				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.1	60.7	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Sales of space heating units - Electric	14.3	32.1	79.9	90.6	91	91	91
Heat Pump (%)							
Sales of space heating units - Electric	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Resistance (%)							
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of water heating units - Electric	0	9.43	49.9	59	59.4	59.4	59.4
Heat Pump (%)							
Sales of water heating units - Electric	30.2	45.9	40.3	39	38.9	38.9	38.9
Resistance (%)							
Sales of water heating units - Gas Furnace	65.2	41.3	7.81	0.329	0	0	0
(%)							
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		193	496	803	1,217	1,325	1,263
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.065		0.324		1.42		2.3
units)							
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Offshore Wind - Base (billion \$2018)		0	0	0	0	5.99	5.64
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	0	0	0	3.3	8.06
Capital invested - Solar PV - Base (billion \$2018)		0.167	0.173	0.318	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.144	0.276	0.328	0	0	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	4,059	8,319
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	4,059	8,319
Installed renewables - Rooftop PV (MW)	110	165	219	290	375	472	584
Installed renewables - Solar - Base land use assumptions (MW)	39.8	186	355	692	692	692	692
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	112	326	326	326	326
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Wind - Constrained land use assumptions (MW)	2	2	2	2	2	2	2

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use	0	0	0	0	0	17,643	37,615
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	17,643	37,615
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	75.2	309	579	1,122	1,122	1,122	1,122
Solar - Constrained land use assumptions	0	0	180	522	522	522	522
(GWh)							
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
Wind - Constrained land use assumptions	8.07	8.07	8.07	8.07	8.07	8.07	8.07
(GWh)							

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

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

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	0	0	0	166
Cumulative investment - All (million \$2018)		0	0	0	0	0	122
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	122
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	166
Trunk (km)		0	0	0	0	0	0

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

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

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

Table 12: E+ Scenario - PILLAR 6: Land Sink			0000	0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							0//
Carbon sink potential - Aggressive							-244
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-6.43
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-250
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-126
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-3.22
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-129
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							171
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							11.7
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							183
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							88.6
deployment - Cropland measures (1000							55.0
hectares)							
Land impacted for carbon sink - Moderate							5.85
deployment - Permanent conservation							0.00
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							94.5
deployment - Total (1000 hectares)							74.0
acproyment - rotar (1000 nectal es)							

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

Table 13: E+ scenario - PILLAR 6: Land sin	ks - Forests						
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-6.94
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-901
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-206
deforestation (1000 tC02e/y)							200
Carbon sink potential - High - Extend							-201
·							-201
rotation length (1000 tC02e/y)							07.0
Carbon sink potential - High - Improve							-27.3
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-208
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-83.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5.4
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-85.9
pasture (1000 tC02e/y)							00.7
Carbon sink potential - High - Restore							-76.6
productivity (1000 tC02e/y)							-10.0
							-3.48
Carbon sink potential - Low - Accelerate							-3.48
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-263
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-34.3
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-77.3
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-13.9
plantations (1000 tCO2e/y)							10.7
Carbon sink potential - Low - Increase							-69.4
							-09.4
retention of HWP (1000 tCO2e/y)							00.0
Carbon sink potential - Low - Increase							-29.2
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2.7
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-6.51
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-25.8
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-5.21
regeneration (1000 tCO2e/y)							0.21
							-581
Carbon sink potential - Mid - All (not							-581
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-120
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-139
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-20.4
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-139
retention of HWP (1000 tCO2e/y)							107
							-56.4
Carbon sink potential - Mid - Increase							-56.4
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-4.05
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-46.2
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-51.2
productivity (1000 tCO2e/y)							
p 32221111 (1200 10020/1)							

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

Table 13: E+ scenario - PILLAR 6: Land sink		<u> </u>		0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1.13
High - Accelerate regeneration (1000							
hectares) Land impacted for carbon sink potential -							27.8
High - Avoid deforestation (over 30 years)							21.0
(1000 hectares)							
,							103
Land impacted for carbon sink potential - High - Extend rotation length (1000							103
5 ,							
hectares)							10.1
Land impacted for carbon sink potential -							10.1
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 -							7.93
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.357
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.44
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.4
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							178
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.567
Low - Accelerate regeneration (1000							0.00.
hectares)							
Land impacted for carbon sink potential -							26.1
Low - Avoid deforestation (over 30 years)							20.1
(1000 hectares)							
Land impacted for carbon sink potential -							39.3
Low - Extend rotation length (1000							37.3
hectares)							
,							F 00
Land impacted for carbon sink potential -							5.03
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 -							4.17
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.179
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.423
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							15.4
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							91.2
Low - Total impacted (over 30 years)							,
(1000 hectares)							
Land impacted for carbon sink potential -					+		0.851
Mid - Accelerate regeneration (1000							0.031
hectares)							
Herial Esj							

Tahla 12. Fx	econario -	DILLAD 6.	Land sinks -	Enrecte	(continued)
Table 15. Et	SCEIIUI 10 -	PILLAK O.	LUIIU SIIIKS -	. คบา ยอเอา	COHUHUEUT

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							27
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							71
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.57
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 -							6.05
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0.268
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.06
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							30.9
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							147
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		73.9	62.3	50	37.6	23.7	16.4
Natural gas consumption - Cumulative (tcf)							1,505
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		13.1	10.7	7.3	4.21	1.8	0
Oil consumption - Cumulative (million bbls)							229
Oil production - Annual (million bbls)		0	0	0	0	0	0

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Natural Gas (million 2019\$)		52.5	38.6	25.7	23.3	15.7	6.52
Monetary damages from air pollution - Transportation (million 2019\$)		232	218	166	96.2	43.7	16.6
Premature deaths from air pollution - Coal (deaths)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Natural Gas (deaths)		5.93	4.36	2.9	2.63	1.77	0.736
Premature deaths from air pollution - Transportation (deaths)		26.1	24.5	18.7	10.8	4.91	1.87

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		3.8	7.71	2.95	2.29	1.68	1.25
By economic sector - Construction (jobs)		1,159	1,095	1,419	1,414	4,193	7,337
By economic sector - Manufacturing		1,426	2,601	2,635	2,094	2,841	2,826
(jobs)							
By economic sector - Mining (jobs)		287	197	119	64.2	27.8	8.9

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

Item 2020 2025 2030 2035 2040 2045 By economic sector - Other (jobs) 116 123 181 172 423 By economic sector - Pipeline (jobs) 81.8 67.9 52 36.7 21.4 By economic sector - Professional (jobs) 476 427 558 573 2,181 By economic sector - Trade (jobs) 359 317 376 364 1,221 By economic sector - Utilities (jobs) 1,300 1,156 1,571 1,840 5,242 By education level - All sectors - Associates degree or some college (jobs) 1,678 1,926 2,244 2,150 5,290 By education level - All sectors - Bachelors degree (jobs) 1,049 1,188 1,348 1,271 3,178 By education level - All sectors - Doctoral degree (jobs) 29.2 28.5 33.8 32.7 102 By education level - All sectors - High school diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801 By education level - All sectors - Masters 238 25	2050 786 39.3 4,081 2,325 8,746 8,572 5,187
By economic sector - Pipeline (jobs) 81.8 67.9 52 36.7 21.4 By economic sector - Professional (jobs) 476 427 558 573 2,181 By economic sector - Trade (jobs) 359 317 376 364 1,221 By economic sector - Utilities (jobs) 1,300 1,156 1,571 1,840 5,242 By education level - All sectors - Associates degree or some college (jobs) 1,678 1,926 2,244 2,150 5,290 By education level - All sectors - Bachelors degree (jobs) 1,049 1,188 1,348 1,271 3,178 By education level - All sectors - Doctoral degree (jobs) 29.2 28.5 33.8 32.7 102 By education level - All sectors - High school diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801	39.3 4,081 2,325 8,746 8,572 5,187
By economic sector - Professional (jobs) 476 427 558 573 2,181	4,081 2,325 8,746 8,572 5,187
By economic sector - Trade (jobs) 359 317 376 364 1,221 By economic sector - Utilities (jobs) 1,300 1,156 1,571 1,840 5,242 By education level - All sectors - Associates degree or some college (jobs) 1,678 1,926 2,244 2,150 5,290 By education level - All sectors - Bachelors degree (jobs) 1,049 1,188 1,348 1,271 3,178 By education level - All sectors - Doctoral degree (jobs) 29.2 28.5 33.8 32.7 102 By education level - All sectors - High school diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801	2,325 8,746 8,572 5,187
By economic sector - Utilities (jobs) 1,300 1,156 1,571 1,840 5,242 By education level - All sectors - Associates degree or some college (jobs) 1,678 1,926 2,244 2,150 5,290 By education level - All sectors - Bachelors degree (jobs) 1,049 1,188 1,348 1,271 3,178 By education level - All sectors - Doctoral degree (jobs) 29.2 28.5 33.8 32.7 102 By education level - All sectors - High school diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801	8,746 8,572 5,187
By education level - All sectors - Associates degree or some college (jobs) 1,678 1,926 2,244 2,150 5,290 By education level - All sectors - Bachelors degree (jobs) 1,049 1,188 1,348 1,271 3,178 By education level - All sectors - Doctoral degree (jobs) 29.2 28.5 33.8 32.7 102 By education level - All sectors - High school diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801	5,187 183
Associates degree or some college (jobs) By education level - All sectors - Bachelors degree (jobs) By education level - All sectors - Doctoral degree (jobs) By education level - All sectors - High school diploma or less (jobs)	5,187
By education level - All sectors - Bachelors degree (jobs) By education level - All sectors - Doctoral degree (jobs) By education level - All sectors - Doctoral degree (jobs) By education level - All sectors - High school diploma or less (jobs) 1,049 1,188 1,348 1,271 3,178 29.2 28.5 33.8 32.7 102 4,800 6,801	183
Bachelors degree (jobs) By education level - All sectors - Doctoral degree (jobs) By education level - All sectors - High school diploma or less (jobs) By education level - All sectors - High school diploma or less (jobs)	183
By education level - All sectors - Doctoral degree (jobs) By education level - All sectors - High school diploma or less (jobs) 29.2 28.5 33.8 32.7 102 2,993 2,820 6,801	
degree (jobs) By education level - All sectors - High cschool diploma or less (jobs) 2,216 2,597 2,993 2,820 6,801	
By education level - All sectors - High 2,216 2,597 2,993 2,820 6,801 school diploma or less (jobs)	10,887
school diploma or less (jobs)	.0,00.
של באינים ווער באינים ווער באינים ווער באינים ווער באינים וווער באינים ווער באינים ווער באינים ווער באינים ווער	1,321
or professional degree (jobs)	, -
By resource sector - Biomass (jobs) 16.3 21.3 8.39 6.88 6.13	5.33
By resource sector - CO2 (jobs) 0 0 0 0	224
By resource sector - Coal (jobs) 60.3 0 0 0	0
By resource sector - Grid (jobs) 1,544 1,578 2,444 2,815 10,088	16,956
By resource sector - Natural Gas (jobs) 1,224 934 898 1,048 701	713
By resource sector - Nuclear (jobs) 0 0 0 0	0
By resource sector - Oil (jobs) 583 435 275 147 58.8	0
By resource sector - Solar (jobs) 1,777 2,924 3,212 2,308 2,259	2,349
By resource sector - Wind (jobs) 4.99 99.5 77 236 3,040	5,904
Median wages - Annual - All (\$2019 per 64,185 63,423 64,501 66,169 68,740 job)	70,482
On-Site or In-Plant Training - Total jobs - 1 860 972 1,135 1,091 2,713	4,412
to 4 years (jobs)	
On-Site or In-Plant Training - Total jobs - 4 338 340 414 417 1,130	1,912
to 10 years (jobs)	
On-Site or In-Plant Training - Total jobs - 840 979 1,121 1,053 2,568	4,154
None (jobs)	
On-Site or In-Plant Training - Total jobs - 45.4 50.2 59.7 58.7 150	246
Over 10 years (jobs)	
On-Site or In-Plant Training - Total jobs - 3,126 3,652 4,184 3,941 9,592	15,426
Up to 1 year (jobs)	F 70F
On-the-Job Training - All sectors - 1 to 4 1,107 1,241 1,453 1,403 3,514	5,735
years (jobs) 329 328 404 411 1,127	1.01/
On-the-Job Training - All sectors - 4 to 10 329 328 404 411 1,127 years (jobs)	1,916
On-the-Job Training - All sectors - None 272 311 356 334 827	1,349
(jobs)	1,347
On-the-Job Training - All sectors - Over 10 53.6 66.8 74.5 67.3 150	233
years (jobs)	200
On-the-Job Training - All sectors - Up to 1 3,447 4,047 4,626 4,345 10,535	16,918
year (jobs)	10,710
Related work experience - All sectors - 1 1,867 2,125 2,453 2,336 5,797	9,419
to 4 years (jobs)	,
Related work experience - All sectors - 4 1,218 1,376 1,592 1,524 3,800	6,192
to 10 years (jobs)	
Related work experience - All sectors - 754 856 994 952 2,345	3,805
None (jobs)	
Related work experience - All sectors - 335 399 453 424 1,014	1,614
Over 10 years (jobs)	
Related work experience - All sectors - Up 1,036 1,238 1,421 1,325 3,197	5,121
to 1 year (jobs)	
Wage income - All (million \$2019) 334 380 446 434 1,110	1,843

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		3,468	3,852				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	36.2	40.9	53.4	71	81.7	85.5
Resistance (%)							
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric	1.53	20.1	24.9	38.9	61.1	76.8	82.8
Heat Pump (%)							
Sales of space heating units - Electric	1.94	8.06	8.33	9.15	10.6	12	12.8
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	4.9	4.55	3.47	1.71	0.536	0.14
Sales of space heating units - Gas Furnace	84.3	66.9	62.2	48.4	26.6	10.7	4.3
(%)							
Sales of water heating units - Electric	0.078	2.03	7.05	21.5	43.6	58.1	63.1
Heat Pump (%)							
Sales of water heating units - Electric	1.96	7.38	9.33	15.1	24	29.7	31.7
Resistance (%)							
Sales of water heating units - Gas Furnace	93.3	86.1	79.2	59.5	29.1	9.29	2.42
(%)							
Sales of water heating units - Other (%)	4.67	4.49	4.43	3.93	3.32	2.91	2.76

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.457	0.458	0.597	0.614	0.89	0.939
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)	29.9	29.9	29.5	28.9	28	27	26.5
Final energy use - Industry (PJ)	16	16.3	16.7	17.1	17.5	17.9	18.4
Final energy use - Residential (PJ)	41.7	39.5	38.4	37	34.6	31.5	28.6
Final energy use - Transportation (PJ)	81.5	76.4	70.2	64.9	60.8	55.9	50.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		0.769	0.798				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	49.9	51.2	55.8	67.9	84.7	95.1	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	50.1	48.8	44.2	32.1	15.3	4.94	1.33
Sales of space heating units - Electric	14.3	22.9	28.3	44	68	83.7	89.1
Heat Pump (%)							
Sales of space heating units - Electric	9.9	12	11.2	9.09	5.93	3.95	3.26
Resistance (%)							
Sales of space heating units - Fossil (%)	20.5	29.9	27.8	21.5	11.8	5.49	3.29
Sales of space heating units - Gas (%)	55.3	35.2	32.6	25.4	14.2	6.89	4.33
Sales of water heating units - Electric	0	1.62	6.23	19.5	39.9	53.2	57.8
Heat Pump (%)							
Sales of water heating units - Electric	30.2	47	46.3	44.4	41.6	39.8	39.1
Resistance (%)							
Sales of water heating units - Gas Furnace	65.2	47.8	44	33.1	16.2	5.18	1.35
(%)							
Sales of water heating units - Other (%)	4.6	3.59	3.44	3	2.33	1.9	1.75

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	31.3	65.7	222	699	1,018
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.065		0.1		0.527		1.47
units)							
Public EV charging plugs - L2 (1000 units)	0.118		2.42		12.7		35.4
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 (%)	1.45	1.88	2.04	1.61	1.02	0.523	0.225
Vehicle sales - Light-duty - EV (%)	2.03	4.99	12.5	26.8	49.4	72.7	87.8
Vehicle sales - Light-duty - gasoline (%)	91.3	86.9	78.6	65.4	45	24.1	10.7
Vehicle sales - Light-duty - hybrid (%)	4.99	5.77	6.44	5.81	4.29	2.5	1.2
Vehicle sales - Light-duty - hydrogen FC	0.112	0.377	0.319	0.241	0.169	0.094	0.044
(%)							
Vehicle sales - Light-duty - other (%)	0.098	0.101	0.091	0.079	0.057	0.031	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-244
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-6.43
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-250
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-126
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-3.22
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-129
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							171
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							11.7
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 -							183
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							88.6
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							5.85
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							94.5
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							-6.94
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-901
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-206
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-201
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-27.3
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-208
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-83.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5.4
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-85.9
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-76.6
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-3.48
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-263
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-34.3
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-77.3
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-13.9
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-69.4
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-29.2
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-2.7
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-6.51
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-25.8
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-5.21
regeneration (1000 tCO2e/y)							

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

Item Contact part notantial Mid. All (not	2020	2025	2030	2035	2040	2045	2050 -581
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-58
Carbon sink potential - Mid - Avoid							-120
deforestation (1000 tCO2e/y)							-120
Carbon sink potential - Mid - Extend							-139
rotation length (1000 tC02e/y)							-137
Carbon sink potential - Mid - Improve							-20.4
plantations (1000 tCO2e/y)							-20.4
Carbon sink potential - Mid - Increase							-139
retention of HWP (1000 tC02e/y)							-107
Carbon sink potential - Mid - Increase							-56.4
trees outside forests (1000 tC02e/y)							-50.4
Carbon sink potential - Mid - Reforest							-4.05
cropland (1000 tCO2e/y)							4.00
Carbon sink potential - Mid - Reforest							-46.2
pasture (1000 tC02e/y)							-40.2
Carbon sink potential - Mid - Restore							-51.2
productivity (1000 tC02e/y)							01.2
Land impacted for carbon sink potential -							1.13
High - Accelerate regeneration (1000							1.10
hectares)							
Land impacted for carbon sink potential -							27.8
High - Avoid deforestation (over 30 years)							21.0
(1000 hectares)							
Land impacted for carbon sink potential -							103
High - Extend rotation length (1000							100
hectares)							
Land impacted for carbon sink potential -							10.1
High - Improve plantations (1000							10.
hectares)							
Land impacted for carbon sink potential -							C
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							7.93
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.357
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.44
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.4
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							178
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.567
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							26.1
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							39.3
Low - Extend rotation length (1000							27.0
hectares)							
Land impacted for carbon sink potential -							5.03
Low - Improve plantations (1000							5.50
hectares)							
Land impacted for carbon sink potential -					+		C
Low - Increase retention of HWP (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							4.17
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.179
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.423
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							15.4
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							91.2
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.851
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							27
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							71
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.57
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 -							6.05
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0.268
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.06
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							30.9
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							147
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Natural Gas (million 2019\$)		47.6	30.8	13.4	5.77	1.89	1.29
Monetary damages from air pollution - Transportation (million 2019\$)		237	240	234	212	169	116
Premature deaths from air pollution - Coal (deaths)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Natural Gas (deaths)		5.37	3.48	1.51	0.651	0.213	0.146
Premature deaths from air pollution - Transportation (deaths)		26.6	27	26.4	23.8	19	13.1

Table 25: 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)		3,472	3,883				
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric Heat Pump (%)	1.53	28.2	70.6	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of space heating units - Gas Furnace (%)	84.3	59.2	18.1	3.53	1.88	1.85	1.84
Sales of water heating units - Electric Heat Pump (%)	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Sales of water heating units - Gas Furnace (%)	93.3	74.5	14.1	0.593	0	0	0
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.526	0.536	0.919	0.973	0.907	0.947
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)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		0.774	0.771				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.1	60.7	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Sales of space heating units - Electric	14.3	32.1	79.9	90.6	91	91	91
Heat Pump (%)							
Sales of space heating units - Electric	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Resistance (%)							
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of water heating units - Electric	0	9.43	49.9	59	59.4	59.4	59.4
Heat Pump (%)							
Sales of water heating units - Electric	30.2	45.9	40.3	39	38.9	38.9	38.9
Resistance (%)							
Sales of water heating units - Gas Furnace	65.2	41.3	7.81	0.329	0	0	0
(%)							
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		193	496	803	1,217	1,325	1,263
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.065		0.324		1.42		2.3
units)							
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base		0	0	0	3.88	7.84	1.02
(billion \$2018)							
Capital invested - Solar PV - Base (billion		0	0.242	0	0	0	2.91
\$2018)							
Capital invested - Wind - Base (billion		0	0	0	0	0	0.246
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	2,235	7,552	8,319
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	4,479	4,479	16,647
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	39.8	39.8	276	276	276	276	3,955
use assumptions (MW)							
Installed renewables - Solar -	79.6	327	1,722	1,722	1,722	1,722	8,675
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	2	2	2	2	2	2	131
use assumptions (MW)							
Installed renewables - Wind - Constrained	4	4	4	4	4	4	4
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	9,506	33,967	37,615
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	19,052	19,052	75,270
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	75.2	75.2	454	454	454	454	6,352
Solar - Constrained land use assumptions	150	548	2,786	2,786	2,786	2,786	13,929
(GWh)							
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	403

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

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Constrained land use assumptions	16.1	16.1	16.1	16.1	16.1	16.1	16.1
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-244
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-6.43
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-250
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Moderate							-126
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-3.22
deployment - Permanent conservation							0.22
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-129
deployment - Total (1000 tC02e/y)							127
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							O
energy grasses (1000 hectares)							
Land impacted for carbon sink -							171
Aggressive deployment - Cropland							111
measures (1000 hectares)							
Land impacted for carbon sink -							11.7
Aggressive deployment - Permanent							11.1
conservation cover (1000 hectares)							
Land impacted for carbon sink -							183
·							103
Aggressive deployment - Total (1000							
hectares) Land impacted for carbon sink - Moderate							0
							U
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							00.7
Land impacted for carbon sink - Moderate							88.6
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							5.85
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							94.5
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 regeneration (1000 tCO2e/y)							-6.94
Carbon sink potential - High - All (not counting overlap) (1000 tC02e/y)							-901
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-206

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-20
• , , , , , , , , , , , , , , , , , , ,							07
Carbon sink potential - High - Improve							-27.
plantations (1000 tC02e/y)							00
Carbon sink potential - High - Increase							-20
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-83.
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5.
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-85.
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-76.
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-3.4
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-26
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-34
deforestation (1000 tCO2e/y)							0-1
Carbon sink potential - Low - Extend							-77
rotation length (1000 tC02e/y)							-11
							-13
Carbon sink potential - Low - Improve							-13
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-69
retention of HWP (1000 tC02e/y)							
Carbon sink potential - Low - Increase							-29
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-6.
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-25.
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-5.2
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-58
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-12
deforestation (1000 tC02e/y)							12
Carbon sink potential - Mid - Extend							-13
rotation length (1000 tC02e/y)							-10
							00
Carbon sink potential - Mid - Improve							-20
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-13
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-56
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4.0
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-46
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-51
productivity (1000 tCO2e/y)							٠.
and impacted for carbon sink potential -							1.
High - Accelerate regeneration (1000							1.
nectares)							
-							27.
and impacted for carbon sink potential -							27
High - Avoid deforestation (over 30 years) (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050 103
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000							10.1
hectares) Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares) Land impacted for carbon sink potential - High - Increase trees outside forests							7.93
(1000 hectares) Land impacted for carbon sink potential -							0.357
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							2.44
High - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -							25.4
High - Restore productivity (1000 hectares)							
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000							39.3
hectares) Land impacted for carbon sink potential - Low - Improve plantations (1000							5.03
hectares) Land impacted for carbon sink potential - Low - Increase retention of HWP (1000							O
hectares) Land impacted for carbon sink potential - Low - Increase trees outside forests							4.17
(1000 hectares) Land impacted for carbon sink potential -							0.179
Low - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							0.423
Low - Reforest pasture (1000 hectares) Land impacted for carbon sink potential - Low - Restore productivity (1000							15.4
hectares) Land impacted for carbon sink potential - Low - Total impacted (over 30 years)							91.2
(1000 hectares) Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000							0.85
hectares) Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years)							27
(1000 hectares) Land impacted for carbon sink potential - Mid - Extend rotation length (1000							71
hectares) Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57

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 -							0
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							6.05
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0.268
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.06
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							30.9
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							147
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 -		129	0.09	0.089	0.082	0.057	0.005
Coal (million 2019\$)							
Monetary damages from air pollution -		43.7	32.3	19.8	13.5	4.78	0.946
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		232	218	166	96.2	43.7	16.6
Transportation (million 2019\$)							
Premature deaths from air pollution -		14.6	0.01	0.01	0.009	0.006	0.001
Coal (deaths)							
Premature deaths from air pollution -		4.93	3.65	2.23	1.52	0.539	0.107
Natural Gas (deaths)							
Premature deaths from air pollution -		26.1	24.5	18.7	10.8	4.91	1.87
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 -		3,472	3,883				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	46	79.9	86.5	86.9	86.9	86.9
Resistance (%)							
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Sales of space heating units - Electric	1.53	28.2	70.6	83.7	85	85.1	85.1
Heat Pump (%)							
Sales of space heating units - Electric	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of space heating units - Gas Furnace	84.3	59.2	18.1	3.53	1.88	1.85	1.84
(%)							
Sales of water heating units - Electric	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Heat Pump (%)							
Sales of water heating units - Electric	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Resistance (%)							
Sales of water heating units - Gas Furnace	93.3	74.5	14.1	0.593	0	0	0
(%)							
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.526	0.536	0.919	0.973	0.907	0.947
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)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		0.774	0.771				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.1	60.7	93.3	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Sales of space heating units - Electric	14.3	32.1	79.9	90.6	91	91	91
Heat Pump (%)							
Sales of space heating units - Electric	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Resistance (%)							
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of water heating units - Electric	0	9.43	49.9	59	59.4	59.4	59.4
Heat Pump (%)							
Sales of water heating units - Electric	30.2	45.9	40.3	39	38.9	38.9	38.9
Resistance (%)							
Sales of water heating units - Gas Furnace	65.2	41.3	7.81	0.329	0	0	0
(%)							
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		193	496	803	1,217	1,325	1,263
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.065		0.324		1.42		2.3
units)							
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.43	1.71	1.21	0.386	0.073	0.013	0
Vehicle sales - Light-duty - EV (%)	4.31	16.4	48.3	82.5	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.2	76.6	46.9	15.8	3.2	0.587	0
Vehicle sales - Light-duty - hybrid (%)	4.8	4.82	3.34	1.23	0.301	0.066	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.333	0.194	0.06	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.092	0.059	0.021	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 40: E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	0	0	0	0.356	0.106
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0.127	0.275	0	0.217	0
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	0	0	0
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	241	321
Installed renewables - Solar - Base land use assumptions (MW)	39.8	39.8	39.8	39.8	39.8	39.8	39.8
Installed renewables - Solar - Constrained land use assumptions (MW)	39.8	39.8	164	456	456	715	715
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Wind - Constrained land use assumptions (MW)	2	2	2	2	2	2	2

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	1,008	1,348
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	75.2	75.2	75.2	75.2	75.2	75.2	75.2
Solar - Constrained land use assumptions	75.2	75.2	274	743	743	1,157	1,157
(GWh)							
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
Wind - Constrained land use assumptions	8.07	8.07	8.07	8.07	8.07	8.07	8.07
(GWh)							

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

0
-244
-6.43
-250
0
-

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-126
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-3.22
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-129
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							171
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							11.7
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							183
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							88.6
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							5.85
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							94.5
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 regeneration (1000 tCO2e/y)							-6.94
Carbon sink potential - High - All (not							-901
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-206
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-201
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-27.3
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-208
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-83.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5.4
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-85.9
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-76.6
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-3.48
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-263
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-34.3
deforestation (1000 tCO2e/y)							

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

Item Comban sink natantial Law Extend	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Extend							-77.
rotation length (1000 tCO2e/y)							10
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-69.
Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y)							-29.
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2.
Carbon sink potential - Low - Reforest							-6.5
pasture (1000 tC02e/y) Carbon sink potential - Low - Restore							-25.8
productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate							-5.2
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not							-58
counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid							-120
deforestation (1000 tCO2e/y) Carbon sink potential - Mid - Extend							-13'
rotation length (1000 tCO2e/y) Carbon sink potential - Mid - Improve							-20.4
plantations (1000 tCO2e/y) Carbon sink potential - Mid - Increase							-13
retention of HWP (1000 tC02e/y) Carbon sink potential - Mid - Increase							-56.
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4.0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-46.
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-51.
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.1
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							10
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							7.9
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.35
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.

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

Item	2020	2025	2030	2035	2040	2045	205
Land impacted for carbon sink potential -							17
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.56
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							26
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							39.
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							5.0
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							4.
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.17
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.42
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							15.
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							91
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.8
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							2
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.5
Mid - Improve plantations (1000 hectares)							
Land impacted for carbon sink potential -							
Mid - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -				T		T	6.0
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -		T	Ţ	T			0.26
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.0
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							30
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							14
Mid - Total impacted (over 30 years) (1000							
hectares)							

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Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		129	0.09	0.089	0.082	0.057	0.005
Coal (million 2019\$)							
Monetary damages from air pollution -		51.3	41.8	48.2	36.9	14.7	4.27
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		232	218	166	96.2	43.7	16.6
Transportation (million 2019\$)							
Premature deaths from air pollution -		14.6	0.01	0.01	0.009	0.006	0.001
Coal (deaths)							
Premature deaths from air pollution -		5.79	4.72	5.44	4.16	1.66	0.482
Natural Gas (deaths)							
Premature deaths from air pollution -		26.1	24.5	18.7	10.8	4.91	1.87
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		3,468	3,852				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	36.2	40.9	53.4	71	81.7	85.5
Resistance (%)							
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Sales of space heating units - Electric	1.53	20.1	24.9	38.9	61.1	76.8	82.8
Heat Pump (%)							
Sales of space heating units - Electric	1.94	8.06	8.33	9.15	10.6	12	12.8
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	4.9	4.55	3.47	1.71	0.536	0.14
Sales of space heating units - Gas Furnace	84.3	66.9	62.2	48.4	26.6	10.7	4.3
(%)							
Sales of water heating units - Electric	0.078	2.03	7.05	21.5	43.6	58.1	63.1
Heat Pump (%)							
Sales of water heating units - Electric	1.96	7.38	9.33	15.1	24	29.7	31.7
Resistance (%)							
Sales of water heating units - Gas Furnace	93.3	86.1	79.2	59.5	29.1	9.29	2.42
(%)							
Sales of water heating units - Other (%)	4.67	4.49	4.43	3.93	3.32	2.91	2.76

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		0.457	0.458	0.597	0.614	0.89	0.939
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)	29.9	29.9	29.5	28.9	28	27	26.5
Final energy use - Industry (PJ)	16	16.3	16.7	17.1	17.5	17.9	18.4
Final energy use - Residential (PJ)	41.7	39.5	38.4	37	34.6	31.5	28.6
Final energy use - Transportation (PJ)	81.5	76.4	70.2	64.9	60.8	55.9	50.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		0.769	0.798				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	49.9	51.2	55.8	67.9	84.7	95.1	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	50.1	48.8	44.2	32.1	15.3	4.94	1.33
Sales of space heating units - Electric	14.3	22.9	28.3	44	68	83.7	89.1
Heat Pump (%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric	9.9	12	11.2	9.09	5.93	3.95	3.26
Resistance (%)							
Sales of space heating units - Fossil (%)	20.5	29.9	27.8	21.5	11.8	5.49	3.29
Sales of space heating units - Gas (%)	55.3	35.2	32.6	25.4	14.2	6.89	4.33
Sales of water heating units - Electric	0	1.62	6.23	19.5	39.9	53.2	57.8
Heat Pump (%)							
Sales of water heating units - Electric	30.2	47	46.3	44.4	41.6	39.8	39.1
Resistance (%)							
Sales of water heating units - Gas Furnace	65.2	47.8	44	33.1	16.2	5.18	1.35
(%)							
Sales of water heating units - Other (%)	4.6	3.59	3.44	3	2.33	1.9	1.75

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	31.3	65.7	222	699	1,018
Cumulative 5-yr (million \$2018)							,
Public EV charging plugs - DC Fast (1000 units)	0.065		0.1		0.527		1.47
Public EV charging plugs - L2 (1000 units)	0.118		2.42		12.7		35.4
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 (%)	1.45	1.88	2.04	1.61	1.02	0.523	0.225
Vehicle sales - Light-duty - EV (%)	2.03	4.99	12.5	26.8	49.4	72.7	87.8
Vehicle sales - Light-duty - gasoline (%)	91.3	86.9	78.6	65.4	45	24.1	10.7
Vehicle sales - Light-duty - hybrid (%)	4.99	5.77	6.44	5.81	4.29	2.5	1.2
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.377	0.319	0.241	0.169	0.094	0.044
Vehicle sales - Light-duty - other (%)	0.098	0.101	0.091	0.079	0.057	0.031	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen 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 50: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

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

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	0	69.2
Conversion capital investment -		0	0	0	0	0	772
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	1
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	0	0	0	0	0
Cumulative investment - All (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	0
Trunk (km)		0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy							-25.9
grasses (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							-225
deployment - Cropland measures (1000							
tCO2e/y) Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							U
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							·
(1000 tC02e/y)							
Carbon sink potential - Aggressive							-5.61
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-257
deployment - Total (1000 tC02e/y)							25.0
Carbon sink potential - Moderate							-25.9
deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-116
deployment - Cropland measures (1000							110
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-2.8
deployment - Permanent conservation cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-145
deployment - Total (1000 tC02e/y)							-140
Land impacted for carbon sink -							13.8
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							390
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							3.07
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							0.14
Land impacted for carbon sink - Aggressive deployment - Pasture to							0.14
energy crops (1000 hectares)							
Land impacted for carbon sink -							10.2
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							417
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							13.8
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000							81.5
hectares)							
Land impacted for carbon sink - Moderate							3.07
deployment - Cropland to woody energy							0.01
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							0.14
deployment - Pasture to energy crops							
(1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation							5.1
cover (1000 hectares) Land impacted for carbon sink - Moderate							104
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
	2020	2025	2030	2035	2040	2045	-6.94
Carbon sink potential - High - Accelerate							-6.94
regeneration (1000 tC02e/y)							-901
Carbon sink potential - High - All (not							-901
counting overlap) (1000 tC02e/y)							007
Carbon sink potential - High - Avoid							-206
deforestation (1000 tC02e/y)							0.01
Carbon sink potential - High - Extend rotation length (1000 tC02e/y)							-201
Carbon sink potential - High - Improve							-27.3
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-208
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-83.5
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5.4
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-85.9
pasture (1000 tCO2e/y)							00.7
Carbon sink potential - High - Restore							-76.6
productivity (1000 tCO2e/y)							10.0
Carbon sink potential - Low - Accelerate							-3.48
regeneration (1000 tC02e/y)							0.40
Carbon sink potential - Low - All (not							-263
counting overlap) (1000 tC02e/y)							200
Carbon sink potential - Low - Avoid							-34.3
deforestation (1000 tC02e/y)							-34.3
Carbon sink potential - Low - Extend							-77.3
rotation length (1000 tCO2e/y)							-11.5
Carbon sink potential - Low - Improve							-13.9
plantations (1000 tCO2e/y)							-13.7
Carbon sink potential - Low - Increase							-69.4
retention of HWP (1000 tCO2e/y)							-09.4
Carbon sink potential - Low - Increase							-29.2
·							-29.2
trees outside forests (1000 tC02e/y)							-2.7
Carbon sink potential - Low - Reforest							-2.7
cropland (1000 tC02e/y)							/ 51
Carbon sink potential - Low - Reforest							-6.51
pasture (1000 tC02e/y)							05.0
Carbon sink potential - Low - Restore							-25.8
productivity (1000 tC02e/y)							F 01
Carbon sink potential - Mid - Accelerate							-5.21
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-581
counting overlap) (1000 tC02e/y)							
Carbon sink potential - Mid - Avoid							-120
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-139
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-20.4
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase	T	Π					-139
retention of HWP (1000 tCO2e/y)							

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

Item Cappen sink notantial Mid Increase	2020	2025	2030	2035	2040	2045	2050 -56.4
Carbon sink potential - Mid - Increase							-56.4
trees outside forests (1000 tC02e/y) Carbon sink potential - Mid - Reforest							-4.05
cropland (1000 tCO2e/y)							-4.05
Carbon sink potential - Mid - Reforest							-46.2
pasture (1000 tC02e/y)							-40.2
Carbon sink potential - Mid - Restore							-51.2
productivity (1000 tC02e/y)							-31.2
Land impacted for carbon sink potential -							1.13
High - Accelerate regeneration (1000							1.10
hectares)							
Land impacted for carbon sink potential -							27.8
High - Avoid deforestation (over 30 years)							21.0
(1000 hectares)							
Land impacted for carbon sink potential -							103
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							10.1
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 -							7.93
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.357
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							2.44
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							25.4
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							178
High - Total impacted (over 30 years)							
(1000 hectares)							0.5/3
Land impacted for carbon sink potential -							0.567
Low - Accelerate regeneration (1000							
hectares)							0/1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years)							26.1
(1000 hectares)							
Land impacted for carbon sink potential -							39.3
Low - Extend rotation length (1000							39.3
hectares)							
Land impacted for carbon sink potential -							5.03
Low - Improve plantations (1000							3.00
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							Ū
hectares)							
Land impacted for carbon sink potential -							4.17
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							0.179
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.423
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							15.4
Low - Restore productivity (1000							
hectares)							

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 - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Natural Gas (million 2019\$)		46.6	28.3	15.9	11.4	6.65	1.97
Monetary damages from air pollution - Transportation (million 2019\$)		237	240	234	212	169	116
Premature deaths from air pollution - Coal (deaths)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Natural Gas (deaths)		5.26	3.19	1.79	1.29	0.751	0.223
Premature deaths from air pollution - Transportation (deaths)		26.6	27	26.4	23.8	19	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		3,421	3,558				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	32	34.3	34.3	34.3	34.4	34.3	34.3
Resistance (%)							
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Sales of space heating units - Electric	1.53	24.1	48.5	68.4	71.7	72.1	72.1
Heat Pump (%)							
Sales of space heating units - Electric	1.94	8.79	12.8	20.1	25.2	25.9	26
Resistance (%)							
Sales of space heating units - Fossil (%)	12.2	4.76	3.52	1.51	0.221	0.018	0

Table CO. DCC accompaig	DILLAD 1. Efficiency /Floorwiff continue	0
Table 59: REE Scenorio	- PTLLAR 1 [,] Efficiency/Flectrification -	Commerciai I continuea i

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace	84.3	62.4	35.2	9.91	2.84	1.91	1.84
(%)							
Sales of water heating units - Electric	0.078	0.268	0.265	0.267	0.268	0.267	0.268
Heat Pump (%)							
Sales of water heating units - Electric	1.96	6.67	6.62	6.62	6.65	6.63	6.65
Resistance (%)							
Sales of water heating units - Gas Furnace	93.3	88.5	88.5	88.6	88.5	88.5	88.5
(%)							
Sales of water heating units - Other (%)	4.67	4.54	4.63	4.53	4.56	4.58	4.53

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		0.488	0.492	0.647	0.67	0.83	0.869

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	29.9	30.3	30.5	30.5	30.7	31.5	33.2
Final energy use - Industry (PJ)	16	16.8	17.7	18.8	20	21.3	22.7
Final energy use - Residential (PJ)	41.7	39.3	38.7	38.6	39	40	41.1
Final energy use - Transportation (PJ)	81.4	76.3	70.4	66.8	66.7	68.4	70.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.756	0.716				
Sales of cooking units - Electric Resistance (%)	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Sales of cooking units - Gas (%)	50.6	50.6	50.6	50.6	50.6	50.6	50.6
Sales of space heating units - Electric Heat Pump (%)	11.1	37.9	39.1	40.3	41.2	41.9	42.9
Sales of space heating units - Electric Resistance (%)	10.4	9.91	9.75	9.4	9.02	8.38	7.34
Sales of space heating units - Fossil (%)	21.2	21.3	11.8	7.55	7.21	7.18	7.25
Sales of space heating units - Gas (%)	57.3	30.9	39.4	42.7	42.6	42.6	42.6
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	30.2	47.2	47.2	47.1	47	47	46.9
Sales of water heating units - Gas Furnace (%)	65.2	49.1	49.2	49.2	49.3	49.4	49.4
Sales of water heating units - Other (%)	4.6	3.64	3.64	3.65	3.66	3.66	3.67

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 (%)	1.44	1.87	2.16	2.02	1.81	1.69	1.6
Vehicle sales - Light-duty - EV (%)	3.95	6.1	6.91	8.53	10.3	11.9	13.1
Vehicle sales - Light-duty - gasoline (%)	89.6	85.9	83.6	81.6	79.5	77.5	76
Vehicle sales - Light-duty - hybrid (%)	4.82	5.65	6.89	7.44	7.98	8.51	8.88

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - hydrogen FC	0.11	0.373	0.339	0.3	0.296	0.295	0.306
(%)							
Vehicle sales - Light-duty - other (%)	0.097	0.101	0.097	0.097	0.097	0.095	0.098
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
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

Carbon sink potential - High - Accelerate regeneration (1000 t022e/y) Carbon sink potential - High - All (not counting overlap) (1000 t022e/y) Carbon sink potential - High - All (not counting overlap) (1000 t022e/y) Carbon sink potential - High - Extend rotation length (1000 t022e/y) Carbon sink potential - High - Extend rotation length (1000 t022e/y) Carbon sink potential - High - Increase retention of HWP (1000 t022e/y) Carbon sink potential - High - Increase retention of HWP (1000 t022e/y) Carbon sink potential - High - Increase retention of HWP (1000 t022e/y) Carbon sink potential - High - Increase retention of HWP (1000 t022e/y) Carbon sink potential - High - Reforest cropland (1000 t022e/y) Carbon sink potential - High - Reforest cropland (1000 t022e/y) Carbon sink potential - High - Reforest pasture (1000 t022e/y) Carbon sink potential - High - Reforest pasture (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 - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Low - All (not counting overlap) (1000 t022e/y) Carbon sink potential - Low - Wall deforestation (1000 t022e/y) Carbon sink potential - Low - Wall deforestation (1000 t022e/y) Carbon sink potential - Low - Reforest palantations (1000 t022e/y) Carbon sink potential - Low - Reforest palantations (1000 t022e/y) Carbon sink potential - Low - Reforest palantations (1000 t022e/y) Carbon sink potential - Low - Reforest palantations (1000 t022e/y) Carbon sink potential - Low - Reforest palantations (1000 t022e/y) Carbon sink potential - Low - Reforest pasture (1000 t022e/y) Carbon sink potential - Low - Reforest pasture (1000 t022e/y) Carbon sink potential - Low - Reforest pasture (1000 t022e/y) Carbon sink potential - Low - Reforest pasture (1000 t022e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 t022e/y) Carbon sink potential - Mid - A	Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/v) Carbon sink potential - High - Avoid deforestation (1000 tCO2e/v) Carbon sink potential - High - Extend								-6.94
Carbon sink potential - High - Avoid deforestation (1000 tcO2e/v) Carbon sink potential - High - Extend rotation length (1000 tcO2e/v) Carbon sink potential - High - Extend rotation length (1000 tcO2e/v) Carbon sink potential - High - Improve plantations (1000 tcO2e/v) Carbon sink potential - High - Improve plantations (1000 tcO2e/v) Carbon sink potential - High - Improve plantations (1000 tcO2e/v) Carbon sink potential - High - Improve plantations (1000 tcO2e/v) Carbon sink potential - High - Improve plantations (1000 tcO2e/v) Carbon sink potential - High - Reforest plantations (1000 tcO2e/v) Carbon sink potential - High - Reforest plantations (1000 tcO2e/v) Carbon sink potential - High - Reforest plantations (1000 tcO2e/v) Carbon sink potential - High - Restore productivity (1000 tcO2e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tcO2e/v) Carbon sink potential - Low - Accelerate regeneration (1000 tcO2e/v) Carbon sink potential - Low - Ali (Inot counting overlap) (1000 tcO2e/v) Carbon sink potential - Low - Ali (Inot counting overlap) (1000 tcO2e/v) Carbon sink potential - Low - Extend rotation length (1000 tcO2e/v) Carbon sink potential - Low - Extend rotation length (1000 tcO2e/v) Carbon sink potential - Low - Extend rotation length (1000 tcO2e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tcO2e/v) Carbon sink potential - Low - Reforest plantations (1000 tcO2e/v) Carbon sink potential - Low - Reforest plantations (1000 tcO2e/v) Carbon sink potential - Low - Reforest productivity (1000 tcO2e/v) Carbon sink potential - Low - Restore productivity (1000 tcO2e/v) Carbon sink potential - Low - Restore productivity (1000 tcO2e/v) Carbon sink potential - Low - Restore productivity (1000 tcO2e/v) Carbon sink potential - Low - Restore productivity (1000 tcO2e/v) Carbon sink potential - Low - Restore productivity (1000 tcO2e/v) Carbon sink potential - Mid - Accelerate regeneration (1000 tcO2e/v) Carbon sink potential - Mid								001
Carbon sink potential - High - Avoid deforestation (1000 tC02e/v) Carbon sink potential - High - Extend -201								-901
deforestation (1000 CO2e/y) Carbon sink potential - High - Extend rotation length (1000 CO2e/y) -27.3								-206
Carbon sink potential - High - Improve 1-27.3								
Carbon sink potential - High - Improve plantations (1000 tC02e/v) Carbon sink potential - High - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - High - Increase trees outside forests (1000 tC02e/v) Carbon sink potential - High - Reforest cropland (1000 tC02e/v) Carbon sink potential - High - Reforest cropland (1000 tC02e/v) Carbon sink potential - High - Reforest productivity (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 - All (not counting overlap) (1000 tC02e/v) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/v) Carbon sink potential - Low - Avoid deforestation (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 - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Reforest cropland (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 - Low - Reforest pasture (1000 tC02e/v) Carbon sink potential - Low - Restore productivity (1000 tC02e/v) Carbon sink potential - Low - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Restore productivity (1000 tC02e/v) Carbon sink potential - High - Res								-201
Description Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - High - Reforest cropland (1000 tC02e/y) Carbon sink potential - High - Reforest pasture (1000 tC02e/y) Carbon sink potential - High - Reforest productivity (1000 tC02e/y) Carbon sink potential - High - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retens outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - All (100 tc02e/y) Carbon sink potential - Mid - All (100 tc02e/y) Carbon sink potential - Mid - All (100 tc02e/y) Carbon sink potential - Mid - All (100 tc02e/y) Carbon sink potential - Mid -								
Carbon sink potential - High - Increase retention of HWP (1000 tC02e/y)								-27.3
Retention of HWP (1000 tC02e/v) Carbon sink potential - High - Increase trees outside forests (1000 tC02e/v) Carbon sink potential - High - Reforest cropland (1000 tC02e/v) Carbon sink potential - High - Reforest pasture (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 - All (not counting overlap) (1000 tC02e/v) Carbon sink potential - Low - All (not counting overlap) (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 - Improve plantations (1000 tC02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/v) Carbon sink potential - Low - Reforest cropland (1000 tC02e/v) Carbon sink potential - Low - Reforest pool to the counting overlap) (1000 tC02e/v) Carbon sink potential - Low - Reforest pool to to to to to the counting overlap) (1000 tC02e/v) Carbon sink potential - Low - Reforest pool to the counting overlap) (1000 tC02e/v) Carbon sink potential - Low - Reforest pool to the counting overlap) (1000 tC02e/v) Carbon sink potential - Low - Restore productivity (1000 tC02e/v) Carbon sink potential - Low - Restore productivity (1000 tC02e/v) Carbon sink potential - Low - Restore productivity (1000 tC02e/v) Carbon sink potential - Mid - Avoid -581 counting overlap) (1000 tC02e/v) Carbon sink potential - Mid - Avoid -120 Carbon si								200
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - High - Reforest cropland (1000 tC02e/y) Carbon sink potential - High - Reforest soutside forests (1000 tC02e/y) Carbon sink potential - High - Reforest spasture (1000 tC02e/y) Carbon sink potential - High - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - 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 - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest rotation length (1000 tC02e/y) Carbon sink potential - Low - Reforest rotation sink potential - Low - Restore rotation sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - Avoid -120 Carbon sink potential - Mid - Avoid								-200
Trees outside forests (1000 tCO2e/y) Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) Carbon sink potential - High - Restore productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Low - Reforest poductivity (1000 tCO2e/y) Carbon sink potential - Low - Reforest poductivity (1000 tCO2e/y) Carbon sink potential - Low - Reforest productivity (1000 tCO2e/y) Carbon sink potential - Low - Reforest productivity (1000 tCO2e/y) Carbon sink potential - Low - Restore productivity (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 - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting								-83.5
Carbon sink potential - High - Reforest productivity (1000 tCO2e/y) Carbon sink potential - High - Restore productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid -34.3								
Carbon sink potential - High - Reforest pasture (1000 tC02e/y) Carbon sink potential - High - Restore productivity (1000 tC02e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Low - Aul (1not counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest consink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Reforest post ink potential - Low - Reforest post ink potential - Low - Reforest post ink potential - Low - Reforest productivity (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 - Aucclerate5.21 regeneration (1000 tC02e/y) Carbon sink potential - Mid - Alcoclerate5.21 Carbon sink potential - Mid - Alcoclerate5.21 Carbon sink potential - Mid - Alcoclerate5.21 Carbon sink potential - Mid - Alvoid120								-5.4
Pasture (1000 tCO2e/y) Carbon sink potential - High - Restore productivity (1000 tCO2e/y) Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase recessoristic forests (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Restore productivity (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 - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid -120								
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Description Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (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 - Reforest productivity (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 - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid -581 Carbon sink potential - Mid - Avoid -120 -120 -120 -120 -120 -120								74.4
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) Carbon sink potential - Low - Reforest productivity (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 - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid	'							-10.0
regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) Carbon sink potential - Low - Reforest cropland (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 - Restore productivity (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 - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid -120								-3.48
counting overlap) (1000 tC02e/y) Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (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 - Restore 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 - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid								
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deforestation (1000 tC02e/y) Carbon sink potential - Low - Extend rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (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 - 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 - 120								
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rotation length (1000 tC02e/y) Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid								77 2
Carbon sink potential - Low - Improve plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid								-11.5
plantations (1000 tC02e/y) Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y) Carbon sink potential - Low - Increase trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest pasture (1000 tC02e/y) Carbon sink potential - Low - Restore productivity (1000 tC02e/y) Carbon sink potential - Mid - Accelerate regeneration (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid								-13.9
retention of HWP (1000 tCO2e/y) Carbon sink potential - Low - Increase 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 - 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	·							
Carbon sink potential - Low - Increase trees outside forests (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 - 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								-69.4
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 - 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								
Carbon sink potential - Low - Reforest 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 - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid								-29.2
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 - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid								0.7
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								-2.1
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								-6.51
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 -120								
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 -120	Carbon sink potential - Low - Restore							-25.8
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) Carbon sink potential - Mid - Avoid	productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid -120			T					-5.21
counting overlap) (1000 tC02e/y) Carbon sink potential - Mid - Avoid								F01
Carbon sink potential - Mid - Avoid -120								-581
								-120
	deforestation (1000 tC02e/y)							120

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

Item Conhon sink notantial, Mid. Extend	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend							-139
rotation length (1000 tC02e/y)							00.7
Carbon sink potential - Mid - Improve							-20.4
plantations (1000 tCO2e/y)							400
Carbon sink potential - Mid - Increase							-139
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-56.4
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4.05
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-46.2
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-51.2
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							1.13
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							27.8
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							103
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							10.
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							7.93
High - Increase trees outside forests							1170
(1000 hectares)							
Land impacted for carbon sink potential -							0.35
High - Reforest cropland (1000 hectares)							0.00
Land impacted for carbon sink potential -							2.44
High - Reforest pasture (1000 hectares)							2.4-
Land impacted for carbon sink potential -							25.4
High - Restore productivity (1000							20.5
hectares)							
Land impacted for carbon sink potential -							178
							110
High - Total impacted (over 30 years) (1000 hectares)							
•							0.57
Land impacted for carbon sink potential -							0.56
Low - Accelerate regeneration (1000							
hectares)							0/
Land impacted for carbon sink potential -							26.
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							39.3
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							5.03
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							4.1
Low - Increase trees outside forests							
(1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							0.179
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							0.423
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							15.4
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							91.2
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							0.851
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							27
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							71
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							7.57
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 -							6.05
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							0.268
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							3.06
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							30.9
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							147
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)	-0.69		-0.314				-0.281
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.057		-0.102				-0.106
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.747		-0.416				-0.387

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		344	215	201	196	193	177
Monetary damages from air pollution - Natural Gas (million 2019\$)		36.8	41	53.9	55.9	55.9	52.3
Monetary damages from air pollution - Transportation (million 2019\$)		236	243	249	257	265	272
Premature deaths from air pollution - Coal (deaths)		38.9	24.3	22.8	22.2	21.8	19.9
Premature deaths from air pollution - Natural Gas (deaths)		4.15	4.63	6.08	6.31	6.31	5.9

Table 66: REF scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		26.6	27.3	28.1	28.9	29.8	30.6
Transportation (deaths)							