

Net-Zero America - wisconsin 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.

Data by category and subcategory

1	E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	. 1
2	E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	. 1
3	E+ scenario - PILLAR 1: Efficiency/Electrification - Overview	. 1
4	E+ scenario - PILLAR 1: Efficiency/Electrification - Residential	. 1
5	E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	. 2
6	E+ scenario - PILLAR 2: Clean Electricity - Generating capacity	. 2
7	E+ scenario - PILLAR 2: Clean Electricity - Generation	. 3
8	E+ scenario - PILLAR 3: Clean fuels - Bioenergy	. 3
9	E+ scenario - PILLAR 4: CCUS - CO2 capture	. 3
10	E+ scenario - PILLAR 4: CCUS - CO2 pipelines	. 3
11	E+ scenario - PILLAR 4: CCUS - CO2 storage	. 4
12	E+ scenario - PILLAR 6: Land sinks - Agriculture	. 4
13	E+ scenario - PILLAR 6: Land sinks - Forests	. 5
14	E+ scenario - IMPACTS - Fossil fuel industries	. 7
15	E+ scenario - IMPACTS - Health	. 7
16	E+ scenario - IMPACTS - Jobs	. 7
17	E- scenario - PILLAR 1: Efficiency/Electrification - Commercial	. 9
18	E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	. 9
19	E- scenario - PILLAR 1: Efficiency/Electrification - Overview	. 9
20	E- scenario - PILLAR 1: Efficiency/Electrification - Residential	. 9
21	E- scenario - PILLAR 1: Efficiency/Electrification - Transportation	. 10
22	E- scenario - PILLAR 6: Land sinks - Agriculture	
23	E- scenario - PILLAR 6: Land sinks - Forests	
24	E- scenario - IMPACTS - Health	
25	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	. 14
26	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand .	
27	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview	
28	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential	
29	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	
30	E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity	. 15
31	E+RE+ scenario - PILLAR 2: Clean Electricity - Generation	
32	E+RE+ scenario - PILLAR 6: Land sinks - Agriculture	
33	E+RE+ scenario - PILLAR 6: Land sinks - Forests	
34	E+RE+ scenario - IMPACTS - Health	
35	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial	
36	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	
37	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview	
38	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential	
39	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation	
40	E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity	
41	E+RE- scenario - PILLAR 2: Clean Electricity - Generation	
42	E+RE- scenario - PILLAR 6: Land sinks - Agriculture	
43	E+RE- scenario - PILLAR 6: Land sinks - Forests	. 22

44	E+RE- scenario - IMPACTS - Health	24
45	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	25
46	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	25
47	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview	25
48	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential	25
49	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	26
50	E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity	26
51	E-B+ scenario - PILLAR 2: Clean Electricity - Generation	26
52	E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy	26
53	E-B+ scenario - PILLAR 4: CCUS - CO2 capture	27
54	E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines	27
55	E-B+ scenario - PILLAR 4: CCUS - CO2 storage	27
56	E-B+ scenario - PILLAR 6: Land sinks - Agriculture	27
57	E-B+ scenario - PILLAR 6: Land sinks - Forests	29
58	E-B+ scenario - IMPACTS - Health	31
59	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial	31
60	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	32
61	REF scenario - PILLAR 1: Efficiency/Electrification - Overview	32
62	REF scenario - PILLAR 1: Efficiency/Electrification - Residential	32
63	REF scenario - PILLAR 1: Efficiency/Electrification - Transportation	32
64	REF scenario - PILLAR 6: Land sinks - Forests	33
65	REF scenario - PILLAR 6: Land sinks - Forests - REF only	35
66	REF scenario - IMPACTS - Health	35

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		19,303	21,086				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.938	6.01	29.4	77.8	88.2	89	89.1
Heat Pump (%)							
Sales of space heating units - Electric	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of space heating units - Gas Furnace	90.4	87.9	64.6	12.4	1.3	0.384	0.356
(%)							
Sales of water heating units - Electric	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Heat Pump (%)							
Sales of water heating units - Electric	2.97	4.18	16.6	44.4	50.5	51	51
Resistance (%)							
Sales of water heating units - Gas Furnace	96.6	94.3	69.4	13.2	1.05	0.035	0
(%)							
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.38	3.48	6.55	7	5.91	6.17
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)	194	191	184	171	157	146	140
Final energy use - Industry (PJ)	516	524	516	503	496	492	490
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Transportation (PJ)	508	474	413	338	271	230	212

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.31	4.14				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	51.1	61.5	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Sales of space heating units - Electric	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Heat Pump (%)							
Sales of space heating units - Electric	13.4	18.8	15	6.74	4.9	4.78	4.99
Resistance (%)							
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of water heating units - Electric	0	0.766	10.6	32.6	37.2	37.5	37.6
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.6	46.1	59	62.1	62.3	62.3
Resistance (%)							
Sales of water heating units - Gas Furnace	75.4	58.6	43.2	8.25	0.653	0.021	0
(%)							
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,089	2,796	4,523	6,855	7,457	7,112
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.143		2.06		9		14.5
units)							
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350
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 (%)	1.58	1.84	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.8	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.7	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.31	4.46	3.18	1.18	0.288	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0.104	1.36	0.29	0	0.356
Capital invested - Solar PV - Constrained (billion \$2018)		0.719	0.334	1.27	1.13	0.49	0.187
Capital invested - Wind - Base (billion \$2018)		1.17	2.17	2.36	4.1	6.87	14.1
Capital invested - Wind - Constrained (billion \$2018)		1.44	3.18	14.1	13	9.68	4.97
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	103	184	235	313	416	536	679
Installed renewables - Solar - Base land use assumptions (MW)	474	474	575	2,023	2,349	2,349	2,799
Installed renewables - Solar - Constrained land use assumptions (MW)	450	450	551	1,001	1,474	1,620	1,856
Installed renewables - Wind - Base land use assumptions (MW)	737	1,535	3,166	5,072	8,544	14,671	27,957
Installed renewables - Wind - Constrained land use assumptions (MW)	737	1,153	3,144	12,861	24,958	34,220	39,468

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	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	830	830	982	3,137	3,610	3,610	4,278
Solar - Constrained land use assumptions	788	788	940	1,604	2,290	2,508	2,859
(GWh)							
Wind - Base land use assumptions (GWh)	3,031	5,854	11,388	17,739	29,093	49,189	92,875
Wind - Constrained land use assumptions	3,031	4,416	10,931	42,907	82,017	110,217	125,604
(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	653	1,824
Conversion capital investment -		0	0	0	0	9,964	24,682
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	11	14
(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	4
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	11
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	12.8	25.1
Annual - BECCS (MMT)		0	0	0	0	12.8	25.1
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	12.8	37.9
Cumulative - BECCS (MMT)		0	0	0	0	12.8	37.9
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	176	1,528
Cumulative investment - All (million \$2018)		0	0	0	0	253	1,249
Cumulative investment - Spur (million \$2018)		0	0	0	0	253	1,249
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	176	1,528
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 sini			0000	0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							, , , , ,
Carbon sink potential - Aggressive							-4,557
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-189
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,975
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,397
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-94.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,720
deployment - Total (1000 tCO2e/y)							•
Land impacted for carbon sink -							479
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,259
Aggressive deployment - Cropland							-,
measures (1000 hectares)							
Land impacted for carbon sink -							344
Aggressive deployment - Permanent							0-1-1
conservation cover (1000 hectares)							
Land impacted for carbon sink -				+		-	4,082
Aggressive deployment - Total (1000							4,062
hectares)							
Land impacted for carbon sink - Moderate							479
deployment - Corn-ethanol to energy							417
grasses (1000 hectares)							171/
Land impacted for carbon sink - Moderate							1,716
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,367
deployment - Total (1000 hectares)							
<u>-</u>							_

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

Table 13: E+ scenario - PILLAR 6: Land sini							
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-392
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,651
trees outside forests (1000 tC02e/y)							-
Carbon sink potential - High - Reforest							-2,230
cropland (1000 tCO2e/y)							_,_00
Carbon sink potential - High - Reforest							-6,496
pasture (1000 tC02e/y)							0,470
Carbon sink potential - High - Restore							-4,219
productivity (1000 tC02e/y)							-4,219
							-197
Carbon sink potential - Low - Accelerate							-197
regeneration (1000 tC02e/y)							0.074
Carbon sink potential - Low - All (not							-9,861
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-351
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,121
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-464
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-2,121
retention of HWP (1000 tCO2e/y)							-
Carbon sink potential - Low - Increase							-578
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest						-	-1,115
cropland (1000 tC02e/y)							1,110
Carbon sink potential - Low - Reforest							-492
pasture (1000 tC02e/y)							-472
							1 / 00
Carbon sink potential - Low - Restore							-1,422
productivity (1000 tC02e/y)							201
Carbon sink potential - Mid - Accelerate							-294
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-21,170
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,227
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,624
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-680
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-4,243
retention of HWP (1000 tCO2e/y)							•
Carbon sink potential - Mid - Increase							-1,114
trees outside forests (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Reforest							-1,673
cropland (1000 tC02e/y)							-1,013
							9 / 0 /
Carbon sink potential - Mid - Reforest							-3,494
pasture (1000 tC02e/y)							0.000
Carbon sink potential - Mid - Restore							-2,820
productivity (1000 tCO2e/y)							
	-						

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

2050 64.2 285 4,144 336
285 4,144 336
4,144 336
4,144 336
4,144 336
336
336
336
C
C
(
157
147
185
1,398
6,716
32.1
267
1,588
168
С
82.5
73.7
32
846
0.0
3,089
5,557
48.1
40.

Table 13: E+ scenario - PILLAR 6: Land sinks - I	Forests (continued)	1

2025	2030	2035	2040	2045	2050
					276
					2,866
					253
					0
					120
					111
					231
					1,704
					5,608
	0 2025	0 2025 2030	0 2025 2030 2035	0 2025 2030 2035 2040	0 2025 2030 2035 2040 2045

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		420	354	284	214	135	93.3
Natural gas consumption - Cumulative							8,559
(tcf)							
Natural gas production - Annual (tcf)		0	0	0	0	0	0
Oil consumption - Annual (million bbls)		112	99.9	80.7	62.9	48.7	38
Oil consumption - Cumulative (million							2,487
bbls)							
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\$)		455	0.374	0.363	0.319	0.222	0.013
Monetary damages from air pollution - Natural Gas (million 2019\$)		134	93.8	52.9	42.8	27	12.1
Monetary damages from air pollution - Transportation (million 2019\$)		1,048	981	749	435	201	81.6
Premature deaths from air pollution - Coal (deaths)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Natural Gas (deaths)		15.1	10.6	5.97	4.84	3.05	1.37
Premature deaths from air pollution - Transportation (deaths)		118	110	84.2	49	22.6	9.18

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,079	1,220	1,016	574	900	1,821
By economic sector - Construction (jobs)		4,987	5,073	6,937	7,464	9,195	14,789
By economic sector - Manufacturing		6,804	7,976	10,231	9,740	8,396	11,665
(jobs)							
By economic sector - Mining (jobs)		2,322	1,587	1,067	687	423	269

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

Table 16: E+ scenario - IMPACTS - Jobs (co	ntinueaj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		312	344	666	704	906	1,560
By economic sector - Pipeline (jobs)		528	452	362	275	213	360
By economic sector - Professional (jobs)		2,918	2,957	3,558	4,075	6,429	11,532
By economic sector - Trade (jobs)		2,602	2,258	2,526	2,568	3,366	5,661
By economic sector - Utilities (jobs)		6,264	5,853	7,176	8,101	10,069	15,287
By education level - All sectors -		8,381	8,391	10,424	10,849	12,626	19,752
Associates degree or some college (jobs)							
By education level - All sectors -		5,788	5,658	6,651	6,822	8,148	12,964
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		177	172	197	209	293	503
degree (jobs)							
By education level - All sectors - High		12,126	12,188	14,736	14,710	16,816	26,439
school diploma or less (jobs)							
By education level - All sectors - Masters		1,345	1,309	1,531	1,597	2,015	3,285
or professional degree (jobs)							
By resource sector - Biomass (jobs)		2,792	2,909	2,325	1,396	3,327	7,932
By resource sector - CO2 (jobs)		0	0	0	0	206	1,869
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		6,660	6,987	11,146	13,349	16,356	26,106
By resource sector - Natural Gas (jobs)		5,020	4,379	3,611	3,308	3,575	2,390
By resource sector - Nuclear (jobs)		649	508	185	0	0	0
By resource sector - Oil (jobs)		4,997	4,076	3,041	2,199	1,592	1,166
By resource sector - Solar (jobs)		2,968	3,291	6,000	5,459	4,772	7,090
By resource sector - Wind (jobs)		3,376	5,199	7,231	8,477	10,071	16,390
Median wages - Annual - All (\$2019 per		60,691	60,843	61,317	62,867	64,760	65,800
iob)			00,010	0.,0		.,	55,555
On-Site or In-Plant Training - Total jobs - 1		4,344	4,328	5,338	5,538	6,451	10,081
to 4 years (jobs)		.,.	.,	5,555	7,222	,	,
On-Site or In-Plant Training - Total jobs - 4		1,677	1,637	2,023	2,147	2,617	4,140
to 10 years (jobs)		.,	,,,,,	_,====	_,	_,	.,
On-Site or In-Plant Training - Total jobs -		4,470	4,481	5,413	5,519	6,500	10,311
None (jobs)		.,	.,	5, 115	7,511	5,555	,
On-Site or In-Plant Training - Total jobs -		228	229	286	299	351	551
Over 10 years (jobs)			,		_,,		
On-Site or In-Plant Training - Total jobs -		17,098	17,044	20,479	20,684	23,980	37,861
Up to 1 year (jobs)		,070	,.	20,,	20,00	20,700	0.,00.
On-the-Job Training - All sectors - 1 to 4		5,522	5,497	6,802	7,102	8,311	12,985
years (jobs)		0,022	3, 1,7 1	0,002	1,102	0,011	12,700
On-the-Job Training - All sectors - 4 to 10		1,592	1,558	1,955	2,095	2,571	4,072
years (jobs)		1,072	.,000	1,700	2,070	2,011	.,0.2
On-the-Job Training - All sectors - None		1,509	1,487	1,775	1,786	2,097	3,347
(jobs)		1,007	1,401	1,110	1,100	2,071	0,041
On-the-Job Training - All sectors - Over 10		270	276	341	343	377	582
years (jobs)		210	210	0-11	0-10	011	002
On-the-Job Training - All sectors - Up to 1		18,925	18,900	22,666	22,862	26,542	41,957
year (jobs)		10,720	10,700	22,000	22,002	20,042	41,701
Related work experience - All sectors - 1		9,892	9,793	11,821	12,139	14,288	22,516
to 4 years (jobs)		7,072	2,1 70	11,021	12,107	14,200	22,010
Related work experience - All sectors - 4		6,290	6,233	7,587	7,865	9,254	14,555
to 10 years (jobs)		0,270	0,233	1,501	1,000	7,254	14,555
Related work experience - All sectors -		4,057	4,045	4,880	4,945	5,772	9,107
None (jobs)		4,001	4,045	4,000	4,740	3,112	7,101
Related work experience - All sectors -		1,734	1,737	0 117	2,173	0 /.00	3,869
		1,134	1,131	2,117	2,113	2,482	3,069
Over 10 years (jobs)		E 0/.E	E 010	7107	70/5	0 100	10.00/
Related work experience - All sectors - Up		5,845	5,910	7,134	7,065	8,102	12,896
to 1 year (jobs)		1/00	1 / 07	0.057	01/0	0.507	/. 1/ 0
Wage income - All (million \$2019)		1,688	1,687	2,057	2,149	2,584	4,142

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		19,301	21,085				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	0.938	4.33	5.66	9.99	20.2	33.1	40.9
Heat Pump (%)							
Sales of space heating units - Electric	3.03	3.36	3.47	3.84	4.75	5.92	6.59
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	3.12	3.01	2.66	2.19	1.88	1.77
Sales of space heating units - Gas Furnace	90.4	89.2	87.9	83.5	72.8	59.1	50.7
(%)							
Sales of water heating units - Electric	0.306	0.605	1.35	3.8	9.77	17.5	22.2
Heat Pump (%)							
Sales of water heating units - Electric	2.97	3.47	4.17	6.6	12.5	20.1	24.7
Resistance (%)							
Sales of water heating units - Gas Furnace	96.6	95.7	94.3	89.4	77.6	62.3	52.9
(%)							
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.66	2.66	3.62	3.74	5.53	5.85
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)	194	191	186	183	179	175	171
Final energy use - Industry (PJ)	516	524	517	508	504	500	498
Final energy use - Residential (PJ)	247	230	218	208	197	184	171
Final energy use - Transportation (PJ)	509	478	433	396	369	336	297

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.29	4.06				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.9	52.2	56.7	68.5	85	95.2	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	49.1	47.8	43.3	31.5	15	4.84	1.3
Sales of space heating units - Electric	3.66	7.03	8.43	13	23.5	36.7	44.5
Heat Pump (%)							
Sales of space heating units - Electric	13.4	19	18.7	17.9	16	13.7	12.5
Resistance (%)							
Sales of space heating units - Fossil (%)	9.47	16.4	16.3	15.5	14	12.3	11.1
Sales of space heating units - Gas (%)	73.5	57.5	56.6	53.6	46.4	37.4	31.9
Sales of water heating units - Electric	0	0.205	0.783	2.7	7.35	13.3	17
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.2	40.4	41.4	44.2	47.7	49.9
Resistance (%)							
Sales of water heating units - Gas Furnace	75.4	59.4	58.7	55.8	48.3	38.9	33
(%)							
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.115	0.115	0.115	0.115

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	177	370	1,251	3,933	5,731
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.143		0.646		3.34		9.32
units)							
Public EV charging plugs - L2 (1000 units)	0.459		15.5		80.4		224
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 (%)	1.6	2	2.06	1.64	1.05	0.542	0.232
Vehicle sales - Light-duty - EV (%)	1.85	4.59	11.7	25.6	48.1	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.6	79.9	67	46.6	25.1	11
Vehicle sales - Light-duty - hybrid (%)	4.47	5.28	5.94	5.42	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.381	0.328	0.251	0.179	0.099	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.104	0.108	0.098	0.086	0.062	0.034	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-4,557
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-189
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,975
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,397
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-94.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,720
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							479
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,259
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							344
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							4,082
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							479
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,716
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,367
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							-392
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,651
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,230
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,496
pasture (1000 tC02e/y)							
Carbon sink potential - High - Restore							-4,219
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-197
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,861
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-351
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,121
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-464
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-2,121
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-578
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-1,115
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-492
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-1,422
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-294
regeneration (1000 tCO2e/y)							•

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

Item Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not							-21,170
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,227
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-5,624
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-680
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-4,243
retention of HWP (1000 tC02e/y)							444
Carbon sink potential - Mid - Increase							-1,114
trees outside forests (1000 tC02e/y)							1 /70
Carbon sink potential - Mid - Reforest							-1,673
cropland (1000 tCO2e/y)							2 / 0/
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,494
Carbon sink potential - Mid - Restore							-2,820
productivity (1000 tCO2e/y)							-2,620
Land impacted for carbon sink potential -							64.2
High - Accelerate regeneration (1000							04.2
hectares)							
Land impacted for carbon sink potential -							285
High - Avoid deforestation (over 30 years)							200
(1000 hectares)							
Land impacted for carbon sink potential -							4,144
High - Extend rotation length (1000							.,
hectares)							
Land impacted for carbon sink potential -							336
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 -							157
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							147
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							185
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,398
High - Restore productivity (1000							
hectares)							/ 71/
Land impacted for carbon sink potential -							6,716
High - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							32.1
Low - Accelerate regeneration (1000							32.1
hectares)							
Land impacted for carbon sink potential -					-		267
Low - Avoid deforestation (over 30 years)							201
(1000 hectares)							
Land impacted for carbon sink potential -							1,588
Low - Extend rotation length (1000							.,555
hectares)							
Land impacted for carbon sink potential -							168
Low - Improve plantations (1000							.50
hectares)							
-							_
Land impacted for carbon sink potential -			1		l l		U
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							82.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							73.7
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							846
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,089
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							276
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,866
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							253
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 -							120
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							111
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							231
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,704
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,608
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

2020	2025	2030	2035	2040	2045	2050
	455	0.374	0.363	0.319	0.222	0.013
	126	66.5	27.2	12.7	5.01	3.96
	1,066	1,081	1,057	957	766	529
	51.4	0.042	0.041	0.036	0.025	0.001
	14.3	7.5	3.08	1.43	0.566	0.448
	120	122	119	108	86.2	59.5
	2020	455 126 1,066 51.4 14.3	126 66.5 1,066 1,081 51.4 0.042 14.3 7.5	455 0.374 0.363 126 66.5 27.2 1,066 1,081 1,057 51.4 0.042 0.041 14.3 7.5 3.08	455 0.374 0.363 0.319 126 66.5 27.2 12.7 1,066 1,081 1,057 957 51.4 0.042 0.041 0.036 14.3 7.5 3.08 1.43	455 0.374 0.363 0.319 0.222 126 66.5 27.2 12.7 5.01 1,066 1,081 1,057 957 766 51.4 0.042 0.041 0.036 0.025 14.3 7.5 3.08 1.43 0.566

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		19,303	21,086				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.938	6.01	29.4	77.8	88.2	89	89.1
Heat Pump (%)							
Sales of space heating units - Electric	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of space heating units - Gas Furnace	90.4	87.9	64.6	12.4	1.3	0.384	0.356
(%)							
Sales of water heating units - Electric	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Heat Pump (%)							
Sales of water heating units - Electric	2.97	4.18	16.6	44.4	50.5	51	51
Resistance (%)							
Sales of water heating units - Gas Furnace	96.6	94.3	69.4	13.2	1.05	0.035	0
(%)							
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.38	3.48	6.55	7	5.91	6.17
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)	194	191	184	171	157	146	140
Final energy use - Industry (PJ)	516	524	516	503	496	492	490
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Transportation (PJ)	508	474	413	338	271	230	212

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.31	4.14				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	51.1	61.5	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Sales of space heating units - Electric	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Heat Pump (%)							
Sales of space heating units - Electric	13.4	18.8	15	6.74	4.9	4.78	4.99
Resistance (%)							
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of water heating units - Electric	0	0.766	10.6	32.6	37.2	37.5	37.6
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.6	46.1	59	62.1	62.3	62.3
Resistance (%)							
Sales of water heating units - Gas Furnace	75.4	58.6	43.2	8.25	0.653	0.021	0
(%)							
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,089	2,796	4,523	6,855	7,457	7,112
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.143		2.06		9		14.5
units)							
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350
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 (%)	1.58	1.84	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.8	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.7	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.31	4.46	3.18	1.18	0.288	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion		0	0.207	0.28	0.969	0.509	7.33
\$2018)							
Capital invested - Wind - Base (billion		1.23	2.48	3.09	9.85	22.7	26.9
\$2018)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Base land use assumptions (MW)							
Installed renewables - OffshoreWind -	0	0	0	0	0	0	0
Constrained land use assumptions (MW)							
Installed renewables - Solar - Base land	474	474	676	974	2,065	2,673	11,931
use assumptions (MW)							
Installed renewables - Solar -	947	947	1,870	3,872	4,615	4,615	28,397
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	737	1,576	3,438	5,930	14,266	34,531	59,967
use assumptions (MW)							
Installed renewables - Wind - Constrained	1,475	2,500	8,138	34,914	67,408	78,980	96,983
land use assumptions (MW)							

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	830	830	1,132	1,576	3,192	4,095	17,860
Solar - Constrained land use assumptions	1,659	1,659	3,024	5,982	7,085	7,085	42,496
(GWh)							
Wind - Base land use assumptions (GWh)	3,031	5,991	12,295	20,551	47,859	114,530	195,827
Wind - Constrained land use assumptions	6,062	9,467	27,943	116,150	217,377	250,814	309,441
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-4,557
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-189
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,975
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,397
deployment - Cropland measures (1000							,-
tCO2e/y)							
Carbon sink potential - Moderate							-94.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,720
deployment - Total (1000 tC02e/y)							0,120
Land impacted for carbon sink -						+	479
Aggressive deployment - Corn-ethanol to							717
energy grasses (1000 hectares)							
Land impacted for carbon sink -						+	3,259
Aggressive deployment - Cropland							0,207
measures (1000 hectares)							
Land impacted for carbon sink -						+	344
Aggressive deployment - Permanent							344
conservation cover (1000 hectares)							/ 000
Land impacted for carbon sink -							4,082
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							479
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,716
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,367
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							-392
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-1,65
trees outside forests (1000 tC02e/y)							0.007
Carbon sink potential - High - Reforest cropland (1000 tC02e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,496
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,219
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)							-19
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,86
Carbon sink potential - Low - Avoid deforestation (1000 tC02e/y)							-35
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,12
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tC02e/y)							-2,12
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,11
Carbon sink potential - Low - Reforest pasture (1000 tC02e/y)							-49
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,42
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-29
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-21,17
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,22
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,62
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-68
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,24
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,11
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,67
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,49
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,82
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							28
(1000 hectares) Land impacted for carbon sink potential - High - Extend rotation length (1000							4,14
hectares) Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							33

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
High - Increase retention of HWP (1000							
hectares)							157
Land impacted for carbon sink potential - High - Increase trees outside forests							157
(1000 hectares)							
Land impacted for carbon sink potential -							147
High - Reforest cropland (1000 hectares)							141
Land impacted for carbon sink potential -							185
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,398
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,716
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							32.1
Low - Accelerate regeneration (1000							
hectares)							0/7
Land impacted for carbon sink potential -							267
Low - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							1,588
Low - Extend rotation length (1000							1,500
hectares)							
Land impacted for carbon sink potential -							168
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 -							82.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							73.7
Low - Reforest cropland (1000 hectares)							20
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential -							846
Low - Restore productivity (1000							040
hectares)							
Land impacted for carbon sink potential -							3,089
Low - Total impacted (over 30 years)							0,007
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							276
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,866
Mid - Extend rotation length (1000							
hectares)							050
Land impacted for carbon sink potential -							253
Mid - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -		+					120
Mid - Increase trees outside forests (1000							120
hectares)							

Table 33: E+RE+	. cronaria -	DTII AD A	I and cinke -	Forests	(continued)
14018 33. E+KE+	· SCEHUITO -	PILLAR O.	LUHU SHIKS -	FULESTS	COMUNICEUR

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							111
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							231
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,704
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,608
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 -		455	0.374	0.363	0.319	0.222	0.013
Coal (million 2019\$)							
Monetary damages from air pollution -		120	71.9	35	23.8	9.59	3.96
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,048	981	749	435	201	81.6
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.4	0.042	0.041	0.036	0.025	0.001
Coal (deaths)							
Premature deaths from air pollution -		13.5	8.12	3.95	2.69	1.08	0.447
Natural Gas (deaths)							
Premature deaths from air pollution -		118	110	84.2	49	22.6	9.18
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 -		19,303	21,086				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.938	6.01	29.4	77.8	88.2	89	89.1
Heat Pump (%)							
Sales of space heating units - Electric	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of space heating units - Gas Furnace	90.4	87.9	64.6	12.4	1.3	0.384	0.356
(%)							
Sales of water heating units - Electric	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Heat Pump (%)							
Sales of water heating units - Electric	2.97	4.18	16.6	44.4	50.5	51	51
Resistance (%)							
Sales of water heating units - Gas Furnace	96.6	94.3	69.4	13.2	1.05	0.035	0
(%)							
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.38	3.48	6.55	7	5.91	6.17
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)	194	191	184	171	157	146	140

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	516	524	516	503	496	492	490
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Transportation (PJ)	508	474	413	338	271	230	212

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.31	4.14				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	51.1	61.5	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Sales of space heating units - Electric	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Heat Pump (%)							
Sales of space heating units - Electric	13.4	18.8	15	6.74	4.9	4.78	4.99
Resistance (%)							
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of water heating units - Electric	0	0.766	10.6	32.6	37.2	37.5	37.6
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.6	46.1	59	62.1	62.3	62.3
Resistance (%)							
Sales of water heating units - Gas Furnace	75.4	58.6	43.2	8.25	0.653	0.021	0
(%)							
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		1,089	2,796	4,523	6,855	7,457	7,112
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.143		2.06		9		14.5
units)							
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350
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 (%)	1.58	1.84	1.27	0.407	0.075	0.013	0
Vehicle sales - Light-duty - EV (%)	3.8	14.8	45.9	81.6	96.3	99.3	100
Vehicle sales - Light-duty - gasoline (%)	90.1	78.4	49.4	16.7	3.32	0.591	0
Vehicle sales - Light-duty - hybrid (%)	4.31	4.46	3.18	1.18	0.288	0.063	0
Vehicle sales - Light-duty - hydrogen FC	0.111	0.342	0.206	0.064	0.013	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.103	0.099	0.065	0.023	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0.075	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.095	0.11	0.273	0
Capital invested - Wind - Base (billion \$2018)		1.09	0.945	0.889	1.06	1.88	0.039
Capital invested - Wind - Constrained (billion \$2018)		0.324	0.812	2.3	3.78	11.6	0.156
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	474	474	474	474	474	564	564
Installed renewables - Solar - Constrained land use assumptions (MW)	474	474	474	575	698	1,025	1,025
Installed renewables - Wind - Base land use assumptions (MW)	737	1,479	2,188	2,904	3,804	5,477	5,514
Installed renewables - Wind - Constrained land use assumptions (MW)	737	957	1,568	3,421	6,617	16,940	17,087

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

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use	0	0	0	0	0	0	0
assumptions (GWh)							
OffshoreWind - Constrained land use	0	0	0	0	0	0	0
assumptions (GWh)							
Solar - Base land use assumptions (GWh)	830	830	830	830	830	962	962
Solar - Constrained land use assumptions	830	830	830	982	1,166	1,645	1,645
(GWh)							
Wind - Base land use assumptions (GWh)	3,031	5,681	8,106	10,556	13,566	19,104	19,223
Wind - Constrained land use assumptions	3,031	3,784	5,782	11,836	22,371	56,384	56,867
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-4,557
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-189
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-5,975
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,228
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-2,397
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-94.6
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,720
deployment - Total (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink -							479
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							3,259
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							344
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							4,082
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							479
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,716
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							172
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,367
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							-392
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,651
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,230
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,496
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,219
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-197
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,861
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-351
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,121
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-464
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-2,121
retention of HWP (1000 tCO2e/y)							•
Carbon sink potential - Low - Increase							-578
trees outside forests (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	205
Carbon sink potential - Low - Reforest							-1,11
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-49
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-1,42
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-29
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-21,17
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,22
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-5,62
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-68
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-4,24
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,11
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-1,67
cropland (1000 tCO2e/y)							•
Carbon sink potential - Mid - Reforest							-3,49
pasture (1000 tCO2e/y)							-,
Carbon sink potential - Mid - Restore							-2,82
productivity (1000 tCO2e/y)							_,
and impacted for carbon sink potential -							64
High - Accelerate regeneration (1000							0-1
hectares)							
Land impacted for carbon sink potential -							28
High - Avoid deforestation (over 30 years)							20
(1000 hectares)							
Land impacted for carbon sink potential -							4,14
High - Extend rotation length (1000							4,14
nectares)							
Land impacted for carbon sink potential -							33
High - Improve plantations (1000							33
nectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
nectares)							4.5
Land impacted for carbon sink potential -							15
High - Increase trees outside forests							
(1000 hectares)							
and impacted for carbon sink potential -							14
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							18
High - Reforest pasture (1000 hectares)							
and impacted for carbon sink potential -							1,39
High - Restore productivity (1000							
nectares)							
and impacted for carbon sink potential -							6,7
High - Total impacted (over 30 years)							
1000 hectares)							
and impacted for carbon sink potential -							32
ow - Accelerate regeneration (1000							
nectares)							
and impacted for carbon sink potential -							26
Low - Avoid deforestation (over 30 years)							
1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1,588
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							168
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 -							82.5
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							73.7
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							846
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,089
Low - Total impacted (over 30 years)							,
(1000 hectares)							
Land impacted for carbon sink potential -							48.1
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							276
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,866
Mid - Extend rotation length (1000							_,000
hectares)							
Land impacted for carbon sink potential -							253
Mid - Improve plantations (1000 hectares)							200
Land impacted for carbon sink potential -						+	0
Mid - Increase retention of HWP (1000							J
hectares)							
Land impacted for carbon sink potential -						+	120
Mid - Increase trees outside forests (1000							120
hectares)							
Land impacted for carbon sink potential -	+					+	111
Mid - Reforest cropland (1000 hectares)							1111
Land impacted for carbon sink potential -							231
Mid - Reforest pasture (1000 hectares)							231
							170/
Land impacted for carbon sink potential -							1,704
Mid - Restore productivity (1000							
hectares)							F (00
Land impacted for carbon sink potential -							5,608
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		455	0.374	0.363	0.319	0.222	0.013
Coal (million 2019\$)							
Monetary damages from air pollution -		139	97.1	147	108	38.6	14.8
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,048	981	749	435	201	81.6
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.4	0.042	0.041	0.036	0.025	0.001
Coal (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		15.7	11	16.6	12.2	4.36	1.67
Natural Gas (deaths)							
Premature deaths from air pollution -		118	110	84.2	49	22.6	9.18
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 -		19,301	21,085				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	0.938	4.33	5.66	9.99	20.2	33.1	40.9
Heat Pump (%)							
Sales of space heating units - Electric	3.03	3.36	3.47	3.84	4.75	5.92	6.59
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	3.12	3.01	2.66	2.19	1.88	1.77
Sales of space heating units - Gas Furnace	90.4	89.2	87.9	83.5	72.8	59.1	50.7
(%)							
Sales of water heating units - Electric	0.306	0.605	1.35	3.8	9.77	17.5	22.2
Heat Pump (%)							
Sales of water heating units - Electric	2.97	3.47	4.17	6.6	12.5	20.1	24.7
Resistance (%)							
Sales of water heating units - Gas Furnace	96.6	95.7	94.3	89.4	77.6	62.3	52.9
(%)							
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		2.66	2.66	3.62	3.74	5.53	5.85
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)	194	191	186	183	179	175	171
Final energy use - Industry (PJ)	516	524	517	508	504	500	498
Final energy use - Residential (PJ)	247	230	218	208	197	184	171
Final energy use - Transportation (PJ)	509	478	433	396	369	336	297

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.29	4.06				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.9	52.2	56.7	68.5	85	95.2	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	49.1	47.8	43.3	31.5	15	4.84	1.3
Sales of space heating units - Electric	3.66	7.03	8.43	13	23.5	36.7	44.5
Heat Pump (%)							
Sales of space heating units - Electric	13.4	19	18.7	17.9	16	13.7	12.5
Resistance (%)							
Sales of space heating units - Fossil (%)	9.47	16.4	16.3	15.5	14	12.3	11.1
Sales of space heating units - Gas (%)	73.5	57.5	56.6	53.6	46.4	37.4	31.9
Sales of water heating units - Electric	0	0.205	0.783	2.7	7.35	13.3	17
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.2	40.4	41.4	44.2	47.7	49.9
Resistance (%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	75.4	59.4	58.7	55.8	48.3	38.9	33
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.115	0.115	0.115	0.115

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million \$2018)		0	177	370	1,251	3,933	5,731
Public EV charging plugs - DC Fast (1000	0.143		0.646		3.34		9.32
units)							
Public EV charging plugs - L2 (1000 units)	0.459		15.5		80.4		224
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 (%)	1.6	2	2.06	1.64	1.05	0.542	0.232
Vehicle sales - Light-duty - EV (%)	1.85	4.59	11.7	25.6	48.1	71.8	87.5
Vehicle sales - Light-duty - gasoline (%)	91.9	87.6	79.9	67	46.6	25.1	11
Vehicle sales - Light-duty - hybrid (%)	4.47	5.28	5.94	5.42	4.08	2.42	1.18
Vehicle sales - Light-duty - hydrogen FC	0.113	0.381	0.328	0.251	0.179	0.099	0.046
(%)							
Vehicle sales - Light-duty - other (%)	0.104	0.108	0.098	0.086	0.062	0.034	0.016
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	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	2,034	3,688
Conversion capital investment -		0	0	0	0	21,604	18,471
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Beccs hydrogen	0	0	0	0	0	25	28
(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	16
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	27.8	31.1
Annual - BECCS (MMT)		0	0	0	0	27.8	31.1
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	27.8	58.9
Cumulative - BECCS (MMT)		0	0	0	0	27.8	58.9
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	583	380
Cumulative investment - All (million \$2018)		0	0	0	0	928	788
Cumulative investment - Spur (million \$2018)		0	0	0	0	928	788
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Spur (km)		0	0	0	0	583	380
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 grasses (1000 tCO2e/y)							-1,571
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,130
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							
(1000 tCO2e/y)							170
Carbon sink potential - Aggressive							-170
deployment - Permanent conservation							
cover (1000 tC02e/y)							- 070
Carbon sink potential - Aggressive							-5,872
deployment - Total (1000 tCO2e/y)							4 574
Carbon sink potential - Moderate							-1,571
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							0.470
Carbon sink potential - Moderate							-2,172
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-85.2
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,828
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							798
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							7,286
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							33.6
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							137
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							310
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							8,565
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							798
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,553
deployment - Cropland measures (1000							.,
hectares)							
Land impacted for carbon sink - Moderate							33.6
deployment - Cropland to woody energy							00.0
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							137
deployment - Pasture to energy crops							101
(1000 hectares)							
Land impacted for carbon sink - Moderate							155
deployment - Permanent conservation							וטט
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							2,677
							2,011
deployment - Total (1000 hectares)							

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

Table 57: E-B+ scenario - PILLAR 6: Land s			0000	0005	00/0	00/5	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-392
regeneration (1000 tCO2e/y)							00 / 05
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tC02e/y)							0.107
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tC02e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,651
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-2,230
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-6,496
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-4,219
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-197
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-9,861
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-351
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-3,121
rotation length (1000 tCO2e/y)							,
Carbon sink potential - Low - Improve							-464
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-2,121
retention of HWP (1000 tCO2e/y)							_,
Carbon sink potential - Low - Increase							-578
trees outside forests (1000 tC02e/y)							0.0
Carbon sink potential - Low - Reforest							-1,115
cropland (1000 tCO2e/y)							1,110
Carbon sink potential - Low - Reforest							-492
pasture (1000 tC02e/y)							772
Carbon sink potential - Low - Restore		+					-1,422
productivity (1000 tC02e/y)							-1,422
Carbon sink potential - Mid - Accelerate							-294
regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - All (not							-21,170
counting overlap) (1000 tC02e/y)							-21,170
Carbon sink potential - Mid - Avoid							1.007
·							-1,227
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-5,624
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-680
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-4,243
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-1,114
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,673
cropland (1000 tCO2e/y)	<u> </u>						
Carbon sink potential - Mid - Reforest							-3,494
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-2,820
productivity (1000 tCO2e/y)							
•				I			

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Accelerate regeneration (1000							64.2
hectares) Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							285
(1000 hectares) Land impacted for carbon sink potential -							4,144
High - Extend rotation length (1000 hectares)							00/
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares) Land impacted for carbon sink potential -							157
High - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years)							6,716
(1000 hectares) Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							32.1
hectares) Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years)							267
(1000 hectares) Land impacted for carbon sink potential - Low - Extend rotation length (1000							1,588
hectares) Land impacted for carbon sink potential - Low - Improve plantations (1000							168
hectares) Land impacted for carbon sink potential - Low - Increase retention of HWP (1000							0
hectares) Land impacted for carbon sink potential - Low - Increase trees outside forests							82.5
(1000 hectares) Land impacted for carbon sink potential -							73.7
Low - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							32
Low - Reforest pasture (1000 hectares) Land impacted for carbon sink potential - Low - Restore productivity (1000							846
hectares) Land impacted for carbon sink potential - Low - Total impacted (over 30 years)							3,089
(1000 hectares) Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000							48.1
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 -							276
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,866
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							253
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 -							120
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							111
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							231
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,704
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,608
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		455	0.374	0.363	0.319	0.222	0.013
Coal (million 2019\$)							
Monetary damages from air pollution -		127	59.8	34	22.1	10.4	4.7
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,066	1,081	1,057	957	766	529
Transportation (million 2019\$)							
Premature deaths from air pollution -		51.4	0.042	0.041	0.036	0.025	0.001
Coal (deaths)							
Premature deaths from air pollution -		14.3	6.76	3.84	2.49	1.18	0.53
Natural Gas (deaths)							
Premature deaths from air pollution -		120	122	119	108	86.2	59.5
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		19,095	19,795				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	44.2	44.3	44.3	44.3	44.4	44.5
Resistance (%)							
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Sales of space heating units - Electric	0.938	11.3	43.3	70.2	74.9	75.5	75.5
Heat Pump (%)							
Sales of space heating units - Electric	3.03	4.33	9.16	17.5	23.2	24.1	24.1
Resistance (%)							
Sales of space heating units - Fossil (%)	5.62	2.84	1.46	0.267	0.031	0.001	0
Sales of space heating units - Gas Furnace	90.4	81.6	46.1	12	1.88	0.453	0.355
(%)							
Sales of water heating units - Electric	0.306	0.343	0.347	0.346	0.34	0.342	0.342
Heat Pump (%)							
Sales of water heating units - Electric	2.97	3.21	3.18	3.19	3.17	3.16	3.16
Resistance (%)							

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

•••			•	•			
Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	96.6	96.3	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		3.26	3.34	4.1	4.26	3.93	4.03
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	193	194	192	189	185	185	190
Final energy use - Industry (PJ)	516	542	554	566	585	606	631
Final energy use - Residential (PJ)	247	231	221	214	209	206	203
Final energy use - Transportation (PJ)	508	478	436	411	410	422	438

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		3.19	3.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.5	50.5	50.5	50.5	50.5	50.5	50.5
Resistance (%)							
Sales of cooking units - Gas (%)	49.5	49.5	49.5	49.5	49.5	49.5	49.5
Sales of space heating units - Electric	2.81	10.6	10.9	11.5	12	12.6	13.4
Heat Pump (%)							
Sales of space heating units - Electric	13.5	18.3	18.1	17.9	17.4	16.8	16.1
Resistance (%)							
Sales of space heating units - Fossil (%)	9.72	15.4	14.9	14.5	14.5	14.6	14.5
Sales of space heating units - Gas (%)	74	55.7	56	56.1	56	56.1	56
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	24.6	40.1	39.9	39.8	39.9	39.7	39.7
Resistance (%)							
Sales of water heating units - Gas Furnace	75.4	59.8	60	60	60	60.1	60.2
(%)							
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.116	0.115	0.116	0.116

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 (%)	1.59	2	2.19	2.04	1.84	1.71	1.63
Vehicle sales - Light-duty - EV (%)	3.45	5.45	6.22	7.64	9.32	10.8	12
Vehicle sales - Light-duty - gasoline (%)	90.4	86.9	84.8	83	80.9	79	77.4
Vehicle sales - Light-duty - hybrid (%)	4.33	5.18	6.35	6.92	7.49	8.09	8.56
Vehicle sales - Light-duty - hydrogen FC	0.111	0.378	0.348	0.309	0.307	0.308	0.318
(%)							
Vehicle sales - Light-duty - other (%)	0.104	0.107	0.104	0.104	0.104	0.103	0.105
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

Table 64: REF scenario - PILLAR 6: Land sinks - Forests

Table 64: REF scenario - PILLAR 6: Land si							
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-392
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-32,495
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,104
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-8,126
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-912
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-6,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,651
trees outside forests (1000 tC02e/y)							•
Carbon sink potential - High - Reforest							-2,230
cropland (1000 tCO2e/y)							_,
Carbon sink potential - High - Reforest							-6,496
pasture (1000 tC02e/y)							0, 170
Carbon sink potential - High - Restore							-4,219
productivity (1000 tCO2e/y)							.,,
Carbon sink potential - Low - Accelerate							-19 ⁻
regeneration (1000 tC02e/y)							-17
Carbon sink potential - Low - All (not							-9,86
counting overlap) (1000 tC02e/y)							-7,00
Carbon sink potential - Low - Avoid							-35
deforestation (1000 tC02e/y)							-33
Carbon sink potential - Low - Extend							-3,12
rotation length (1000 tCO2e/y)							-5,12
Carbon sink potential - Low - Improve							-464
plantations (1000 tCO2e/y)							-404
Carbon sink potential - Low - Increase							-2,12
retention of HWP (1000 tC02e/y)							-2,12
Carbon sink potential - Low - Increase							-578
trees outside forests (1000 tC02e/y)							-576
							1 111
Carbon sink potential - Low - Reforest							-1,115
cropland (1000 tCO2e/y)							/ 0/
Carbon sink potential - Low - Reforest							-49
pasture (1000 tC02e/y)							1 / 0/
Carbon sink potential - Low - Restore							-1,422
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-294
regeneration (1000 tC02e/y)							
Carbon sink potential - Mid - All (not							-21,170
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,22
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend		Τ	T			T	-5,624
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-680
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-4,243
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,114
Carbon sink potential - Mid - Reforest							-1,673
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-3,494
pasture (1000 tC02e/y) Carbon sink potential - Mid - Restore							-2,820
productivity (1000 tCO2e/y)							-2,620
Land impacted for carbon sink potential -							64.2
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							285
(1000 hectares)							
Land impacted for carbon sink potential -							4,144
High - Extend rotation length (1000							•
hectares)							
Land impacted for carbon sink potential -							336
High - Improve plantations (1000							
hectares) Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							157
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							147
High - Reforest cropland (1000 hectares) Land impacted for carbon sink potential -							185
High - Reforest pasture (1000 hectares)							100
Land impacted for carbon sink potential -							1,398
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,716
High - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							32.1
Low - Accelerate regeneration (1000							02.1
hectares)							
Land impacted for carbon sink potential -							267
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							1.500
Land impacted for carbon sink potential - Low - Extend rotation length (1000							1,588
hectares)							
Land impacted for carbon sink potential -							168
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 -							82.5
Low - Increase trees outside forests							02.0
(1000 hectares)							
Land impacted for carbon sink potential -							73.7
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							32
Low - Reforest pasture (1000 hectares) Land impacted for carbon sink potential -						-	846
Low - Restore productivity (1000							046
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608

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)	-24.8		-14.9				-13.3
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.73		-3.12				-3.24
Business-as-usual carbon sink - Total (Mt CO2e/y)	-26.6		-18				-16.5

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		1,513	876	595	488	439	427
Coal (million 2019\$)							
Monetary damages from air pollution -		145	141	187	144	123	110
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		1,065	1,095	1,126	1,163	1,201	1,239
Transportation (million 2019\$)							
Premature deaths from air pollution -		171	99	67.2	55.1	49.6	48.2
Coal (deaths)							
Premature deaths from air pollution -		16.4	15.9	21.1	16.2	13.9	12.5
Natural Gas (deaths)							
Premature deaths from air pollution -		120	123	127	131	135	139
Transportation (deaths)							