

# Net-Zero America - idaho 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 <a href="https://netzeroamerica.princeton.edu">https://netzeroamerica.princeton.edu</a>.

#### Notes

- These data are all data from the study available at <a href="https://netzeroamerica.prince-ton.edu">https://netzeroamerica.prince-ton.edu</a>.
- 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 -		4,239	4,716				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	54.6	83	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	3.53	8.34	31.3	81.3	90.2	90.7	90.8
Heat Pump (%)							
Sales of space heating units - Electric	3.3	3.52	4.98	8.12	8.7	8.74	8.73
Resistance (%)							
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace	92.1	87.9	63.7	10.6	1.11	0.511	0.508
(%)							
Sales of water heating units - Electric	0.03	1.08	14.4	43.7	48.9	49.2	49.2
Heat Pump (%)							
Sales of water heating units - Electric	1.46	2.52	15.8	44.9	50.1	50.4	50.4
Resistance (%)							
Sales of water heating units - Gas Furnace	98.1	96	69.4	11.1	0.657	0	0
(%)							
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.28	1.35	2.22	2.38	2.18	2.3
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)	49	49.1	48.2	46	43.3	41.4	40.7
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.25	1.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.7	69.9	94.8	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric	9.46	20.4	40.3	80.7	88.3	89	88.8
Heat Pump (%)							
Sales of space heating units - Electric	10.7	17	13.5	5.83	4.48	4.43	4.48
Resistance (%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric	0	0.814	11.1	33.7	37.7	38	38
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.7	43.2	57.2	59.8	59.9	59.9
Resistance (%)							
Sales of water heating units - Gas Furnace	76.7	60.4	43.6	6.97	0.411	0	0
(%)							
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		361	924	1,498	2,269	2,469	2,354
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.066		0.688		3.02		4.88
units)							
Public EV charging plugs - L2 (1000 units)	0.128		16.6		72.7		118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.36	0.233	0.074	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	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	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.002	0	0	0	0	0
Capital invested - Wind - Base (billion \$2018)		0	17.1	6.28	5.04	5.17	0.609
Capital invested - Wind - Constrained (billion \$2018)		0	14.8	7.01	7.45	5.78	0.297
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)	393	606	810	1,055	1,347	1,687	2,089
Installed renewables - Solar - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Wind - Base land use assumptions (MW)	952	952	13,786	18,850	23,115	27,723	28,298
Installed renewables - Wind - Constrained land use assumptions (MW)	1,034	1,034	12,987	18,481	25,008	30,182	30,390

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)	4.27	4.27	4.27	4.27	4.27	4.27	4.27
Solar - Constrained land use assumptions	0	0	0	0	0	0	0
(GWh)							
Wind - Base land use assumptions (GWh)	3,041	3,041	41,571	55,922	67,439	79,837	81,354
Wind - Constrained land use assumptions	3,306	3,306	37,783	52,357	68,321	80,402	80,877
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	0	55.2
Conversion capital investment -		0	0	0	0	0	871
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	0	0	0	3
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	0
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	1.08
Annual - BECCS (MMT)		0	0	0	0	0	1.08
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	1.08
Cumulative - BECCS (MMT)		0	0	0	0	0	1.08
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	177	177	177	508
Cumulative investment - All (million \$2018)		0	0	423	423	423	606
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	183
Cumulative investment - Trunk (million \$2018)		0	0	423	423	423	423
Spur (km)		0	0	0	0	0	332
Trunk (km)		0	0	177	177	177	177

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

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

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

Table 12: E+ Scenario - PILLAR 6: Land Sink			0000	0005	0010	0015	0050
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-1,914
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-62.8
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-1,976
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-972
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-31.4
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,003
deployment - Total (1000 tCO2e/y)							,
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							2,284
Aggressive deployment - Cropland							2,20
measures (1000 hectares)							
Land impacted for carbon sink -							104
Aggressive deployment - Permanent							104
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,387
Aggressive deployment - Total (1000							2,301
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							U
grasses (1000 hectares)							11/0
Land impacted for carbon sink - Moderate							1,168
deployment - Cropland measures (1000							
hectares)							F4 ^
Land impacted for carbon sink - Moderate							51.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,220
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-4,423
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							, , , , , ,
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tC02e/y)							000
Carbon sink potential - High - Improve							-290
plantations (1000 tC02e/y)  Carbon sink potential - High - Increase							-4,259
retention of HWP (1000 tCO2e/y)							-4,239
Carbon sink potential - High - Increase							-812
trees outside forests (1000 tC02e/y)							-012
Carbon sink potential - High - Reforest							-5,953
cropland (1000 tCO2e/y)							0,700
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tCO2e/y)							0,000
Carbon sink potential - High - Restore							-6,761
productivity (1000 tCO2e/y)							-, -
Carbon sink potential - Low - Accelerate							-2,216
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-11,479
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-132
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tC02e/y)							
Carbon sink potential - Low - Improve							-148
plantations (1000 tC02e/y)							
Carbon sink potential - Low - Increase							-1,420
retention of HWP (1000 tC02e/y)							007
Carbon sink potential - Low - Increase							-284
trees outside forests (1000 tC02e/y) Carbon sink potential - Low - Reforest							-2,977
cropland (1000 tC02e/y)							-2,911
Carbon sink potential - Low - Reforest							-233
pasture (1000 tCO2e/y)							-233
Carbon sink potential - Low - Restore							-2,279
productivity (1000 tCO2e/y)							2,217
Carbon sink potential - Mid - Accelerate							-3,320
regeneration (1000 tCO2e/y)							-,
Carbon sink potential - Mid - All (not							-21,253
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Mid - Avoid							-463
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-3,224
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-217
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,839
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-548
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Mid - Reforest							-4,465
cropland (1000 tC02e/y)							4 / = /
Carbon sink potential - Mid - Reforest							-1,656
pasture (1000 tC02e/y)							/ [00
Carbon sink potential - Mid - Restore							-4,520
productivity (1000 tCO2e/y)							

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

Table 13: E+ scenario - PILLAR 6: Land sink		·					
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							724
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							107
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,376
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							107
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 -							77.2
High - Increase trees outside forests							–
(1000 hectares)							
Land impacted for carbon sink potential -							394
High - Reforest cropland (1000 hectares)							074
Land impacted for carbon sink potential -							87.5
High - Reforest pasture (1000 hectares)							61.5
							0.0/1
Land impacted for carbon sink potential -							2,241
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,113
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							362
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							101
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							910
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							53.5
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -	+						0
Low - Increase retention of HWP (1000							J
hectares)							
Land impacted for carbon sink potential -							40.6
Low - Increase trees outside forests							40.0
(1000 hectares)							
,							107
Land impacted for carbon sink potential -							197
Low - Reforest cropland (1000 hectares)							15.0
Land impacted for carbon sink potential -							15.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,356
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,035
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							543
Mid - Accelerate regeneration (1000							

Tahla 13. Fx	econario -	DTIIAP 6.	Land sinks -	Forests	(continued)
14016 12: E+	scenuro -	PILLAR O.	Luiiu Siiiks -	Furests	lconunueur

2020	2025	2030	2035	2040	2045	2050
						104
						1,643
						80.5
						0
						58.9
						295
						110
						2,731
						5,565
	2020	2020 2025	2020 2025 2030	2020 2025 2030 2035	2020 2025 2030 2035 2040	2020 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)		86.5	72.9	58.5	44	27.7	19.2
Natural gas consumption - Cumulative (tcf)							1,761
Natural gas production - Annual (tcf)		2.13	2.02	1.76	1.48	1.18	0.915
Oil consumption - Annual (million bbls)		31.7	27.2	20.5	14.1	9.1	4.81
Oil consumption - Cumulative (million bbls)							629
Oil production - Annual (million bbls)		0.114	0.114	0.114	0.091	0.074	0.049

#### Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		42.2	0.049	0.048	0.042	0.027	0
Monetary damages from air pollution - Natural Gas (million 2019\$)		12.5	7.09	5.76	5.23	3.46	1.91
Monetary damages from air pollution - Transportation (million 2019\$)		125	120	93.3	54.7	25	9.4
Premature deaths from air pollution - Coal (deaths)		4.77	0.005	0.005	0.005	0.003	0
Premature deaths from air pollution - Natural Gas (deaths)		1.41	0.8	0.651	0.591	0.39	0.216
Premature deaths from air pollution - Transportation (deaths)		14.1	13.5	10.5	6.15	2.81	1.06

## Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		143	185	130	77.8	26	66.9
By economic sector - Construction (jobs)		2,221	7,427	8,396	8,720	9,256	9,387
By economic sector - Manufacturing		1,309	2,451	2,881	2,696	2,467	2,658
(jobs)							
By economic sector - Mining (jobs)		581	414	265	155	83.3	39.4

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

Table 16: E+ scenario - IMPACTS - Jobs (col	ntinueaj						
Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		267	741	905	1,047	1,208	1,521
By economic sector - Pipeline (jobs)		123	105	133	58.9	37.3	51.3
By economic sector - Professional (jobs)		1,077	4,833	5,675	6,291	7,026	7,209
By economic sector - Trade (jobs)		828	2,548	3,001	3,366	3,831	4,122
By economic sector - Utilities (jobs)		1,550	5,647	6,258	6,471	7,088	6,824
By education level - All sectors -		2,479	7,748	8,866	9,295	10,016	10,294
Associates degree or some college (jobs)							
By education level - All sectors -		1,682	5,081	5,777	6,080	6,583	6,749
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		60.1	214	246	266	293	302
degree (jobs)							
By education level - All sectors - High		3,471	9,990	11,249	11,637	12,374	12,734
school diploma or less (jobs)							
By education level - All sectors - Masters		406	1,318	1,506	1,605	1,756	1,800
or professional degree (jobs)							
By resource sector - Biomass (jobs)		413	459	309	198	99.6	303
By resource sector - CO2 (jobs)		0	0	419	0	0	236
By resource sector - Coal (jobs)		2.46	0.823	0	0	0	0
By resource sector - Grid (jobs)		1,910	9,465	10,247	11,504	12,808	12,127
By resource sector - Natural Gas (jobs)		922	775	780	569	462	473
By resource sector - Nuclear (jobs)		303	298	173	0	0	0
By resource sector - Oil (jobs)		1,419	1,118	783	500	302	151
By resource sector - Solar (jobs)		2,066	2,102	2,734	2,943	3,155	5,306
By resource sector - Wind (jobs)		1,063	10,133	12,199	13,170	14,195	13,283
Median wages - Annual - All (\$2019 per		54,810	56,192	56,868	57,799	58,888	59,480
job)							
On-Site or In-Plant Training - Total jobs - 1		1,297	3,998	4,551	4,755	5,112	5,233
to 4 years (jobs)							
On-Site or In-Plant Training - Total jobs - 4		535	1,754	2,002	2,100	2,271	2,311
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		1,324	4,005	4,560	4,772	5,130	5,291
None (jobs)							
On-Site or In-Plant Training - Total jobs -		66.7	218	250	262	282	288
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		4,876	14,376	16,282	16,994	18,226	18,755
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		1,661	5,196	5,925	6,197	6,671	6,820
years (jobs)		.	.				
On-the-Job Training - All sectors - 4 to 10		519	1,741	1,991	2,093	2,266	2,308
years (jobs)			<i>'</i>		,	,	,
On-the-Job Training - All sectors - None		454	1,325	1,502	1,571	1,690	1,752
(jobs)			,,,,,	,,,,,	,,,,,,	,,,,,	.,
On-the-Job Training - All sectors - Over 10		81.6	233	265	272	287	296
years (jobs)							
On-the-Job Training - All sectors - Up to 1		5,383	15,856	17,962	18,751	20,108	20,703
year (jobs)		3,555	.5,555	,,	.57.5.	207.00	_0,.00
Related work experience - All sectors - 1		2,897	8,751	9,935	10,405	11,205	11,506
to 4 years (jobs)		_,07.	57.5.	7,700	.0, .00	,200	,000
Related work experience - All sectors - 4		1,863	5,764	6,570	6,883	7,418	7,590
to 10 years (jobs)		.,000	5,104	0,010	0,000	.,-10	.,070
Related work experience - All sectors -		1,167	3,475	3,942	4,113	4,416	4,553
None (jobs)		1,101	0,410	5,742	-1,110	7,710	-,000
Related work experience - All sectors -		499	1,494	1,699	1,772	1,901	1,944
Over 10 years (jobs)		477	1,474	1,077	1,114	1,701	1,744
Related work experience - All sectors - Up		1,673	4,867	5,498	5,710	6,082	6,286
to 1 year (jobs)		1,010	7,001	5,476	3,110	5,002	0,200
Wage income - All (million \$2019)		444	1,368	1,572	1,670	1,827	1,896
wage meeme - An (million \$2017)		444	1,300	1,012	1,010	1,021	1,070

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		4,239	4,714				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	46.2	50.2	60.8	75.4	84.6	87.8
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	53.8	49.8	39.2	24.6	15.4	12.2
Sales of space heating units - Electric	3.53	7.33	9.61	17.1	35.2	58.2	71.6
Heat Pump (%)							
Sales of space heating units - Electric	3.3	3.45	3.58	4.06	5.22	6.69	7.54
Resistance (%)							
Sales of space heating units - Fossil (%)	1.07	0.256	0.242	0.19	0.113	0.063	0.046
Sales of space heating units - Gas Furnace	92.1	89	86.6	78.7	59.5	35.1	20.8
(%)							
Sales of water heating units - Electric	0.03	0.512	1.83	6.23	16.9	30.4	38.3
Heat Pump (%)							
Sales of water heating units - Electric	1.46	1.95	3.27	7.65	18.2	31.6	39.5
Resistance (%)							
Sales of water heating units - Gas Furnace	98.1	97.2	94.5	85.7	64.5	37.6	21.8
(%)							
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.09	1.13	1.39	1.45	2.09	2.22
Cumulative 5-yr (billion \$2018)							

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

142.6 17.1 200.141.10 1.1227.11 1.211.10	,, =						
Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	49	49.1	48.9	48.7	48	47.1	46.1
Final energy use - Industry (PJ)	165	176	181	184	188	193	197
Final energy use - Residential (PJ)	71.3	68.1	66.1	64.1	61.5	57.8	53.1
Final energy use - Transportation (PJ)	150	142	130	120	112	103	93

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.25	1.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.6	62.6	66.1	75.4	88.3	96.2	99
Resistance (%)							
Sales of cooking units - Gas (%)	38.4	37.4	33.9	24.6	11.7	3.79	1.02
Sales of space heating units - Electric	9.46	19.2	21.1	27.7	43.3	62.6	73.4
Heat Pump (%)							
Sales of space heating units - Electric	10.7	17.2	16.8	15.7	12.9	9.42	7.34
Resistance (%)							
Sales of space heating units - Fossil (%)	6.36	10.7	10.8	9.99	8.15	6.52	6.16
Sales of space heating units - Gas (%)	73.4	53	51.3	46.6	35.6	21.5	13.1
Sales of water heating units - Electric	0	0.373	1.39	4.79	13	23.4	29.5
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.4	37.1	39.3	44.4	50.9	54.7
Resistance (%)							
Sales of water heating units - Gas Furnace	76.7	61.1	59.4	53.8	40.4	23.6	13.6
(%)							
Sales of water heating units - Other (%)	1.97	2.1	2.1	2.11	2.11	2.11	2.11

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	58.3	123	414	1,303	1,898
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.066		0.213		1.12		3.13
units)							
Public EV charging plugs - L2 (1000 units)	0.128		5.12		27		75.3
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 (%)	1.92	2.27	2.13	1.71	1.13	0.586	0.249
Vehicle sales - Light-duty - EV (%)	1.46	3.76	9.89	22.7	44.8	69.7	86.6
Vehicle sales - Light-duty - gasoline (%)	93	89.2	82.7	70.7	50.2	27.4	11.9
Vehicle sales - Light-duty - hybrid (%)	3.34	4.23	4.82	4.56	3.59	2.23	1.12
Vehicle sales - Light-duty - hydrogen FC	0.114	0.391	0.348	0.273	0.2	0.113	0.052
(%)							
Vehicle sales - Light-duty - other (%)	0.119	0.122	0.114	0.1	0.074	0.041	0.019
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-1,914
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-62.8
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-1,976
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-972
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-31.4
deployment - Permanent conservation							
cover (1000 tC02e/y)							1.000
Carbon sink potential - Moderate							-1,003
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							0.007
Land impacted for carbon sink -							2,284
Aggressive deployment - Cropland							
measures (1000 hectares)							107
Land impacted for carbon sink -							104
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 -							2,387
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,168
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							51.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,220
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	2020	2025	2030	2030	2040	2045	-4,423
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-290
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,259
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-812
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,953
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,761
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-2,216
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-11,479
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-132
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-148
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,420
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-284
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,977
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-233
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-2,279
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-3,320
regeneration (1000 tCO2e/y)							•

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-21,253
Carbon sink potential - Mid - Avoid							-463
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-3,224
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-217
plantations (1000 tC02e/y)							0.000
Carbon sink potential - Mid - Increase							-2,839
retention of HWP (1000 tC02e/y)  Carbon sink potential - Mid - Increase							-548
trees outside forests (1000 tC02e/y)							-340
Carbon sink potential - Mid - Reforest							-4,465
cropland (1000 tCO2e/y)							.,
Carbon sink potential - Mid - Reforest							-1,656
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-4,520
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							724
High - Accelerate regeneration (1000							
hectares)							107
Land impacted for carbon sink potential -							107
High - Avoid deforestation (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -		+		+			2,376
High - Extend rotation length (1000							2,010
hectares)							
Land impacted for carbon sink potential -							107
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
High - Increase retention of HWP (1000							
hectares)							77.0
Land impacted for carbon sink potential -							77.2
High - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -		+					394
High - Reforest cropland (1000 hectares)							07-
Land impacted for carbon sink potential -		+					87.5
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,241
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,113
High - Total impacted (over 30 years)							
(1000 hectares)							0/0
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							362
hectares)							
Land impacted for carbon sink potential -							101
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							910
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							53.5
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							40.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							197
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,356
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							3,035
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							543
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							104
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,643
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							80.5
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 -							58.9
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							295
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							110
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,731
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,565
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		42.2	0.049	0.048	0.042	0.027	0
Coal (million 2019\$)							
Monetary damages from air pollution -		13	6.27	4.16	2.62	1.49	1.11
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		127	131	131	120	97	67.5
Transportation (million 2019\$)							
Premature deaths from air pollution -		4.77	0.005	0.005	0.005	0.003	0
Coal (deaths)							
Premature deaths from air pollution -		1.47	0.708	0.47	0.295	0.168	0.125
Natural Gas (deaths)							
Premature deaths from air pollution -		14.3	14.8	14.7	13.5	10.9	7.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		4,239	4,716				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	54.6	83	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	3.53	8.34	31.3	81.3	90.2	90.7	90.8
Heat Pump (%)							
Sales of space heating units - Electric	3.3	3.52	4.98	8.12	8.7	8.74	8.73
Resistance (%)							
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace	92.1	87.9	63.7	10.6	1.11	0.511	0.508
(%)							
Sales of water heating units - Electric	0.03	1.08	14.4	43.7	48.9	49.2	49.2
Heat Pump (%)							
Sales of water heating units - Electric	1.46	2.52	15.8	44.9	50.1	50.4	50.4
Resistance (%)							
Sales of water heating units - Gas Furnace	98.1	96	69.4	11.1	0.657	0	0
(%)							
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.28	1.35	2.22	2.38	2.18	2.3
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)	49	49.1	48.2	46	43.3	41.4	40.7
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.25	1.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.7	69.9	94.8	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric	9.46	20.4	40.3	80.7	88.3	89	88.8
Heat Pump (%)							
Sales of space heating units - Electric	10.7	17	13.5	5.83	4.48	4.43	4.48
Resistance (%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric	0	0.814	11.1	33.7	37.7	38	38
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.7	43.2	57.2	59.8	59.9	59.9
Resistance (%)							
Sales of water heating units - Gas Furnace	76.7	60.4	43.6	6.97	0.411	0	0
(%)							
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		361	924	1,498	2,269	2,469	2,354
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.066		0.688		3.02		4.88
units)							
Public EV charging plugs - L2 (1000 units)	0.128		16.6		72.7		118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.36	0.233	0.074	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion		0	17.8	9.95	14.3	8.47	14.1
\$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	2	2	2	2	2	2	2
use assumptions (MW)							
Installed renewables - Solar -	4	4	4	4	4	4	13,054
Constrained land use assumptions (MW)							
Installed renewables - Wind - Base land	952	952	14,294	22,314	34,448	42,003	55,310
use assumptions (MW)							
Installed renewables - Wind - Constrained	2,635	2,635	26,959	46,429	66,415	79,003	115,932
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)	4.27	4.27	4.27	4.27	4.27	4.27	4.27
Solar - Constrained land use assumptions	8.54	8.54	8.54	8.54	8.54	8.54	23,418
(GWh)							
Wind - Base land use assumptions (GWh)	3,041	3,041	43,012	65,295	97,655	117,079	150,061
Wind - Constrained land use assumptions	8,434	8,434	78,211	128,207	174,357	201,000	269,797
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-1,914
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-62.8
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-1,976
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-972
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-31.4
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,003
deployment - Total (1000 tC02e/y)							•
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							_
energy grasses (1000 hectares)							
Land impacted for carbon sink -							2,284
Aggressive deployment - Cropland							_,
measures (1000 hectares)							
Land impacted for carbon sink -							104
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -						+	2,387
Aggressive deployment - Total (1000							2,001
hectares)							
Land impacted for carbon sink - Moderate						+	0
deployment - Corn-ethanol to energy							J
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,168
deployment - Cropland measures (1000							1,100
hectares)							
Land impacted for carbon sink - Moderate						+	51.8
deployment - Permanent conservation							31.0
cover (1000 hectares)							
Land impacted for carbon sink - Moderate						+	1,220
deployment - Total (1000 hectares)							1,220
uepioyment - rotar (1000 nectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-4,423
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-290
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,259
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							-812
trees outside forests (1000 tC02e/y)							F 0F(
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5,953
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tCO2e/y)							-3,000
Carbon sink potential - High - Restore	+						-6,76
productivity (1000 tC02e/y)							-0,10
Carbon sink potential - Low - Accelerate							-2,216
regeneration (1000 tCO2e/y)							_,
Carbon sink potential - Low - All (not							-11,479
counting overlap) (1000 tCO2e/y)							•
Carbon sink potential - Low - Avoid							-132
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tCO2e/y)							•
Carbon sink potential - Low - Improve							-148
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,420
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-284
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,97
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23
pasture (1000 tCO2e/y)							
Carbon sink potential - Low - Restore							-2,27
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-3,320
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-21,25
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-46
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-3,224
rotation length (1000 tCO2e/y)							04
Carbon sink potential - Mid - Improve							-21
plantations (1000 tCO2e/y)							0.00
Carbon sink potential - Mid - Increase							-2,83
retention of HWP (1000 tC02e/y)							F/1
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-54
Carbon sink potential - Mid - Reforest							-4,46
carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4,46
Carbon sink potential - Mid - Reforest							-1,65
pasture (1000 tCO2e/y)							-1,00
Carbon sink potential - Mid - Restore							-4,52
productivity (1000 tCO2e/y)							-4,52
Land impacted for carbon sink potential -							72
High - Accelerate regeneration (1000							12
hectares)							
Land impacted for carbon sink potential -							10
High - Avoid deforestation (over 30 years)							10
(1000 hectares)							
Land impacted for carbon sink potential -							2,37
High - Extend rotation length (1000							2,31
hectares)							
Land impacted for carbon sink potential -							10
High - Improve plantations (1000							10
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							(
hectares)							
Land impacted for carbon sink potential -							77.
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							39
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							87.
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,24
High - Restore productivity (1000							
hectares)							/ 11/
Land impacted for carbon sink potential -							6,113
High - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							36
Low - Accelerate regeneration (1000							302
hectares)							
Land impacted for carbon sink potential -							10
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							910
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							53.5
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							40.6
Low - Increase trees outside forests							
(1000 hectares)  Land impacted for carbon sink potential -							19
Low - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential -							15.2
Low - Reforest pasture (1000 hectares)							10.2
Land impacted for carbon sink potential -							1,356
Low - Restore productivity (1000							.,00
hectares)							
Land impacted for carbon sink potential -							3,039
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							543
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							104
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							4 ( )
Land impacted for carbon sink potential -							1,643
Mid - Extend rotation length (1000							
hectares)							00.1
Land impacted for carbon sink potential -							80.9
Mid - Improve plantations (1000 hectares)  Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							·
hectares)							
Land impacted for carbon sink potential -							58.9
Mid - Increase trees outside forests (1000							50.
hectares)							

T 11 00 E DE '	DTI I AD ( ) I ' I	
Table 33: F+RF+ scenario -	PILLAR 6. Land sinks -	- Forests icontinuedi

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							295
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							110
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,731
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,565
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 -		42.2	0.049	0.048	0.042	0.027	0
Coal (million 2019\$)							
Monetary damages from air pollution -		11.3	5.84	3.23	2.52	1.5	0.779
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		125	120	93.3	54.7	25	9.4
Transportation (million 2019\$)							
Premature deaths from air pollution -		4.77	0.005	0.005	0.005	0.003	0
Coal (deaths)							
Premature deaths from air pollution -		1.28	0.659	0.364	0.285	0.169	0.088
Natural Gas (deaths)							
Premature deaths from air pollution -		14.1	13.5	10.5	6.15	2.81	1.06
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		4,239	4,716				
Sales of cooking units - Electric Resistance (%)	41.9	54.6	83	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	58.1	45.4	17	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	3.53	8.34	31.3	81.3	90.2	90.7	90.8
Sales of space heating units - Electric Resistance (%)	3.3	3.52	4.98	8.12	8.7	8.74	8.73
Sales of space heating units - Fossil (%)	1.07	0.221	0.042	0.002	0	0	0
Sales of space heating units - Gas Furnace (%)	92.1	87.9	63.7	10.6	1.11	0.511	0.508
Sales of water heating units - Electric Heat Pump (%)	0.03	1.08	14.4	43.7	48.9	49.2	49.2
Sales of water heating units - Electric Resistance (%)	1.46	2.52	15.8	44.9	50.1	50.4	50.4
Sales of water heating units - Gas Furnace (%)	98.1	96	69.4	11.1	0.657	0	0
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.28	1.35	2.22	2.38	2.18	2.3
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)	49	49.1	48.2	46	43.3	41.4	40.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	165	175	179	179	180	185	191
Final energy use - Residential (PJ)	71.3	68.1	65.2	58.8	51.1	45.3	41.4
Final energy use - Transportation (PJ)	150	141	124	104	85.9	74.5	69.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.25	1.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.7	69.9	94.8	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	38.3	30.1	5.15	0.259	0	0	0
Sales of space heating units - Electric	9.46	20.4	40.3	80.7	88.3	89	88.8
Heat Pump (%)							
Sales of space heating units - Electric	10.7	17	13.5	5.83	4.48	4.43	4.48
Resistance (%)							
Sales of space heating units - Fossil (%)	6.36	10.6	9.29	6.2	5.2	4.89	5.13
Sales of space heating units - Gas (%)	73.4	52.1	37	7.24	1.97	1.65	1.64
Sales of water heating units - Electric	0	0.814	11.1	33.7	37.7	38	38
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.7	43.2	57.2	59.8	59.9	59.9
Resistance (%)							
Sales of water heating units - Gas Furnace	76.7	60.4	43.6	6.97	0.411	0	0
(%)							
Sales of water heating units - Other (%)	1.97	2.09	2.1	2.1	2.1	2.1	2.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		361	924	1,498	2,269	2,469	2,354
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.066		0.688		3.02		4.88
units)							
Public EV charging plugs - L2 (1000 units)	0.128		16.6		72.7		118
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 (%)	1.91	2.13	1.41	0.454	0.081	0.013	0
Vehicle sales - Light-duty - EV (%)	2.71	11.5	40.7	79.5	96	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.9	82.2	54.8	18.9	3.6	0.6	0
Vehicle sales - Light-duty - hybrid (%)	3.24	3.69	2.8	1.08	0.255	0.053	0
Vehicle sales - Light-duty - hydrogen FC	0.112	0.36	0.233	0.074	0.014	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.118	0.114	0.079	0.028	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0	0	0.217	0.57
Capital invested - Wind - Base (billion \$2018)		1.28	11	4.77	6.07	2.13	0
Capital invested - Wind - Constrained (billion \$2018)		1.72	11.5	2.37	7.03	3.43	0
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Solar - Constrained land use assumptions (MW)	2	2	2	2	2	261	981
Installed renewables - Wind - Base land use assumptions (MW)	952	1,820	10,104	13,951	19,089	20,990	20,990
Installed renewables - Wind - Constrained land use assumptions (MW)	1,317	2,486	11,110	13,021	18,974	22,030	22,030

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)	4.27	4.27	4.27	4.27	4.27	4.27	4.27
Solar - Constrained land use assumptions	4.27	4.27	4.27	4.27	4.27	470	1,775
(GWh)							
Wind - Base land use assumptions (GWh)	3,041	5,811	30,893	42,045	56,581	61,738	61,738
Wind - Constrained land use assumptions	4,217	7,876	32,710	37,875	53,612	61,273	61,273
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-1,914
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-62.8
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-1,976
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-972
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-31.4
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,003
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 -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							2,284
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							104
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							2,387
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,168
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							51.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,220
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							-4,423
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-290
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,259
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-812
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,953
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,761
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-2,216
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-11,479
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-132
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-148
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,420
retention of HWP (1000 tCO2e/y)							, -
Carbon sink potential - Low - Increase							-284
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							-2,97
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23
pasture (1000 tC02e/y)							0.07
Carbon sink potential - Low - Restore							-2,27
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-3,32
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-21,25
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-46
deforestation (1000 tC02e/y)							
Carbon sink potential - Mid - Extend							-3,22
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-21
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,83
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-54
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4,46
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-1,65
pasture (1000 tCO2e/y)							
Carbon sink potential - Mid - Restore							-4,52
productivity (1000 tCO2e/y)							
and impacted for carbon sink potential -							72
High - Accelerate regeneration (1000							
nectares)							
Land impacted for carbon sink potential -							10
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							2,37
High - Extend rotation length (1000							
nectares)							
Land impacted for carbon sink potential -							10
High - Improve plantations (1000							
nectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
nectares)							
Land impacted for carbon sink potential -							77.
High - Increase trees outside forests							- •
(1000 hectares)							
Land impacted for carbon sink potential -							39
High - Reforest cropland (1000 hectares)							3,
Land impacted for carbon sink potential -						+	87
High - Reforest pasture (1000 hectares)							31
Land impacted for carbon sink potential -				+		+	2,2
High - Restore productivity (1000							۷,۷
nectares)							
Land impacted for carbon sink potential -	-					+	6,11
High - Total impacted (over 30 years)							0,1
1000 hectares)							
•							36
Land impacted for carbon sink potential -							36
Low - Accelerate regeneration (1000							
nectares)							4.
Land impacted for carbon sink potential -							10
Low - Avoid deforestation (over 30 years)	1	1	1				

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 -							910
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							53.5
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 -							40.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							197
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,356
Low - Restore productivity (1000							.,000
hectares)							
Land impacted for carbon sink potential -		+					3,035
Low - Total impacted (over 30 years)							0,000
(1000 hectares)							
Land impacted for carbon sink potential -		+				+	543
Mid - Accelerate regeneration (1000							040
hectares)							
Land impacted for carbon sink potential -							104
Mid - Avoid deforestation (over 30 years)							104
(1000 hectares)							
Land impacted for carbon sink potential -		-					1,643
Mid - Extend rotation length (1000							1,043
hectares)							
,							80.5
Land impacted for carbon sink potential -							80.5
Mid - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares)							500
Land impacted for carbon sink potential -							58.9
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							295
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							110
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,731
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,565
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 -		42.2	0.049	0.048	0.042	0.027	0
Coal (million 2019\$)							
Monetary damages from air pollution -		12.8	6.82	7.04	8.14	4.25	1.34
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		125	120	93.3	54.7	25	9.4
Transportation (million 2019\$)							
Premature deaths from air pollution -		4.77	0.005	0.005	0.005	0.003	0
Coal (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution -		1.45	0.77	0.794	0.919	0.48	0.151
Natural Gas (deaths)							
Premature deaths from air pollution -		14.1	13.5	10.5	6.15	2.81	1.06
Transportation (deaths)							

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

	<u> </u>					
2020	2025	2030	2035	2040	2045	2050
	4,239	4,714				
41.9	46.2	50.2	60.8	75.4	84.6	87.8
58.1	53.8	49.8	39.2	24.6	15.4	12.2
3.53	7.33	9.61	17.1	35.2	58.2	71.6
3.3	3.45	3.58	4.06	5.22	6.69	7.54
1.07	0.256	0.242	0.19	0.113	0.063	0.046
92.1	89	86.6	78.7	59.5	35.1	20.8
0.03	0.512	1.83	6.23	16.9	30.4	38.3
1.46	1.95	3.27	7.65	18.2	31.6	39.5
98.1	97.2	94.5	85.7	64.5	37.6	21.8
0.366	0.384	0.383	0.384	0.383	0.384	0.383
	2020 41.9 58.1 3.53 3.3 1.07 92.1 0.03 1.46	2020 2025 4,239 41.9 46.2 58.1 53.8 3.53 7.33 3.3 3.45 1.07 0.256 92.1 89 0.03 0.512 1.46 1.95 98.1 97.2	2020         2025         2030           4,239         4,714           41.9         46.2         50.2           58.1         53.8         49.8           3.53         7.33         9.61           3.3         3.45         3.58           1.07         0.256         0.242           92.1         89         86.6           0.03         0.512         1.83           1.46         1.95         3.27           98.1         97.2         94.5	4,239     4,714       41.9     46.2     50.2     60.8       58.1     53.8     49.8     39.2       3.53     7.33     9.61     17.1       3.3     3.45     3.58     4.06       1.07     0.256     0.242     0.19       92.1     89     86.6     78.7       0.03     0.512     1.83     6.23       1.46     1.95     3.27     7.65       98.1     97.2     94.5     85.7	2020         2025         2030         2035         2040           4,239         4,714         2035         2040           41.9         46.2         50.2         60.8         75.4           58.1         53.8         49.8         39.2         24.6           3.53         7.33         9.61         17.1         35.2           3.3         3.45         3.58         4.06         5.22           1.07         0.256         0.242         0.19         0.113           92.1         89         86.6         78.7         59.5           0.03         0.512         1.83         6.23         16.9           1.46         1.95         3.27         7.65         18.2           98.1         97.2         94.5         85.7         64.5	2020         2025         2030         2035         2040         2045           4,239         4,714         2035         2040         2045           41.9         46.2         50.2         60.8         75.4         84.6           58.1         53.8         49.8         39.2         24.6         15.4           3.53         7.33         9.61         17.1         35.2         58.2           3.3         3.45         3.58         4.06         5.22         6.69           1.07         0.256         0.242         0.19         0.113         0.063           92.1         89         86.6         78.7         59.5         35.1           0.03         0.512         1.83         6.23         16.9         30.4           1.46         1.95         3.27         7.65         18.2         31.6           98.1         97.2         94.5         85.7         64.5         37.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.09	1.13	1.39	1.45	2.09	2.22
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)	49	49.1	48.9	48.7	48	47.1	46.1
Final energy use - Industry (PJ)	165	176	181	184	188	193	197
Final energy use - Residential (PJ)	71.3	68.1	66.1	64.1	61.5	57.8	53.1
Final energy use - Transportation (PJ)	150	142	130	120	112	103	93

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.25	1.37				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.6	62.6	66.1	75.4	88.3	96.2	99
Resistance (%)							
Sales of cooking units - Gas (%)	38.4	37.4	33.9	24.6	11.7	3.79	1.02
Sales of space heating units - Electric	9.46	19.2	21.1	27.7	43.3	62.6	73.4
Heat Pump (%)							
Sales of space heating units - Electric	10.7	17.2	16.8	15.7	12.9	9.42	7.34
Resistance (%)							
Sales of space heating units - Fossil (%)	6.36	10.7	10.8	9.99	8.15	6.52	6.16
Sales of space heating units - Gas (%)	73.4	53	51.3	46.6	35.6	21.5	13.1
Sales of water heating units - Electric	0	0.373	1.39	4.79	13	23.4	29.5
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.4	37.1	39.3	44.4	50.9	54.7
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 (%)	76.7	61.1	59.4	53.8	40.4	23.6	13.6
Sales of water heating units - Other (%)	1.97	2.1	2.1	2.11	2.11	2.11	2.11

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

	, .		•				
Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -		0	58.3	123	414	1,303	1,898
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.066		0.213		1.12		3.13
units)							
Public EV charging plugs - L2 (1000 units)	0.128		5.12		27		75.3
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 (%)	1.92	2.27	2.13	1.71	1.13	0.586	0.249
Vehicle sales - Light-duty - EV (%)	1.46	3.76	9.89	22.7	44.8	69.7	86.6
Vehicle sales - Light-duty - gasoline (%)	93	89.2	82.7	70.7	50.2	27.4	11.9
Vehicle sales - Light-duty - hybrid (%)	3.34	4.23	4.82	4.56	3.59	2.23	1.12
Vehicle sales - Light-duty - hydrogen FC	0.114	0.391	0.348	0.273	0.2	0.113	0.052
(%)							
Vehicle sales - Light-duty - other (%)	0.119	0.122	0.114	0.1	0.074	0.041	0.019
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	0.041
power plant (billion \$2018)							
Capital invested - Biomass w/ccu power	0	0	0	0	0	0	0.096
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	40.5
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	107

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million \$2018/year)		0	0	0	0	0	78.2
Conversion capital investment -		0	0	0	0	0	1,084
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	0	0	0	1
(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	0	2
(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	1
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	0	0	0	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	1.16
Annual - BECCS (MMT)		0	0	0	0	0	1.16
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	1.16
Cumulative - BECCS (MMT)		0	0	0	0	0	1.16
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	177	177	177	439
Cumulative investment - All (million \$2018)		0	0	423	423	423	573
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	150
Cumulative investment - Trunk (million \$2018)		0	0	423	423	423	423
Spur (km)		0	0	0	0	0	262
Trunk (km)		0	0	177	177	177	177

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)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-1,913
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 tC02e/y)							
Carbon sink potential - Aggressive							-62.8
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-1,976
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							0
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-972
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Moderate							0
deployment - Pasture to energy crops							
(1000 tC02e/y)							
Carbon sink potential - Moderate							-31.4
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-1,003
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							0
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							5,638
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							0.25
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							4.37
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							104
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							5,746
Aggressive deployment - Total (1000							-,
hectares)							
Land impacted for carbon sink - Moderate							0
deployment - Corn-ethanol to energy							J
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							1,168
deployment - Cropland measures (1000							1,100
hectares)							
Land impacted for carbon sink - Moderate							0.25
deployment - Cropland to woody energy							0.20
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							4.37
							4.51
deployment - Pasture to energy crops							
(1000 hectares)							F1.0
Land impacted for carbon sink - Moderate							51.8
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							1,224
deployment - Total (1000 hectares)							

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

Iable 57: E-B+ scenario - PILLAR 6: Land s Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate	2020	2025	2030	2035	2040	2045	-4,423
regeneration (1000 tCO2e/y)							-4,423
							21 020
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tC02e/y)							700
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-290
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,259
retention of HWP (1000 tCO2e/y)							.,
Carbon sink potential - High - Increase	+						-812
trees outside forests (1000 tCO2e/y)							012
Carbon sink potential - High - Reforest							-5,953
							-5,953
cropland (1000 tC02e/y)							0.000
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-6,761
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-2,216
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-11,479
counting overlap) (1000 tCO2e/y)							, >
Carbon sink potential - Low - Avoid							-132
deforestation (1000 tC02e/y)							-102
							1700
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-148
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,420
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-284
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,977
cropland (1000 tC02e/y)							2,711
Carbon sink potential - Low - Reforest	+						-233
							-233
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-2,279
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-3,320
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-21,253
counting overlap) (1000 tCO2e/y)							-
Carbon sink potential - Mid - Avoid						+	-463
deforestation (1000 tC02e/y)							.00
Carbon sink potential - Mid - Extend			-				-3,224
rotation length (1000 tCO2e/y)							-3,224
							017
Carbon sink potential - Mid - Improve							-217
plantations (1000 tC02e/y)							
Carbon sink potential - Mid - Increase							-2,839
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-548
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4,465
cropland (1000 tC02e/y)							., 700
Carbon sink potential - Mid - Reforest							-1,656
=							-1,056
		I					
pasture (1000 tC02e/y)							, 500
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-4,520

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 hectares)							724
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years)							107
(1000 hectares)  Land impacted for carbon sink potential - High - Extend rotation length (1000							2,376
hectares) Land impacted for carbon sink potential -							107
High - Improve plantations (1000 hectares)							107
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)  Land impacted for carbon sink potential - High - Increase trees outside forests							77.2
(1000 hectares)  Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							394
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							87.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,241
Land impacted for carbon sink potential - High - Total impacted (over 30 years)							6,113
(1000 hectares)  Land impacted for carbon sink potential - Low - Accelerate regeneration (1000							362
hectares)  Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							910
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							53.5
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests							40.6
(1000 hectares)  Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							197
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,356
Land impacted for carbon sink potential - Low - Total impacted (over 30 years)							3,035
(1000 hectares)  Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000							543

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							104
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,643
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							80.5
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 -							58.9
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							295
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							110
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,731
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							5,565
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 -		42.2	0.049	0.048	0.042	0.027	0
Coal (million 2019\$)							
Monetary damages from air pollution -		12.3	6.04	4.41	3.69	2.37	1.54
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		127	131	131	120	97	67.5
Transportation (million 2019\$)							
Premature deaths from air pollution -		4.77	0.005	0.005	0.005	0.003	0
Coal (deaths)							
Premature deaths from air pollution -		1.39	0.682	0.497	0.416	0.267	0.174
Natural Gas (deaths)							
Premature deaths from air pollution -		14.3	14.8	14.7	13.5	10.9	7.6
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -		4,185	4,377				
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41.9	44.7	44.7	44.6	44.4	44.5	44.6
Resistance (%)							
Sales of cooking units - Gas (%)	58.1	55.3	55.3	55.4	55.6	55.5	55.4
Sales of space heating units - Electric	3.53	14.1	47	73.9	78.3	78.8	78.8
Heat Pump (%)							
Sales of space heating units - Electric	3.3	4.34	8.76	15.7	20	20.6	20.7
Resistance (%)							
Sales of space heating units - Fossil (%)	1.07	0.24	0.141	0.039	0.005	0	0
Sales of space heating units - Gas Furnace	92.1	81.3	44.1	10.4	1.72	0.57	0.509
(%)							
Sales of water heating units - Electric	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Heat Pump (%)							
Sales of water heating units - Electric	1.46	1.47	1.47	1.48	1.47	1.48	1.47
Resistance (%)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	98.1	98.1	98.1	98.1	98.1	98.1	98.1
Sales of water heating units - Other (%)	0.366	0.384	0.383	0.384	0.383	0.384	0.383

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		1.18	1.23	1.36	1.42	1.52	1.58
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)	49	50.1	51.1	51.5	51.9	53.3	55.8
Final energy use - Industry (PJ)	165	182	194	206	220	239	257
Final energy use - Residential (PJ)	71.3	68.6	67.8	67.5	68	68.9	69.7
Final energy use - Transportation (PJ)	150	142	131	124	124	127	132

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.		1.22	1.24				
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	61.2	61.2	61.2	61.2	61.2	61.2	61.2
Resistance (%)							
Sales of cooking units - Gas (%)	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Sales of space heating units - Electric	8.94	22	22.3	22.8	23.5	24.2	24.8
Heat Pump (%)							
Sales of space heating units - Electric	10.9	16.6	16.4	16.3	16.1	15.6	14.8
Resistance (%)							
Sales of space heating units - Fossil (%)	6.39	10.3	10.4	10.2	9.34	8.82	9.31
Sales of space heating units - Gas (%)	73.8	51.2	50.9	50.7	51.1	51.4	51
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	21.3	36.2	36.3	36.3	36.4	36.4	36.5
Resistance (%)							
Sales of water heating units - Gas Furnace	76.7	61.7	61.6	61.6	61.5	61.4	61.4
(%)							
Sales of water heating units - Other (%)	1.97	2.1	2.11	2.11	2.12	2.12	2.12

# 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 (%)	1.92	2.27	2.25	2.09	1.9	1.77	1.69
Vehicle sales - Light-duty - EV (%)	2.37	4.07	4.67	5.64	6.94	8.25	9.35
Vehicle sales - Light-duty - gasoline (%)	92.2	89	87.5	86.1	84.4	82.4	80.7
Vehicle sales - Light-duty - hybrid (%)	3.26	4.17	5.13	5.71	6.36	7.09	7.8
Vehicle sales - Light-duty - hydrogen FC	0.113	0.39	0.367	0.332	0.333	0.337	0.348
(%)							
Vehicle sales - Light-duty - other (%)	0.118	0.122	0.12	0.121	0.121	0.121	0.124
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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-4,423
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-31,032
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-793
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-4,659
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-290
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-4,259
retention of HWP (1000 tCO2e/y)							, -
Carbon sink potential - High - Increase							-81
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,95
cropland (1000 tCO2e/y)							0,70
Carbon sink potential - High - Reforest							-3,080
pasture (1000 tC02e/y)							-3,000
Carbon sink potential - High - Restore							-6,76
productivity (1000 tCO2e/y)							-0,10
Carbon sink potential - Low - Accelerate							-2,21
							-2,21
regeneration (1000 tC02e/y)							11 / 7
Carbon sink potential - Low - All (not							-11,47
counting overlap) (1000 tCO2e/y)							10
Carbon sink potential - Low - Avoid							-13
deforestation (1000 tC02e/y)							
Carbon sink potential - Low - Extend							-1,790
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-14
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,42
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-28
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,97
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-23
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-2,27
productivity (1000 tCO2e/y)							•
Carbon sink potential - Mid - Accelerate							-3,32
regeneration (1000 tCO2e/y)							-,
Carbon sink potential - Mid - All (not							-21,25
counting overlap) (1000 tCO2e/y)							21,20
Carbon sink potential - Mid - Avoid							-46
deforestation (1000 tC02e/y)							-40
Carbon sink potential - Mid - Extend							-3,22
rotation length (1000 tC02e/y)							-3,22
Carbon sink potential - Mid - Improve							-21
							-21
plantations (1000 tC02e/y)							0.00
Carbon sink potential - Mid - Increase							-2,83
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							-548
trees outside forests (1000 tC02e/y)							1.1.5
Carbon sink potential - Mid - Reforest							-4,465
cropland (1000 tC02e/y)							1/5/
Carbon sink potential - Mid - Reforest							-1,656
pasture (1000 tCO2e/y)							/ 500
Carbon sink potential - Mid - Restore							-4,520
productivity (1000 tCO2e/y)  Land impacted for carbon sink potential -							724
High - Accelerate regeneration (1000							724
,							
hectares)							107
Land impacted for carbon sink potential -							107
High - Avoid deforestation (over 30 years)							
(1000 hectares)							0.07/
Land impacted for carbon sink potential -							2,376
High - Extend rotation length (1000							
hectares)							40-
Land impacted for carbon sink potential -							107
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 -							77.2
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							394
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							87.5
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							2,241
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							6,113
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							362
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							101
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							910
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							53.5
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 -							40.6
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							197
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							15.2
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							1,356
Low - Restore productivity (1000							
hectares)		[					

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,035
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							543
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,643
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							80.5
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)							58.9
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							295
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							110
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,731
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,565

## 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)	-22		4.29				1.23
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.16		-2.41				-2.53
Business-as-usual carbon sink - Total (Mt CO2e/y)	-23.1		1.88				-1.3

## Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		70.2	46.2	22.8	18	16.5	15.5
Coal (million 2019\$)							
Monetary damages from air pollution -		13.8	12.6	14.5	10.6	10	8.51
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		127	133	139	145	152	158
Transportation (million 2019\$)							
Premature deaths from air pollution -		7.93	5.22	2.58	2.03	1.87	1.75
Coal (deaths)							
Premature deaths from air pollution -		1.56	1.42	1.63	1.2	1.13	0.961
Natural Gas (deaths)							
Premature deaths from air pollution -		14.3	15	15.6	16.3	17.1	17.8
Transportation (deaths)							