

Net-Zero America - illinois state report

2021-03-05

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

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

Notes

- These data are all data from the study available at https://netzeroamerica.prince-ton.edu.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one "no new policies" reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not statelevel results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- For Pillar 6 (Land sinks), values shown are maximum carbon storage potentials.

Data by category and subcategory

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

44	E+RE- scenario - IMPACTS - Health	24
45	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	24
46	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	24
47	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview	24
48	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential	25
49	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	25
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	26
54	E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines	26
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	28
58	E-B+ scenario - IMPACTS - Health	30
59	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial	31
60	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	31
61	REF scenario - PILLAR 1: Efficiency/Electrification - Overview	31
62	REF scenario - PILLAR 1: Efficiency/Electrification - Residential	31
63	REF scenario - PILLAR 1: Efficiency/Electrification - Transportation	32
64	REF scenario - PILLAR 6: Land sinks - Forests	32
65	REF scenario - PILLAR 6: Land sinks - Forests - REF only	34
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 - Cumulative 5-yr (million \$2018)	0	40,927	44,680	0	0	0	0
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric Heat Pump (%)	0.751	8.27	35.3	81	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	2.86	3.5	5.34	9.38	10.1	10.2	10.2
Sales of space heating units - Fossil (%)	0	2.07	0.402	0.017	0	0	0
Sales of space heating units - Gas Furnace (%)	96.4	86.2	59	9.63	0.906	0.363	0.363
Sales of water heating units - Electric Heat Pump (%)	0.271	2.48	19.4	46.1	50.7	51	51
Sales of water heating units - Electric Resistance (%)	2.65	4.62	18.3	44	48.5	48.8	48.8
Sales of water heating units - Gas Furnace (%)	96.9	92.7	62.2	9.74	0.572	0	0
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.63	6.83	11.6	12.4	12.3	13
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)	441	434	415	383	346	319	305
Final energy use - Industry (PJ)	634	660	671	671	678	686	694
Final energy use - Residential (PJ)	591	551	512	443	367	307	269
Final energy use - Transportation (PJ)	1,043	977	873	748	634	562	530

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	10.8	14.4	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.8	61.3	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.2	38.7	6.63	0.334	0	0	0
Sales of space heating units - Electric	3.5	10.7	39.6	85.8	93.9	94.4	94.2
Heat Pump (%)							
Sales of space heating units - Electric	12.7	18.4	13.8	6.17	4.76	4.69	4.9
Resistance (%)							
Sales of space heating units - Fossil (%)	2.45	4.48	3.17	1.07	0.718	0.695	0.671
Sales of space heating units - Gas (%)	81.4	66.5	43.4	6.93	0.605	0.212	0.217
Sales of water heating units - Electric	0	1.85	15.9	37.3	41	41.2	41.2
Heat Pump (%)							
Sales of water heating units - Electric	22.7	38.5	43.9	56.3	58.6	58.7	58.6
Resistance (%)							
Sales of water heating units - Gas Furnace	77.3	59.6	40	6.28	0.367	0	0
(%)							
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.111	0.111	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	2,022	5,214	8,399	12,743	13,847	13,214
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.299	0	3.24	0	13.9	0	22.4
units)							
Public EV charging plugs - L2 (1000 units)	1.41	0	78	0	334	0	539
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam	0	0	0	0.024	0	0	0
power plant (billion \$2018)				0.02			
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.199	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)	0	2.64	1.73	5.31	8.41	4.98	2.34
Capital invested - Solar PV - Constrained (billion \$2018)	0	1.16	2.5	7.75	8.56	5.43	1.47
Capital invested - Wind - Base (billion \$2018)	0	10.1	29	25.6	30.1	28	30.8
Capital invested - Wind - Constrained (billion \$2018)	0	3.55	6.59	4.41	2.68	0.201	66
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Rooftop PV (MW)	62.5	110	164	248	368	523	724
Installed (cumulative) - Solar - Base land use assumptions (MW)	305	2,274	3,715	8,534	16,621	21,701	24,228
Installed (cumulative) - Wind - Base land use assumptions (MW)	6,208	13,063	34,871	55,544	81,007	105,985	135,080

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	24.2	24.2	24.2	24.2
Biomass w/ccu power plant (GWh)	0	0	224	224	224	224	224
Solar - Base land use assumptions (GWh)	650	3,663	2,607	8,856	14,766	8,959	4,440
Solar - Constrained land use assumptions (GWh)	770	1,890	4,260	8,627	12,881	11,258	2,947

Table 7: Eucopean	rio - PILLAR 2: Clean	Electricity	Cononation	loontinuedl
TADIC L. ET SCEITUL	IU - PILLAK Z. GIBUII	EIECLI ICILV -	Generation.	ICUIILIIIUEUI

	-	•	-				
Item	2020	2025	2030	2035	2040	2045	2050
Wind - Base land use assumptions (GWh)	22,788	22,093	70,431	65,330	79,992	77,614	88,212
Wind - Constrained land use assumptions	23,175	7,399	15,480	10,759	6,967	407	178,172
(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	11.3	2,030	3,353	3,754	3,754
Conversion capital investment -	0	0	183	29,262	19,141	5,818	0
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	33	56	63	63
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	2	2	2	2	2
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	1	1	1	1
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	2	2	2	2	2

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.24	41.5	66.8	74.1	74.8
Annual - BECCS (MMT)		0	0.22	37.8	62.4	69.9	69.9
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0.02	0.38	1.08	0.81	1.38
Cumulative - All (MMT)		0	0.24	41.8	109	183	257
Cumulative - BECCS (MMT)		0	0.22	38	100	170	240
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6
Cumulative - NGCC (MMT)		0	0.02	0.4	1.48	2.29	3.67

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	1,464	3,167	4,446	5,778	6,621
Cumulative investment - All (million \$2018)		0	6,204	9,975	10,943	12,504	13,165
Cumulative investment - Spur (million \$2018)		0	304	1,825	2,792	4,354	5,015
Cumulative investment - Trunk (million \$2018)		0	5,900	8,150	8,150	8,150	8,150
Spur (km)		0	507	1,842	3,122	4,454	5,297
Trunk (km)		0	958	1,324	1,324	1,324	1,324

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	1.1	3.52	7.23	11.2	14.9
Injection wells (wells)		0	2	9	15	26	32
Resource characterization, appraisal, permitting costs (million \$2020)		100	281	361	361	361	361
Wells and facilities construction costs (million \$2020)		0	66.8	260	464	776	963

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							
Carbon sink potential - Aggressive							-17,544
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-428
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-21,808
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-9,245
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-214
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-13,295
deployment - Total (1000 tC02e/y)							
Land impacted for carbon sink -							1,734
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							7,209
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							779
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							9,721
Aggressive deployment - Total (1000							,
hectares)							
Land impacted for carbon sink - Moderate	+						1,734
deployment - Corn-ethanol to energy							.,
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3,799
deployment - Cropland measures (1000							0,,,,
hectares)							
Land impacted for carbon sink - Moderate							389
deployment - Permanent conservation							507
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							5,922
deployment - Total (1000 hectares)							0,722
achicaling - local (1000 liegtal es)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-95.6
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,662
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-2,426
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-108
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,364
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase	2020	2023	2030	2033	2040	2045	-3,477
trees outside forests (1000 tC02e/y)							-5,411
Carbon sink potential - High - Reforest							-5,430
cropland (1000 tC02e/y)							-5,430
Carbon sink potential - High - Reforest							-4,831
pasture (1000 tC02e/y)							-4,031
Carbon sink potential - High - Restore	-						-1,239
							-1,239
productivity (1000 tC02e/y)							/70
Carbon sink potential - Low - Accelerate							-47.9
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,654
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-449
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-932
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-55.1
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-455
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,217
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,715
cropland (1000 tCO2e/y)							_,
Carbon sink potential - Low - Reforest							-366
pasture (1000 tCO2e/y)							000
Carbon sink potential - Low - Restore							-418
productivity (1000 tCO2e/y)							-410
Carbon sink potential - Mid - Accelerate							-71.7
·							-/1./
regeneration (1000 tC02e/y)							1/ 157
Carbon sink potential - Mid - All (not							-14,157
counting overlap) (1000 tC02e/y)							4 570
Carbon sink potential - Mid - Avoid							-1,570
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-1,679
rotation length (1000 tCO2e/y)							
Carbon sink potential - Mid - Improve							-80.8
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-909
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,347
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4,073
cropland (1000 tCO2e/y)							·
Carbon sink potential - Mid - Reforest							-2,599
pasture (1000 tC02e/y)							,-
Carbon sink potential - Mid - Restore							-828
productivity (1000 tCO2e/y)							0_0
Land impacted for carbon sink potential -							15.6
High - Accelerate regeneration (1000							10.0
hectares)							
Land impacted for carbon sink potential -		-					364
High - Avoid deforestation (over 30 years)							304
- , , , , , , , , , , , , , , , , , , ,							
(1000 hectares)							4 00-
Land impacted for carbon sink potential -							1,237
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -	T					T	39.9
High - Improve plantations (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000							0
hectares)							
Land impacted for carbon sink potential -							330
High - Increase trees outside forests							
(1000 hectares)							0.50
Land impacted for carbon sink potential -							359
High - Reforest cropland (1000 hectares)							407
Land impacted for carbon sink potential -							137
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							411
High - Restore productivity (1000							
hectares) Land impacted for carbon sink potential -							2,894
High - Total impacted (over 30 years)							2,094
(1000 hectares)							
Land impacted for carbon sink potential -							7.82
Low - Accelerate regeneration (1000							1.02
hectares)							
Land impacted for carbon sink potential -							342
Low - Avoid deforestation (over 30 years)							042
(1000 hectares)							
Land impacted for carbon sink potential -							474
Low - Extend rotation length (1000							717
hectares)							
Land impacted for carbon sink potential -							20
Low - Improve plantations (1000							20
hectares)							
Land impacted for carbon sink potential -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							174
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							11.7
Mid - Accelerate regeneration (1000							
hectares)							050
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							055
Land impacted for carbon sink potential -							855
Mid - Extend rotation length (1000							
hectares)							30
Land impacted for carbon sink potential -							30
Mid - Improve plantations (1000 hectares) Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							U
hectares)							
Land impacted for carbon sink potential -							252
Mid - Increase trees outside forests (1000							202
a						I .	

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,444
Mid - Total impacted (over 30 years) (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		858	723	580	437	275	191
Natural gas consumption - Cumulative		0	0	0	0	0	17,474
(tcf)							
Natural gas production - Annual (tcf)		2.9	2.75	2.39	2.02	1.6	1.25
Oil consumption - Annual (million bbls)		204	179	143	108	81.3	59.6
Oil consumption - Cumulative (million		0	0	0	0	0	4,405
bbls)							
Oil production - Annual (million bbls)		10.9	10.9	10.9	8.66	7.04	4.69

Table 15: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		961	0.815	0.792	0.688	0.483	0.033
Coal (million 2019\$)							
Monetary damages from air pollution -		406	285	214	182	104	45.1
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,899	4,586	3,504	2,047	963	413
Transportation (million 2019\$)							
Premature deaths from air pollution -		109	0.092	0.089	0.078	0.055	0.004
Coal (deaths)							
Premature deaths from air pollution -		45.8	32.2	24.1	20.6	11.8	5.09
Natural Gas (deaths)							
Premature deaths from air pollution -		551	516	394	230	108	46.5
Transportation (deaths)							

Table 16: E+ scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		2,969	3,009	6,027	6,096	4,421	3,486
By economic sector - Construction (jobs)		17,402	25,542	34,708	42,720	45,856	51,094
By economic sector - Manufacturing		19,745	23,393	31,660	31,381	26,513	32,791
(jobs)							
By economic sector - Mining (jobs)		7,211	4,726	3,490	2,423	1,769	1,288
By economic sector - Other (jobs)		1,357	1,979	3,434	5,038	5,493	6,239
By economic sector - Pipeline (jobs)		1,058	1,601	1,066	632	556	657
By economic sector - Professional (jobs)		10,710	15,142	24,613	32,319	36,422	40,856
By economic sector - Trade (jobs)		8,059	9,493	12,933	16,399	18,501	21,341
By economic sector - Utilities (jobs)		21,944	26,956	32,994	38,326	40,915	46,284
By education level - All sectors -		27,319	34,622	46,468	54,488	56,651	64,674
Associates degree or some college (jobs)							
By education level - All sectors -		18,781	23,004	30,907	36,166	37,734	42,706
Bachelors degree (jobs)							
By education level - All sectors - Doctoral		621	798	1,160	1,442	1,570	1,749
degree (jobs)							
By education level - All sectors - High		39,240	47,835	64,703	74,038	74,717	83,892
school diploma or less (jobs)							

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

Table 10. L+ Scellal 10 - IMPACTS - 3003 (col	•						
Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - Masters		4,493	5,582	7,687	9,200	9,776	11,014
or professional degree (jobs)							
By resource sector - Biomass (jobs)		7,011	6,882	15,395	17,314	16,261	15,366
By resource sector - CO2 (jobs)		53.1	5,823	3,018	974	1,978	3,799
By resource sector - Coal (jobs)		4,620	1,584	1,162	1,004	900	796
By resource sector - Grid (jobs)		24,329	31,296	49,021	61,863	71,240	83,397
By resource sector - Natural Gas (jobs)		10,687	8,662	7,320	7,749	4,221	3,147
By resource sector - Nuclear (jobs)		6,266	5,516	3,870	2,680	1,368	0
By resource sector - Oil (jobs)		11,530	9,557	7,423	5,282	3,774	2,521
By resource sector - Solar (jobs)		9,777	10,623	18,308	23,642	20,303	23,475
By resource sector - Wind (jobs)		16,180	31,897	45,408	54,826	60,402	71,532
Median wages - Annual - All (\$2019 per		64,977	66,411	67,018	68,533	70,362	71,320
job)							
On-Site or In-Plant Training - Total jobs - 1		14,200	17,888	23,892	27,925	28,977	32,936
to 4 years (jobs)					-	.	
On-Site or In-Plant Training - Total jobs - 4		5,518	7,215	9,578	11,448	12,172	13,775
to 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		14,546	18,152	24,767	28,922	29,763	33,601
None (jobs)							
On-Site or In-Plant Training - Total jobs -		732	953	1,277	1,501	1,573	1,799
Over 10 years (jobs)							
On-Site or In-Plant Training - Total jobs -		55,458	67,632	91,410	105,538	107,963	121,924
Up to 1 year (jobs)							
On-the-Job Training - All sectors - 1 to 4		18,106	22,978	30,637	35,933	37,435	42,598
years (jobs)							
On-the-Job Training - All sectors - 4 to 10		5,281	6,999	9,347	11,254	12,014	13,607
years (jobs)							
On-the-Job Training - All sectors - None		4,926	6,033	8,107	9,440	9,734	10,961
(jobs)							
On-the-Job Training - All sectors - Over 10		879	1,109	1,459	1,659	1,669	1,899
years (jobs)							
On-the-Job Training - All sectors - Up to 1		61,261	74,721	101,374	117,048	119,594	134,970
year (jobs)							
Related work experience - All sectors - 1		32,202	39,725	53,657	62,656	64,815	73,283
to 4 years (jobs)							
Related work experience - All sectors - 4		20,469	25,716	34,424	40,324	42,009	47,740
to 10 years (jobs)							
Related work experience - All sectors -		13,011	16,120	21,780	25,262	25,904	29,229
None (jobs)							
Related work experience - All sectors -		5,658	7,001	9,294	10,723	11,039	12,597
Over 10 years (jobs)							
Related work experience - All sectors - Up		19,114	23,279	31,769	36,369	36,680	41,185
to 1 year (jobs)							
Wage income - All (million \$2019)		5,878	7,428	10,115	12,017	12,698	14,553

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	40,922	44,666	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	0.751	6.2	9.31	19.3	41.6	67.6	82.4
Heat Pump (%)							
Sales of space heating units - Electric	2.86	3.43	3.64	4.33	6.04	8.25	9.53
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.4	2.27	1.73	0.88	0.287	0.075
Sales of space heating units - Gas Furnace	96.4	88	84.8	74.6	51.5	23.8	7.97
(%)							

Table 17: E- scenario -	DILLAR 1. Efficience	//Electrification -	Commercial	continued
Table II. E- Scellul IO -	PILLAK I. EIIILIEIIL	// EIECH 111CUHUH -	CUITITIETCIULT	Continueur

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric	0.271	1.04	2.99	9.2	22.7	38.2	46.9
Heat Pump (%)							
Sales of water heating units - Electric	2.65	3.78	5.32	10.5	22.3	36.6	44.8
Resistance (%)							
Sales of water heating units - Gas Furnace	96.9	95	91.5	80.1	54.8	25	8.1
(%)							
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.41	5.46	7.27	7.54	10.4	11
Cumulative 5-yr (billion \$2018)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	441	434	424	414	399	379	356
Final energy use - Industry (PJ)	634	660	674	680	693	701	708
Final energy use - Residential (PJ)	591	552	524	495	458	408	352
Final energy use - Transportation (PJ)	1,044	984	908	847	798	740	672

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)	0	10.7	14.3	0	0	0	0
Sales of cooking units - Electric Resistance (%)	50.6	51.9	56.4	68.3	84.9	95.1	98.7
Sales of cooking units - Gas (%)	49.4	48.1	43.6	31.7	15.1	4.87	1.31
Sales of space heating units - Electric Heat Pump (%)	3.5	8.23	11.6	22.2	45.5	72.3	87.2
Sales of space heating units - Electric Resistance (%)	12.7	18.7	18.1	16.4	12.5	8.16	5.9
Sales of space heating units - Fossil (%)	2.45	4.6	4.47	3.97	2.93	1.72	1.01
Sales of space heating units - Gas (%)	81.4	68.5	65.9	57.4	39	17.8	5.87
Sales of water heating units - Electric Heat Pump (%)	0	0.582	2.2	7.34	18.4	30.9	37.9
Sales of water heating units - Electric Resistance (%)	22.7	38.3	38.8	40.9	46.2	52.8	56.7
Sales of water heating units - Gas Furnace (%)	77.3	61	58.9	51.7	35.3	16.1	5.22
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.113	0.113	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	333	687	2,331	7,297	10,644
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.299	0	1.05	0	5.19	0	14.3
units)							
Public EV charging plugs - L2 (1000 units)	1.41	0	25.2	0	125	0	345
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-17,544
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-428
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-21,808
deployment - Total (1000 tCO2e/y)							
Carbon sink potential - Moderate							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-9,245
deployment - Cropland measures (1000							
tC02e/y)							
Carbon sink potential - Moderate							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-13,295
deployment - Total (1000 tCO2e/y)							-, -
Land impacted for carbon sink -							1,734
Aggressive deployment - Corn-ethanol to							.,
energy grasses (1000 hectares)							
Land impacted for carbon sink -							7,209
Aggressive deployment - Cropland							1,207
measures (1000 hectares)							
Land impacted for carbon sink -							779
Aggressive deployment - Permanent							117
conservation cover (1000 hectares)							
Land impacted for carbon sink -						+	9,721
Aggressive deployment - Total (1000							7,1 21
hectares)							
Land impacted for carbon sink - Moderate							1,734
deployment - Corn-ethanol to energy							1,134
grasses (1000 hectares)							
							0.700
Land impacted for carbon sink - Moderate							3,799
deployment - Cropland measures (1000							
hectares)							000
Land impacted for carbon sink - Moderate							389
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 - Moderate							5,922
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							-95.6
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,662
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-2,426
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-108
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,477
trees outside forests (1000 tCO2e/y)							•
Carbon sink potential - High - Reforest							-5,430
cropland (1000 tCO2e/y)							-,
Carbon sink potential - High - Reforest							-4,831
pasture (1000 tC02e/y)							-4,00
Carbon sink potential - High - Restore							-1,239
							-1,239
productivity (1000 tC02e/y)							/70
Carbon sink potential - Low - Accelerate							-47.9
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,654
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-449
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-932
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-55.1
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-455
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,217
trees outside forests (1000 tCO2e/y)							1,211
Carbon sink potential - Low - Reforest							-2,715
cropland (1000 tCO2e/y)							-2,110
Carbon sink potential - Low - Reforest							2//
							-366
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-418
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-71.7
regeneration (1000 tCO2e/y)							
Carbon sink potential - Mid - All (not							-14,157
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Mid - Avoid							-1,570
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-1,679
rotation length (1000 tCO2e/y)							•
Carbon sink potential - Mid - Improve							-80.8
plantations (1000 tCO2e/y)							00.0
Carbon sink potential - Mid - Increase							-909
							-709
retention of HWP (1000 tCO2e/y)							0.07
Carbon sink potential - Mid - Increase							-2,347
trees outside forests (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 - Reforest							-4,073
cropland (1000 tC02e/y)							0.500
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,599
Carbon sink potential - Mid - Restore			+				-828
productivity (1000 tCO2e/y)							-020
Land impacted for carbon sink potential -			+				15.6
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							364
High - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							1,237
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							39.9
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 -							330
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							359
High - Reforest cropland (1000 hectares)							407
Land impacted for carbon sink potential -							137
High - Reforest pasture (1000 hectares)							/ 11
Land impacted for carbon sink potential - High - Restore productivity (1000							411
hectares)							
Land impacted for carbon sink potential -			+				2,894
High - Total impacted (over 30 years)							2,074
(1000 hectares)							
Land impacted for carbon sink potential -			+				7.82
Low - Accelerate regeneration (1000							1.02
hectares)							
Land impacted for carbon sink potential -							342
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							474
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							20
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 -							174
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							<u> </u>
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							11.7
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							855
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							30
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 -							252
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,444
Mid - Total impacted (over 30 years) (1000							
hectares)							

Table 24: E- scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		961	0.815	0.792	0.688	0.483	0.033
Monetary damages from air pollution - Natural Gas (million 2019\$)		440	300	127	55.5	18.5	13.4
Monetary damages from air pollution - Transportation (million 2019\$)		4,985	5,062	4,958	4,497	3,605	2,497
Premature deaths from air pollution - Coal (deaths)		109	0.092	0.089	0.078	0.055	0.004
Premature deaths from air pollution - Natural Gas (deaths)		49.7	33.9	14.4	6.27	2.09	1.52
Premature deaths from air pollution - Transportation (deaths)		561	569	558	506	405	281

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	40,927	44,680	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.751	8.27	35.3	81	89	89.5	89.5
Heat Pump (%)							
Sales of space heating units - Electric	2.86	3.5	5.34	9.38	10.1	10.2	10.2
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.07	0.402	0.017	0	0	0

Table 25: <i>E+RE+</i>	scenario -	PTIIAR 1.	Efficiency/	Flectrification -	Commercial	(continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	96.4	86.2	59	9.63	0.906	0.363	0.363
Sales of water heating units - Electric Heat Pump (%)	0.271	2.48	19.4	46.1	50.7	51	51
Sales of water heating units - Electric Resistance (%)	2.65	4.62	18.3	44	48.5	48.8	48.8
Sales of water heating units - Gas Furnace (%)	96.9	92.7	62.2	9.74	0.572	0	0
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.63	6.83	11.6	12.4	12.3	13
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)	441	434	415	383	346	319	305
Final energy use - Industry (PJ)	634	660	671	671	678	686	694
Final energy use - Residential (PJ)	591	551	512	443	367	307	269
Final energy use - Transportation (PJ)	1,043	977	873	748	634	562	530

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	10.8	14.4	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.8	61.3	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.2	38.7	6.63	0.334	0	0	0
Sales of space heating units - Electric	3.5	10.7	39.6	85.8	93.9	94.4	94.2
Heat Pump (%)							
Sales of space heating units - Electric	12.7	18.4	13.8	6.17	4.76	4.69	4.9
Resistance (%)							
Sales of space heating units - Fossil (%)	2.45	4.48	3.17	1.07	0.718	0.695	0.671
Sales of space heating units - Gas (%)	81.4	66.5	43.4	6.93	0.605	0.212	0.217
Sales of water heating units - Electric	0	1.85	15.9	37.3	41	41.2	41.2
Heat Pump (%)							
Sales of water heating units - Electric	22.7	38.5	43.9	56.3	58.6	58.7	58.6
Resistance (%)							
Sales of water heating units - Gas Furnace	77.3	59.6	40	6.28	0.367	0	0
(%)							
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.111	0.111	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	2,022	5,214	8,399	12,743	13,847	13,214
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.299	0	3.24	0	13.9	0	22.4
units)							
Public EV charging plugs - L2 (1000 units)	1.41	0	78	0	334	0	539
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
(%)							

Table 29: E+RE+ scena	nio DILLAD 1. Efficience	v/Electrification	Transportation	(nontinued)
Table 29. E+RE+ Scellu	II IU - PILLAR I. EIIIUIEIIU	: 7/ = 12011 1110011011 -	Trunsbortution	COMUNICEUM

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)	0	1.93	6.22	10.7	7.78	9.39	13.6
Capital invested - Wind - Base (billion \$2018)	0	10.5	29.9	38.8	42.7	38.7	18.6
Installed (cumulative) - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed (cumulative) - Solar - Base land use assumptions (MW)	305	1,746	6,941	16,607	24,091	33,662	48,380
Installed (cumulative) - Wind - Base land use assumptions (MW)	6,208	13,339	35,822	67,091	103,262	137,735	155,340

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	650	2,685	9,605	17,415	13,767	17,465	26,717
Solar - Constrained land use assumptions (GWh)	650	3,869	8,165	17,245	13,051	17,936	29,931
Wind - Base land use assumptions (GWh)	22,788	22,969	72,467	98,809	112,813	104,504	50,957
Wind - Constrained land use assumptions (GWh)	23,175	7,399	15,587	17,489	537	99.8	380,451

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-17,544
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-428
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-21,808
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-9,245
deployment - Cropland measures (1000							
tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate							-214
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-13,295
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							1,734
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							
Land impacted for carbon sink -							7,209
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							779
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							9,721
Aggressive deployment - Total (1000							
hectares)							
Land impacted for carbon sink - Moderate							1,734
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3,799
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							389
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							5,922
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-95.6
Carbon sink potential - High - All (not							-21,662
counting overlap) (1000 tC02e/y) Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tCO2e/y)							-2,092
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-2,426
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-108
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-1,364
Carbon sink potential - High - Increase trees outside forests (1000 tC02e/y)							-3,477
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5,430
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,831
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-1,239
Carbon sink potential - Low - Accelerate regeneration (1000 tC02e/y)							-47.9
Carbon sink potential - Low - All (not counting overlap) (1000 tC02e/y)							-6,654
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-449
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-932

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

Item Conhon sink notantial Low Improve	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Improve							-55.
plantations (1000 tCO2e/y)							, -
Carbon sink potential - Low - Increase							-45
retention of HWP (1000 tC02e/y)							1 01
Carbon sink potential - Low - Increase							-1,21
trees outside forests (1000 tC02e/y)							0.71
Carbon sink potential - Low - Reforest							-2,71
cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest							-360
·							-360
pasture (1000 tC02e/y)							/ 1/
Carbon sink potential - Low - Restore							-418
productivity (1000 tCO2e/y) Carbon sink potential - Mid - Accelerate							-71.
regeneration (1000 tCO2e/y)							-71.
Carbon sink potential - Mid - All (not							-14,15
counting overlap) (1000 tCO2e/y)							-14,15
Carbon sink potential - Mid - Avoid							-1,570
deforestation (1000 tC02e/y)							-1,571
Carbon sink potential - Mid - Extend							-1,67
rotation length (1000 tC02e/y)							-1,07
Carbon sink potential - Mid - Improve							-80.
plantations (1000 tCO2e/y)							-00.
Carbon sink potential - Mid - Increase							-90
retention of HWP (1000 tCO2e/y)							-90
Carbon sink potential - Mid - Increase							-2,34
trees outside forests (1000 tCO2e/y)							-2,54
Carbon sink potential - Mid - Reforest							-4,07
cropland (1000 tCO2e/y)							-4,01
Carbon sink potential - Mid - Reforest							-2,59
pasture (1000 tC02e/y)							2,07
Carbon sink potential - Mid - Restore							-828
productivity (1000 tC02e/y)							-02
Land impacted for carbon sink potential -							15.
High - Accelerate regeneration (1000							10.
hectares)							
Land impacted for carbon sink potential -							36
High - Avoid deforestation (over 30 years)							00
(1000 hectares)							
Land impacted for carbon sink potential -							1,23
High - Extend rotation length (1000							.,_0
hectares)							
Land impacted for carbon sink potential -							39.
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							33
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							35
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							13
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							4
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,89
High - Total impacted (over 30 years)							,
(1000 hectares)							

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

Table 35. ETRET Section 10 TILLAN 6. Lai	ia onino	10000 (001111)	macaj				
Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							7.82
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							342
Low - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							474
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							20
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 -							174
Low - Increase trees outside forests							174
(1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							100
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							23.0
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							240
hectares)							
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							1,407
(1000 hectares)							
Land impacted for carbon sink potential -							11.7
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							855
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							30
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 -							252
Mid - Increase trees outside forests (1000							
hectares)							
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)	1						500
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							
hectares)	1						0 / / /
Land impacted for carbon sink potential -							2,444
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 - Coal (million 2019\$)		961	0.815	0.792	0.688	0.483	0.033

T-1-1-0/ F	DC	TATOACTO	1 141-	(
Table 34: <i>E</i> -	+RE+ scenario -	IMPACIS - F	teaith i	continueai

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		432	286	165	110	39.2	10.8
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,899	4,586	3,504	2,047	963	413
Transportation (million 2019\$)							
Premature deaths from air pollution -		109	0.092	0.089	0.078	0.055	0.004
Coal (deaths)							
Premature deaths from air pollution -		48.7	32.3	18.6	12.5	4.43	1.22
Natural Gas (deaths)							
Premature deaths from air pollution -		551	516	394	230	108	46.5
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 -	0	40,927	44,680	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	54.2	82.9	88.6	88.9	88.9	88.9
Resistance (%)							
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Sales of space heating units - Electric	0.751	8.27	35.3	81	89	89.5	89.5
Heat Pump (%)							
Sales of space heating units - Electric	2.86	3.5	5.34	9.38	10.1	10.2	10.2
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.07	0.402	0.017	0	0	0
Sales of space heating units - Gas Furnace	96.4	86.2	59	9.63	0.906	0.363	0.363
(%)							
Sales of water heating units - Electric	0.271	2.48	19.4	46.1	50.7	51	51
Heat Pump (%)							
Sales of water heating units - Electric	2.65	4.62	18.3	44	48.5	48.8	48.8
Resistance (%)							
Sales of water heating units - Gas Furnace	96.9	92.7	62.2	9.74	0.572	0	0
(%)							
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		6.63	6.83	11.6	12.4	12.3	13
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)	441	434	415	383	346	319	305
Final energy use - Industry (PJ)	634	660	671	671	678	686	694
Final energy use - Residential (PJ)	591	551	512	443	367	307	269
Final energy use - Transportation (PJ)	1,043	977	873	748	634	562	530

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	10.8	14.4	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.8	61.3	93.4	99.7	100	100	100
Resistance (%)							
Sales of cooking units - Gas (%)	49.2	38.7	6.63	0.334	0	0	0
Sales of space heating units - Electric	3.5	10.7	39.6	85.8	93.9	94.4	94.2
Heat Pump (%)							
Sales of space heating units - Electric	12.7	18.4	13.8	6.17	4.76	4.69	4.9
Resistance (%)							

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Fossil (%)	2.45	4.48	3.17	1.07	0.718	0.695	0.671
Sales of space heating units - Gas (%)	81.4	66.5	43.4	6.93	0.605	0.212	0.217
Sales of water heating units - Electric Heat Pump (%)	0	1.85	15.9	37.3	41	41.2	41.2
Sales of water heating units - Electric Resistance (%)	22.7	38.5	43.9	56.3	58.6	58.7	58.6
Sales of water heating units - Gas Furnace (%)	77.3	59.6	40	6.28	0.367	0	0
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.111	0.111	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	2,022	5,214	8,399	12,743	13,847	13,214
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.299	0	3.24	0	13.9	0	22.4
units)							
Public EV charging plugs - L2 (1000 units)	1.41	0	78	0	334	0	539
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC	0.392	2.54	12.7	30.4	38.2	39.7	40
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.4	1.68	1.2	0.382	0.072	0.013	0
Vehicle sales - Light-duty - EV (%)	4.42	16.7	48.8	82.7	96.4	99.3	100
Vehicle sales - Light-duty - gasoline (%)	89.1	76.3	46.4	15.6	3.17	0.586	0
Vehicle sales - Light-duty - hybrid (%)	4.91	4.9	3.38	1.24	0.304	0.067	0
Vehicle sales - Light-duty - hydrogen FC	0.11	0.331	0.191	0.059	0.012	0.002	0
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.091	0.058	0.02	0.004	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen	0.196	1.27	6.33	15.2	19.1	19.9	20
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		2.75	6.89	3.69	4.13	1.86	0
Capital invested - Solar PV - Constrained (billion \$2018)		2.5	5.3	4.21	4.26	1.14	0
Capital invested - Wind - Base (billion \$2018)		7.65	9.8	0	7.4	12.2	24
Capital invested - Wind - Constrained (billion \$2018)		3.22	3.5	0.04	1.89	2.27	4.57

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	650	3,834	10,723	6,208	7,362	3,470	0
Solar - Constrained land use assumptions	650	3,470	8,244	7,050	7,618	2,139	0
(GWh)							
Wind - Base land use assumptions (GWh)	22,788	16,823	24,209	0	19,958	34,467	71,885
Wind - Constrained land use assumptions	22,788	6,911	8,515	107	4,977	6,191	12,646
(GWh)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tC02e/y)							17.57.7
Carbon sink potential - Aggressive							-17,544
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							-428
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Aggressive							-21,808
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-3,836
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-9,245
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Moderate							-214
deployment - Permanent conservation							
cover (1000 tC02e/y)							
Carbon sink potential - Moderate							-13,295
deployment - Total (1000 tCO2e/y)							
Land impacted for carbon sink -							1,734
Aggressive deployment - Corn-ethanol to							•
energy grasses (1000 hectares)							
Land impacted for carbon sink -							7,209
Aggressive deployment - Cropland							·
measures (1000 hectares)							
Land impacted for carbon sink -							779
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							9,72
Aggressive deployment - Total (1000							7,1.2
hectares)							
Land impacted for carbon sink - Moderate		-					1,734
deployment - Corn-ethanol to energy							1,10
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3,799
deployment - Cropland measures (1000							0,177
hectares)							
Land impacted for carbon sink - Moderate							389
deployment - Permanent conservation							307
cover (1000 hectares)							
							E 000
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							5,922

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-95.6
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,662
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-2,426
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-108
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,364
retention of HWP (1000 tCO2e/y)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase							-3,477
trees outside forests (1000 tC02e/y)							
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5,430
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,831
Carbon sink potential - High - Restore productivity (1000 tC02e/y)							-1,239
Carbon sink potential - Low - Accelerate							-47.9
regeneration (1000 tCO2e/y) Carbon sink potential - Low - All (not							-6,654
counting overlap) (1000 tCO2e/y) Carbon sink potential - Low - Avoid							-449
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-932
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-55.1
Carbon sink potential - Low - Increase							-455
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,217
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,715
cropland (1000 tC02e/y) Carbon sink potential - Low - Reforest							-366
pasture (1000 tC02e/y)							300
Carbon sink potential - Low - Restore							-418
productivity (1000 tCO2e/y)							
Carbon sink potential - Mid - Accelerate							-71.7
regeneration (1000 tCO2e/y) Carbon sink potential - Mid - All (not							-14,157
counting overlap) (1000 tCO2e/y)							-14,157
Carbon sink potential - Mid - Avoid							-1,570
deforestation (1000 tCO2e/y)							
Carbon sink potential - Mid - Extend							-1,679
rotation length (1000 tC02e/y)							-80.8
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-80.8
Carbon sink potential - Mid - Increase							-909
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,347
trees outside forests (1000 tC02e/y)							, 070
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4,073
Carbon sink potential - Mid - Reforest							-2,599
pasture (1000 tC02e/y)							2,077
Carbon sink potential - Mid - Restore							-828
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							15.6
High - Accelerate regeneration (1000 hectares)							
Land impacted for carbon sink potential -		+	+				364
High - Avoid deforestation (over 30 years)							004
(1000 hectares)							
Land impacted for carbon sink potential -							1,237
High - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							39.9
High - Improve plantations (1000							
hectares)							

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

Land impacted for carbon sink potential -	2020	2025	2030	2035	2040	2045	2050
High - Increase retention of HWP (1000							·
hectares)							
Land impacted for carbon sink potential -							330
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							359
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							137
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							41
High - Restore productivity (1000							
hectares)							0.007
Land impacted for carbon sink potential -							2,894
High - Total impacted (over 30 years) (1000 hectares)							
Land impacted for carbon sink potential -							7.82
Low - Accelerate regeneration (1000							1.02
hectares)							
Land impacted for carbon sink potential -							342
Low - Avoid deforestation (over 30 years)							J 12
(1000 hectares)							
Land impacted for carbon sink potential -							474
Low - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							20
Low - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							(
Low - Increase retention of HWP (1000							
hectares)							17/
Land impacted for carbon sink potential -							174
Low - Increase trees outside forests (1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							100
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							20.0
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							11.
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares) Land impacted for carbon sink potential -							85
Mid - Extend rotation length (1000							85
hectares)							
Land impacted for carbon sink potential -							30
Mid - Improve plantations (1000 hectares)							30
Land impacted for carbon sink potential -							(
Mid - Increase retention of HWP (1000							,
hectares)							
Land impacted for carbon sink potential -							252
Mid - Increase trees outside forests (1000							
hectares)							

Table 43: E+RE-	econario -	DTIIADA	· I and einke .	Enrecte	(continued)
1auit 45. E+KE-	SCEIIUI 10 -	PILLAR	o. Luiiu Siiiks ·	- ศบาษธเธา	CUILLIIUEUI

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,444
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 -		961	0.815	0.792	0.688	0.483	0.033
Coal (million 2019\$)							
Monetary damages from air pollution -		369	199	317	227	91	29.4
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,899	4,586	3,504	2,047	963	413
Transportation (million 2019\$)							
Premature deaths from air pollution -		109	0.092	0.089	0.078	0.055	0.004
Coal (deaths)							
Premature deaths from air pollution -		41.6	22.4	35.8	25.6	10.3	3.32
Natural Gas (deaths)							
Premature deaths from air pollution -		551	516	394	230	108	46.5
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	40,922	44,666	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	45.8	49.8	60.5	75.4	84.5	87.7
Resistance (%)							
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Sales of space heating units - Electric	0.751	6.2	9.31	19.3	41.6	67.6	82.4
Heat Pump (%)							
Sales of space heating units - Electric	2.86	3.43	3.64	4.33	6.04	8.25	9.53
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.4	2.27	1.73	0.88	0.287	0.075
Sales of space heating units - Gas Furnace	96.4	88	84.8	74.6	51.5	23.8	7.97
(%)							
Sales of water heating units - Electric	0.271	1.04	2.99	9.2	22.7	38.2	46.9
Heat Pump (%)							
Sales of water heating units - Electric	2.65	3.78	5.32	10.5	22.3	36.6	44.8
Resistance (%)							
Sales of water heating units - Gas Furnace	96.9	95	91.5	80.1	54.8	25	8.1
(%)							
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.41	5.46	7.27	7.54	10.4	11
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)	441	434	424	414	399	379	356

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	634	660	674	680	693	701	708
Final energy use - Residential (PJ)	591	552	524	495	458	408	352
Final energy use - Transportation (PJ)	1,044	984	908	847	798	740	672

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	10.7	14.3	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.6	51.9	56.4	68.3	84.9	95.1	98.7
Resistance (%)							
Sales of cooking units - Gas (%)	49.4	48.1	43.6	31.7	15.1	4.87	1.31
Sales of space heating units - Electric	3.5	8.23	11.6	22.2	45.5	72.3	87.2
Heat Pump (%)							
Sales of space heating units - Electric	12.7	18.7	18.1	16.4	12.5	8.16	5.9
Resistance (%)							
Sales of space heating units - Fossil (%)	2.45	4.6	4.47	3.97	2.93	1.72	1.01
Sales of space heating units - Gas (%)	81.4	68.5	65.9	57.4	39	17.8	5.87
Sales of water heating units - Electric	0	0.582	2.2	7.34	18.4	30.9	37.9
Heat Pump (%)							
Sales of water heating units - Electric	22.7	38.3	38.8	40.9	46.2	52.8	56.7
Resistance (%)							
Sales of water heating units - Gas Furnace	77.3	61	58.9	51.7	35.3	16.1	5.22
(%)							
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.113	0.113	0.112

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs -	0	0	333	687	2,331	7,297	10,644
Cumulative 5-yr (million \$2018)							
Public EV charging plugs - DC Fast (1000	0.299	0	1.05	0	5.19	0	14.3
_units)							
Public EV charging plugs - L2 (1000 units)	1.41	0	25.2	0	125	0	345
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC	0.332	0.969	2.74	7.17	15.7	26.3	34
(%)							
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.41	1.85	2.03	1.61	1.02	0.519	0.223
Vehicle sales - Light-duty - EV (%)	2.06	5.07	12.6	27.1	49.7	72.9	87.9
Vehicle sales - Light-duty - gasoline (%)	91.2	86.7	78.4	65.1	44.7	23.9	10.6
Vehicle sales - Light-duty - hybrid (%)	5.1	5.88	6.55	5.89	4.34	2.52	1.21
Vehicle sales - Light-duty - hydrogen FC	0.112	0.376	0.317	0.239	0.168	0.092	0.043
(%)							
Vehicle sales - Light-duty - other (%)	0.096	0.1	0.09	0.078	0.056	0.03	0.014
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen	0.166	0.485	1.37	3.58	7.86	13.2	17
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.075	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	1.9	1.4	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	74.6	74.6	74.6	74.6
Biomass w/ccu power plant (GWh)	0	0	2,136	3,710	3,710	3,710	3,710

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	151	6,164	10,720	10,720	10,720
Conversion capital investment -	0	0	1,746	60,802	45,876	0	0
Cumulative 5-yr (million \$2018)							
Number of facilities - Allam power w ccu	0	0	0	2	2	2	2
(quantity)							
Number of facilities - Beccs hydrogen	0	0	0	70	124	124	124
(quantity)							
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	2	2	2	2
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu	0	0	2	4	4	4	4
(quantity)							
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu	0	0	0	2	2	2	2
(quantity)							
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	2	2	2	2	2

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	2.13	83.5	142	142	143
Annual - BECCS (MMT)		0	2.12	80	139	139	139
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Annual - NGCC (MMT)		0	0.01	0.09	0.11	0.08	0.03
Cumulative - All (MMT)		0	2.13	85.6	228	371	513
Cumulative - BECCS (MMT)		0	2.12	82.2	221	360	499
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6
Cumulative - NGCC (MMT)		0	0.01	0.1	0.21	0.29	0.32

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	1,311	5,604	8,760	8,881	8,894
Cumulative investment - All (million \$2018)		0	6,509	13,041	20,368	21,553	21,678
Cumulative investment - Spur (million \$2018)		0	240	4,152	6,968	8,152	8,277
Cumulative investment - Trunk (million \$2018)		0	6,269	8,888	13,401	13,401	13,401
Spur (km)		0	354	4,280	6,716	6,837	6,849
Trunk (km)		0	958	1,324	2,045	2,045	2,045

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	2.77	13.9	27.3	38.4	40.1
Injection wells (wells)		0	7	26	46	78	96
Resource characterization, appraisal, permitting costs (million \$2020)		100	441	682	682	682	682
Wells and facilities construction costs (million \$2020)		0	200	781	1,392	2,327	2,890

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

Table 56: E-B+ Scenario - PILLAR 6: Lana S			2222	2225	00/0	2015	2252
Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive							-4,993
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Aggressive							-15,905
deployment - Cropland measures (1000							
tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Cropland to woody energy							
crops (1000 tCO2e/y)							
Carbon sink potential - Aggressive							0
deployment - Pasture to energy crops							J
(1000 tC02e/y)							
Carbon sink potential - Aggressive						+	-387
deployment - Permanent conservation							-301
cover (1000 tC02e/y)							
						+	01.005
Carbon sink potential - Aggressive							-21,285
deployment - Total (1000 tC02e/y)							
Carbon sink potential - Moderate							-4,993
deployment - Corn-ethanol to energy							
grasses (1000 tCO2e/y)							
Carbon sink potential - Moderate							-8,380
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							-193
deployment - Permanent conservation							
cover (1000 tCO2e/y)							
Carbon sink potential - Moderate							-13,567
deployment - Total (1000 tCO2e/y)							10,001
Land impacted for carbon sink -							2,460
							2,400
Aggressive deployment - Corn-ethanol to							
energy grasses (1000 hectares)							17 107
Land impacted for carbon sink -							16,127
Aggressive deployment - Cropland							
measures (1000 hectares)							
Land impacted for carbon sink -							822
Aggressive deployment - Cropland to							
woody energy crops (1000 hectares)							
Land impacted for carbon sink -							113
Aggressive deployment - Pasture to							
energy crops (1000 hectares)							
Land impacted for carbon sink -							703
Aggressive deployment - Permanent							
conservation cover (1000 hectares)							
Land impacted for carbon sink -							20,227
Aggressive deployment - Total (1000							, ·
hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate							2,460
deployment - Corn-ethanol to energy							
grasses (1000 hectares)							
Land impacted for carbon sink - Moderate							3,442
deployment - Cropland measures (1000							
hectares)							
Land impacted for carbon sink - Moderate							822
deployment - Cropland to woody energy							
crops (1000 hectares)							
Land impacted for carbon sink - Moderate							113
deployment - Pasture to energy crops							
(1000 hectares)							
Land impacted for carbon sink - Moderate							352
deployment - Permanent conservation							
cover (1000 hectares)							
Land impacted for carbon sink - Moderate							7,189
deployment - Total (1000 hectares)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-95.
regeneration (1000 tC02e/y)							
Carbon sink potential - High - All (not							-21,66
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tCO2e/y)							
Carbon sink potential - High - Extend							-2,426
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-108
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,47
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,430
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,83
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-1,239
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-47.9
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,654
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-449
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-932
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-55.
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-455
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,21
trees outside forests (1000 tC02e/y)							
Carbon sink potential - Low - Reforest							-2,715
cropland (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-366
pasture (1000 tC02e/y)							
Carbon sink potential - Low - Restore							-418
productivity (1000 tCO2e/y)							

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

2020	2025	2030	2035	2040	2045	2050
						-71.7
						-14,157
						-1,570
						-1,679
						-80.8
						-909
						-2,347
						-4,073
						-2,599
						•
						-828
						15.6
						364
						304
						1,237
						1,231
						00.0
						39.9
						0
						330
						359
						137
						411
						2,894
						7.82
						342
						474
						717
+	-					20
						20
		2020 2025				2020 2023 2030 2033 2040 2043

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 -							0
Low - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							174
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							.,
(1000 hectares)							
Land impacted for carbon sink potential -							11.7
Mid - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							855
Mid - Extend rotation length (1000							
hectares)							
Land impacted for carbon sink potential -							30
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 -							252
Mid - Increase trees outside forests (1000							202
hectares)							
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							207
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)							112
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							500
hectares)							
Land impacted for carbon sink potential -		+		+		+	2,444
Mid - Total impacted (over 30 years) (1000							4,774
hectares)							
HEGIAI ESJ							

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution -		961	0.815	0.792	0.688	0.483	0.033
Coal (million 2019\$)							
Monetary damages from air pollution -		461	269	163	105	52.6	17.4
Natural Gas (million 2019\$)							
Monetary damages from air pollution -		4,985	5,062	4,958	4,497	3,605	2,497
Transportation (million 2019\$)							
Premature deaths from air pollution -		109	0.092	0.089	0.078	0.055	0.004
Coal (deaths)							
Premature deaths from air pollution -		52	30.4	18.4	11.8	5.93	1.97
Natural Gas (deaths)							
Premature deaths from air pollution -		561	569	558	506	405	281
Transportation (deaths)							

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s -	0	40,483	41,990	0	0	0	0
Cumulative 5-yr (million \$2018)							
Sales of cooking units - Electric	41	44.2	44.3	44.3	44.3	44.4	44.5
Resistance (%)							
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Sales of space heating units - Electric	0.751	12.5	44.7	71.1	75.5	75.9	75.9
Heat Pump (%)							
Sales of space heating units - Electric	2.86	4.31	8.93	17.1	22.7	23.6	23.7
Resistance (%)							
Sales of space heating units - Fossil (%)	0	2.21	1.15	0.205	0.023	0	0
Sales of space heating units - Gas Furnace	96.4	81	45.2	11.6	1.78	0.443	0.362
(%)							
Sales of water heating units - Electric	0.271	0.342	0.346	0.345	0.34	0.342	0.342
Heat Pump (%)							
Sales of water heating units - Electric	2.65	3.2	3.17	3.18	3.17	3.15	3.16
Resistance (%)							
Sales of water heating units - Gas Furnace	96.9	96.3	96.3	96.3	96.3	96.3	96.3
(%)							
Sales of water heating units - Other (%)	0.154	0.185	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested -		5.74	5.83	7.97	8.31	10.3	10.9
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)	441	441	437	426	415	414	426
Final energy use - Industry (PJ)	634	673	695	715	742	766	795
Final energy use - Residential (PJ)	591	553	532	516	507	501	496
Final energy use - Transportation (PJ)	1,044	993	935	904	914	947	988

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs.	0	10.3	11.1	0	0	0	0
REF - Cumulative 5-yr (billion \$2018)							
Sales of cooking units - Electric	50.2	50.2	50.2	50.2	50.2	50.2	50.2
Resistance (%)							
Sales of cooking units - Gas (%)	49.8	49.8	49.8	49.8	49.8	49.8	49.8
Sales of space heating units - Electric	2.39	12.9	13.5	14.3	15	15.6	16.5
Heat Pump (%)							
Sales of space heating units - Electric	12.9	17.8	17.6	17.4	16.8	16	15.2
Resistance (%)							
Sales of space heating units - Fossil (%)	2.6	4.13	4.15	4.15	4.16	4.19	4.17
Sales of space heating units - Gas (%)	82.1	65.2	64.8	64.2	64.1	64.2	64
Sales of water heating units - Electric	0	0	0	0	0	0	0
Heat Pump (%)							
Sales of water heating units - Electric	22.7	38.1	37.9	37.8	37.8	37.7	37.7
Resistance (%)							
Sales of water heating units - Gas Furnace	77.3	61.8	62	62.1	62.1	62.2	62.2
(%)							
Sales of water heating units - Other (%)	0.046	0.112	0.113	0.113	0.113	0.114	0.114

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC	0.119	0.138	0.16	0.186	0.216	0.25	0.29
(%)							
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.4	1.84	2.16	2.01	1.81	1.68	1.6
Vehicle sales - Light-duty - EV (%)	4.06	6.24	7.06	8.71	10.6	12.1	13.3
Vehicle sales - Light-duty - gasoline (%)	89.4	85.7	83.3	81.3	79.2	77.2	75.7
Vehicle sales - Light-duty - hybrid (%)	4.93	5.75	7	7.56	8.09	8.59	8.95
Vehicle sales - Light-duty - hydrogen FC	0.11	0.371	0.337	0.297	0.293	0.293	0.303
(%)							
Vehicle sales - Light-duty - other (%)	0.095	0.099	0.095	0.096	0.095	0.094	0.096
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen	0.175	0.208	0.242	0.285	0.339	0.409	0.487
FC (%)							
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate							-95.6
regeneration (1000 tCO2e/y)							
Carbon sink potential - High - All (not							-21,662
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - High - Avoid							-2,692
deforestation (1000 tC02e/y)							
Carbon sink potential - High - Extend							-2,426
rotation length (1000 tCO2e/y)							
Carbon sink potential - High - Improve							-108
plantations (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-1,364
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - High - Increase							-3,477
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-5,430
cropland (1000 tCO2e/y)							
Carbon sink potential - High - Reforest							-4,831
pasture (1000 tCO2e/y)							
Carbon sink potential - High - Restore							-1,239
productivity (1000 tCO2e/y)							
Carbon sink potential - Low - Accelerate							-47.9
regeneration (1000 tCO2e/y)							
Carbon sink potential - Low - All (not							-6,654
counting overlap) (1000 tCO2e/y)							
Carbon sink potential - Low - Avoid							-449
deforestation (1000 tCO2e/y)							
Carbon sink potential - Low - Extend							-932
rotation length (1000 tCO2e/y)							
Carbon sink potential - Low - Improve							-55.1
plantations (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-455
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Low - Increase							-1,217
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Low - Reforest							-2,715
cropland (1000 tCO2e/y)							

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

Item Carbon sink potential - Low - Reforest	2020	2025	2030	2035	2040	2045	205 -36
-							-36
pasture (1000 tC02e/y)							-41
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-41
Carbon sink potential - Mid - Accelerate							-71.
regeneration (1000 tCO2e/y)							-71.
							1/. 15
Carbon sink potential - Mid - All (not							-14,15
counting overlap) (1000 tC02e/y)							1 [7
Carbon sink potential - Mid - Avoid							-1,57
deforestation (1000 tC02e/y)							4 (7
Carbon sink potential - Mid - Extend							-1,67
rotation length (1000 tC02e/y)							
Carbon sink potential - Mid - Improve							-80.
plantations (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-90
retention of HWP (1000 tCO2e/y)							
Carbon sink potential - Mid - Increase							-2,34
trees outside forests (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-4,07
cropland (1000 tCO2e/y)							
Carbon sink potential - Mid - Reforest							-2,59
pasture (1000 tC02e/y)							
Carbon sink potential - Mid - Restore							-82
productivity (1000 tCO2e/y)							
Land impacted for carbon sink potential -							15.
High - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -							36
High - Avoid deforestation (over 30 years)							00
(1000 hectares)							
Land impacted for carbon sink potential -							1,23
High - Extend rotation length (1000							1,20
hectares)							
Land impacted for carbon sink potential -							39.
							39.
High - Improve plantations (1000							
hectares)							
Land impacted for carbon sink potential -							
High - Increase retention of HWP (1000							
hectares)							
Land impacted for carbon sink potential -							33
High - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							35
High - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							13
High - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							4
High - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							2,89
High - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							7.8
Low - Accelerate regeneration (1000							
hectares)							
Land impacted for carbon sink potential -		-					34
Low - Avoid deforestation (over 30 years)							54
(1000 hectares)							
•							47
Land impacted for carbon sink potential -							47
Low - Extend rotation length (1000							

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential -							20
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 -							174
Low - Increase trees outside forests							
(1000 hectares)							
Land impacted for carbon sink potential -							180
Low - Reforest cropland (1000 hectares)							
Land impacted for carbon sink potential -							23.8
Low - Reforest pasture (1000 hectares)							
Land impacted for carbon sink potential -							248
Low - Restore productivity (1000							
hectares)							
Land impacted for carbon sink potential -							1,469
Low - Total impacted (over 30 years)							
(1000 hectares)							
Land impacted for carbon sink potential -							11.7
Mid - Accelerate regeneration (1000							
hectares)							0.50
Land impacted for carbon sink potential -							353
Mid - Avoid deforestation (over 30 years)							
(1000 hectares)							055
Land impacted for carbon sink potential -							855
Mid - Extend rotation length (1000							
hectares)							20
Land impacted for carbon sink potential -							30
Mid - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential -							0
Mid - Increase retention of HWP (1000							
hectares) Land impacted for carbon sink potential -							252
Mid - Increase trees outside forests (1000							232
hectares)							
Land impacted for carbon sink potential -							269
Mid - Reforest cropland (1000 hectares)							207
Land impacted for carbon sink potential -							172
Mid - Reforest pasture (1000 hectares)							112
Land impacted for carbon sink potential -							500
Mid - Restore productivity (1000							300
hectares)							
Land impacted for carbon sink potential -							2,444
Mid - Total impacted (over 30 years) (1000							۷,٦٦4
hectares)							
nootal ooj							

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)	-11.1		-4.33				-3.87
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.371		-0.667				-0.694
Business-as-usual carbon sink - Total (Mt CO2e/y)	-11.5		-5				-4.57

Table 66: REF scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019\$)		3,823	2,373	1,653	1,334	1,212	1,193
Monetary damages from air pollution - Natural Gas (million 2019\$)		410	476	592	594	630	563
Monetary damages from air pollution - Transportation (million 2019\$)		4,980	5,129	5,287	5,472	5,655	5,836
Premature deaths from air pollution - Coal (deaths)		432	268	187	151	137	135
Premature deaths from air pollution - Natural Gas (deaths)		46.3	53.8	66.9	67	71.1	63.5
Premature deaths from air pollution - Transportation (deaths)		560	577	595	615	636	656