



## **Net-Zero America - Ohio data**

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See the [Data Sheet Guide](#) for explanations of the contents of this document. The data herein underlie graphs and tables found in Princeton's Net-Zero America report:

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## Contents

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

44	E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial . . . . .	27
45	E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity . . . . .	27
46	E+RE- scenario - PILLAR 2: Clean Electricity - Generation . . . . .	27
47	E+RE- scenario - PILLAR 6: Land sinks - Forests . . . . .	28
48	E+RE- scenario - PILLAR 6: Land sinks - Agriculture . . . . .	30
49	E-B+ scenario - IMPACTS - Health . . . . .	31
50	E-B+ scenario - IMPACTS - Jobs . . . . .	32
51	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview . . . . .	33
52	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand . . .	33
53	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation . . . . .	33
54	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential . . . . .	34
55	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial . . . . .	34
56	E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity . . . . .	34
57	E-B+ scenario - PILLAR 2: Clean Electricity - Generation . . . . .	34
58	E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy . . . . .	35
59	E-B+ scenario - PILLAR 4: CCUS - CO2 capture . . . . .	35
60	E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines . . . . .	35
61	E-B+ scenario - PILLAR 4: CCUS - CO2 storage . . . . .	35
62	E-B+ scenario - PILLAR 6: Land sinks - Forests . . . . .	36
63	E-B+ scenario - PILLAR 6: Land sinks - Agriculture . . . . .	38
64	REF scenario - IMPACTS - Health . . . . .	39
65	REF scenario - IMPACTS - Jobs . . . . .	40
66	REF scenario - PILLAR 1: Efficiency/Electrification - Overview . . . . .	41
67	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand . . .	42
68	REF scenario - PILLAR 1: Efficiency/Electrification - Residential . . . . .	42
69	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial . . . . .	42
70	REF scenario - PILLAR 2: Clean Electricity - Generating capacity . . . . .	42
71	REF scenario - PILLAR 2: Clean Electricity - Generation . . . . .	43
72	REF scenario - PILLAR 6: Land sinks - Forests - REF only . . . . .	43
73	REF scenario - PILLAR 6: Land sinks - Forests . . . . .	43

Table 1: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		43.2	34.9	22.2	18.4	10	3.88
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.27	0.936	0.914	0.883	0.88	0.863
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	162	142	109	78.4	47.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		382	309	197	163	88.6	34.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million \$2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		514	467	364	235	132	62.5

Table 1: *E+ scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		20	8.26	8.06	7.79	7.77	7.61
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,576	1,441	1,264	972	696	419

Table 2: *E+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		991	1,049	946	522	643	1,916
By economic sector - Construction (jobs)		10,256	10,979	20,269	20,807	22,041	21,263
By economic sector - Manufacturing (jobs)		9,317	9,766	11,331	10,168	8,510	9,575
By economic sector - Mining (jobs)		11,133	8,438	6,292	4,037	2,522	1,363
By economic sector - Other (jobs)		454	584	2,641	2,977	3,850	3,490
By economic sector - Pipeline (jobs)		1,603	1,561	1,101	823	555	476
By economic sector - Professional (jobs)		5,635	5,503	9,514	9,962	11,408	13,287
By economic sector - Trade (jobs)		5,432	4,861	7,044	6,907	7,482	7,529
By economic sector - Utilities (jobs)		12,408	12,143	17,592	18,990	18,493	19,934
By resource sector - Biomass (jobs)		2,429	2,442	2,131	1,241	2,390	8,335
By resource sector - CO2 (jobs)		0	1,539	0	0	131	1,132
By resource sector - Coal (jobs)		1,710	216	18	13.3	10.4	8.76
By resource sector - Grid (jobs)		10,721	11,497	25,660	29,591	31,067	34,857
By resource sector - Natural Gas (jobs)		18,143	15,108	12,583	10,498	6,865	4,378
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,280	16,571	13,779	9,722	6,954	4,254
By resource sector - Solar (jobs)		1,617	2,544	15,658	16,241	20,540	16,484
By resource sector - Wind (jobs)		2,667	4,315	6,262	7,256	6,926	8,772
By education level - All sectors - High school diploma or less (jobs)		23,702	23,003	32,558	31,770	31,873	33,469
By education level - All sectors - Associates degree or some college (jobs)		17,178	16,646	23,961	23,885	24,057	24,778
By education level - All sectors - Bachelors degree (jobs)		12,877	12,008	15,827	15,260	15,199	15,920
By education level - All sectors - Masters or professional degree (jobs)		3,063	2,846	3,848	3,750	3,814	4,055
By education level - All sectors - Doctoral degree (jobs)		409	380	538	527	560	612
Related work experience - All sectors - None (jobs)		8,184	7,894	11,120	10,928	11,005	11,534
Related work experience - All sectors - Up to 1 year (jobs)		10,976	10,648	15,293	14,905	15,088	16,066
Related work experience - All sectors - 1 to 4 years (jobs)		20,969	19,996	27,690	27,130	27,227	28,312
Related work experience - All sectors - 4 to 10 years (jobs)		13,418	12,836	17,864	17,585	17,598	18,180
Related work experience - All sectors - Over 10 years (jobs)		3,682	3,509	4,765	4,644	4,587	4,743
On-the-Job Training - All sectors - None (jobs)		3,105	2,939	4,130	4,016	4,078	4,251
On-the-Job Training - All sectors - Up to 1 year (jobs)		38,336	36,640	50,535	49,183	49,301	52,035

Table 2: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,757	11,357	16,176	16,065	16,101	16,459
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,490	3,419	5,150	5,214	5,316	5,375
On-the-Job Training - All sectors - Over 10 years (jobs)		542	528	740	716	708	715
On-Site or In-Plant Training - All sectors - None (jobs)		9,090	8,710	12,257	12,012	12,161	12,759
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,773	33,235	45,932	44,750	44,825	47,155
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,174	8,859	12,581	12,456	12,480	12,790
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,731	3,625	5,296	5,306	5,367	5,434
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		461	455	665	668	671	695
Wage income - All (million \$2019)		3,228	3,112	4,323	4,283	4,333	4,571

Table 3: *E+ scenario - IMPACTS - Fossil fuel industries*

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		183	157	120	85.6	58.3	37
Oil consumption - Cumulative (million bbls)							3,717
Oil production - Annual (million bbls)		30.1	30.2	30.2	23.9	19.4	12.9
Natural gas consumption - Annual (tcf)		882	743	596	449	282	196
Natural gas consumption - Cumulative (tcf)							17,958
Natural gas production - Annual (tcf)		2,865	2,708	2,358	1,994	1,581	1,228

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

Table 5: *E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.24	6.43	13.3	14.2	13.1	13.8

Table 6: *E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 7: *E+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.7	12.8				

Table 8: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
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
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,680	40,065				

Table 9: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	14,788	15,171	18,473	14,988	12,493	9,851
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	552	1,071	12,379	21,718	34,525	39,741
Installed renewables - Wind - Base land use assumptions (MW)	638	827	4,636	15,584	33,653	35,902	38,809
Installed renewables - Solar - Constrained land use assumptions (MW)	539	539	2,105	11,799	23,367	36,327	43,696
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	9,867	19,628	19,628	19,628	19,628
Capital invested - Solar PV - Base (billion \$2018)		0	0.621	12.5	9.71	12.6	4.83
Capital invested - Wind - Base (billion \$2018)		0	5.07	13.6	21.4	2.52	3.08

Table 9: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion \$2018)		1.55	0.276	10.4	9.72	11.5	5.9
Capital invested - Wind - Constrained (billion \$2018)		0	12.9	11.3	0	0	0.2
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

Table 10: *E+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	2,369	22,189	38,393	60,473	69,347
Wind - Base land use assumptions (GWh)	2,973	2,973	14,885	48,163	98,677	104,614	112,056
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,334	1,334	4,096	21,004	41,108	63,417	76,016
Wind - Constrained land use assumptions (GWh)	2,973	2,973	28,568	53,532	53,532	53,532	53,532
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

Table 11: *E+ scenario - PILLAR 3: Clean fuels - Bioenergy*

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	7	30
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	6,167	22,362
Biomass purchases (million \$2018/y)		0	0	0	0	402	1,858

Table 12: *E+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	7.93	36.7
Annual - BECCS (MMT)		0	0	0	0	7.93	36.7
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	7.93	44.6
Cumulative - BECCS (MMT)		0	0	0	0	7.93	44.6
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0



Table 13: *E+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	477	477	477	477	477
Spur (km)		0	0	0	0	301	1,550
All (km)		0	477	477	477	778	2,027
Cumulative investment - Trunk (million \$2018)		0	1,555	1,555	1,555	1,555	1,555
Cumulative investment - Spur (million \$2018)		0	0	0	0	350	1,462
Cumulative investment - All (million \$2018)		0	1,555	1,555	1,555	1,905	3,017

Table 14: *E+ scenario - PILLAR 4: CCUS - CO2 storage*

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

Table 15: *E+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874

Table 15: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411

Table 15: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

Table 16: *E+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,883

Table 16: *E+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

Table 17: *E- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		39.5	25.5	9.81	4.31	1.44	0.866
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	459	446	402	320	220
Premature deaths from air pollution - Gas Stations (deaths)		60.1	60.6	58.5	52.5	41.8	28.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88.3	80.5	71.9	61.1	47	31.3
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		11.1	10.7	10.3	8.94	6.52	4.01
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.5	10.7	10.7	9.99	8.12	5.83

Table 17: *E- scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.2	56.7	54.4	49.1	40.6	30.1
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.76	5.12	4.52	3.82	3.11	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.51	3.12	2.74	2.37	2.02
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.18	0.939	0.925	0.903	0.882	0.824
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	155	128	107	91.1	64.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		350	226	86.9	38.1	12.7	7.67
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,048	4,080	3,966	3,572	2,847	1,959
Monetary damages from air pollution - Gas Stations (million \$2019)		532	537	518	465	370	256
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		782	713	637	541	417	278
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		98.3	95.2	91.1	79.2	57.8	35.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		93.1	94.5	94.7	88.6	72	51.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		515	502	482	435	359	267
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		51	45.3	40	33.8	27.5	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.6	31	27.6	24.2	21	17.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		19.2	8.28	8.17	7.97	7.78	7.27
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,571	1,374	1,133	947	809	570

Table 18: *E- scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,003	1,023	936	510	859	1,915
By economic sector - Construction (jobs)		9,975	10,820	16,311	17,322	23,035	22,075

Table 18: E- scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		9,386	9,819	10,200	9,964	10,882	11,910
By economic sector - Mining (jobs)		11,148	8,410	6,386	4,816	3,578	2,069
By economic sector - Other (jobs)		434	560	2,132	2,518	4,076	3,530
By economic sector - Pipeline (jobs)		1,605	1,639	1,038	845	713	733
By economic sector - Professional (jobs)		5,512	5,273	7,968	8,741	12,645	13,918
By economic sector - Trade (jobs)		5,385	4,827	6,320	6,475	8,431	8,105
By economic sector - Utilities (jobs)		11,826	11,457	12,595	13,908	17,588	19,727
By resource sector - Biomass (jobs)		2,447	2,363	2,118	1,230	3,658	8,057
By resource sector - CO2 (jobs)		0	2,638	0	0	225	1,942
By resource sector - Coal (jobs)		1,695	217	19.6	15.8	10.6	4.86
By resource sector - Grid (jobs)		9,658	9,893	17,093	20,412	29,448	33,543
By resource sector - Natural Gas (jobs)		17,970	13,848	10,237	8,717	6,444	4,688
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,377	17,062	15,072	12,950	10,831	6,847
By resource sector - Solar (jobs)		1,680	2,653	12,895	14,084	22,232	16,602
By resource sector - Wind (jobs)		2,784	4,503	5,811	7,059	8,335	11,686
By education level - All sectors - High school diploma or less (jobs)		23,307	22,596	27,086	27,407	34,503	35,585
By education level - All sectors - Associates degree or some college (jobs)		16,847	16,289	19,627	20,325	25,715	26,289
By education level - All sectors - Bachelors degree (jobs)		12,699	11,791	13,456	13,579	16,777	17,135
By education level - All sectors - Masters or professional degree (jobs)		3,016	2,781	3,252	3,312	4,184	4,321
By education level - All sectors - Doctoral degree (jobs)		404	371	464	477	627	652
Related work experience - All sectors - None (jobs)		8,039	7,738	9,210	9,389	11,861	12,234
Related work experience - All sectors - Up to 1 year (jobs)		10,803	10,460	12,776	12,902	16,416	17,067
Related work experience - All sectors - 1 to 4 years (jobs)		20,621	19,606	23,097	23,572	29,540	30,205
Related work experience - All sectors - 4 to 10 years (jobs)		13,185	12,581	14,820	15,188	18,996	19,380
Related work experience - All sectors - Over 10 years (jobs)		3,624	3,443	3,981	4,048	4,993	5,095
On-the-Job Training - All sectors - None (jobs)		3,060	2,891	3,485	3,525	4,462	4,532
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,743	35,962	42,368	42,914	53,822	55,599
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,530	11,118	13,264	13,687	17,183	17,458
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,405	3,335	4,143	4,342	5,562	5,617
On-the-Job Training - All sectors - Over 10 years (jobs)		535	522	624	631	777	775
On-Site or In-Plant Training - All sectors - None (jobs)		8,949	8,549	10,241	10,444	13,230	13,610
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,224	32,615	38,451	38,973	48,842	50,345
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,002	8,677	10,352	10,652	13,364	13,584
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,648	3,542	4,304	4,470	5,661	5,710
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		451	444	538	560	710	732
Wage income - All (million \$2019)		3,173	3,048	3,600	3,712	4,688	4,866

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663

Table 20: E- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.04	5.08	6.88	7.14	11.1	11.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	41.9	304	566	1,780	2,994	5,681	8,368
Vehicle stocks - LDV – All others (1000 units)	10,939	10,939	10,939	10,376	9,813	7,562	5,311
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326		1.12		5.95		16.6
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400

Table 22: E- scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.67	12.6				

Table 23: E- scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Gas (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

Table 23: E- scenario - PILLAR 1: Efficiency/Electrification - Commercial (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,676	40,057				

Table 24: E- scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	14,585	13,536	12,232	8,044	5,478	4,146
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312

Table 25: E- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130



Table 25: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139

Table 25: E- scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

Table 26: E- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-5,463

Table 26: E- scenario - PILLAR 6: Land sinks - Agriculture (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

Table 27: E+RE+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		35.7	26	15.4	10.2	3.41	0.815
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993

Table 27: *E+RE+ scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.48	0.936	0.912	0.881	0.878	0.777
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		174	159	131	92.8	53.8	6.54
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		316	231	136	90.6	30.2	7.22
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million \$2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		514	467	364	235	132	62.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		21.9	8.26	8.05	7.78	7.75	6.85
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,543	1,414	1,167	824	478	58

Table 28: *E+RE+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		991	1,052	946	516	560	1,922
By economic sector - Construction (jobs)		10,912	11,887	28,513	27,464	25,255	28,307
By economic sector - Manufacturing (jobs)		9,584	10,666	13,541	13,061	13,632	14,754
By economic sector - Mining (jobs)		11,045	8,323	5,929	3,508	1,830	291
By economic sector - Other (jobs)		638	919	4,610	4,620	4,501	5,295
By economic sector - Pipeline (jobs)		1,559	1,323	955	630	339	95.8
By economic sector - Professional (jobs)		5,840	6,153	13,013	13,128	13,307	17,683
By economic sector - Trade (jobs)		5,584	5,247	9,333	8,905	8,472	10,108
By economic sector - Utilities (jobs)		11,946	11,665	19,949	21,900	20,894	24,307
By resource sector - Biomass (jobs)		2,407	2,458	2,123	1,229	2,120	8,609
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		1,750	216	17.8	13	10.2	0.028
By resource sector - Grid (jobs)		10,402	12,678	31,871	37,172	38,104	46,456

Table 28: *E+RE+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		17,259	14,208	10,411	8,083	4,546	2,653
By resource sector - Nuclear (jobs)		662	651	641	631	366	0
By resource sector - Oil (jobs)		19,282	16,488	13,369	8,776	5,198	815
By resource sector - Solar (jobs)		3,358	5,454	29,858	27,425	25,806	26,641
By resource sector - Wind (jobs)		2,977	5,081	8,496	10,403	12,639	17,588
By education level - All sectors - High school diploma or less (jobs)		24,143	24,039	41,302	39,765	37,548	43,546
By education level - All sectors - Associates degree or some college (jobs)		17,436	17,336	30,446	29,920	28,458	32,710
By education level - All sectors - Bachelors degree (jobs)		13,007	12,486	19,552	18,749	17,735	20,501
By education level - All sectors - Masters or professional degree (jobs)		3,094	2,970	4,792	4,630	4,407	5,216
By education level - All sectors - Doctoral degree (jobs)		418	405	696	666	641	790
Related work experience - All sectors - None (jobs)		8,301	8,206	14,034	13,618	12,888	14,992
Related work experience - All sectors - Up to 1 year (jobs)		11,223	11,236	19,632	18,879	17,939	21,149
Related work experience - All sectors - 1 to 4 years (jobs)		21,254	20,809	34,749	33,665	31,876	36,732
Related work experience - All sectors - 4 to 10 years (jobs)		13,592	13,331	22,438	21,821	20,639	23,686
Related work experience - All sectors - Over 10 years (jobs)		3,727	3,653	5,934	5,748	5,447	6,203
On-the-Job Training - All sectors - None (jobs)		3,166	3,094	5,290	5,065	4,783	5,570
On-the-Job Training - All sectors - Up to 1 year (jobs)		38,912	38,281	63,482	61,248	58,172	67,731
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,919	11,777	20,444	19,995	18,881	21,524
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,543	3,527	6,616	6,514	6,100	6,982
On-the-Job Training - All sectors - Over 10 years (jobs)		556	556	954	908	853	956
On-Site or In-Plant Training - All sectors - None (jobs)		9,254	9,135	15,616	15,104	14,380	16,775
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		35,291	34,698	57,701	55,703	52,831	61,360
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,306	9,200	15,897	15,510	14,646	16,711
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,780	3,732	6,734	6,583	6,145	7,008
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		467	470	841	831	787	909
Wage income - All (million \$2019)		3,264	3,224	5,381	5,274	5,034	5,874

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

Table 30: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.24	6.43	13.3	14.2	13.1	13.8

Table 31: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 32: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.7	12.8				

Table 33: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
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
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,680	40,065				

Table 34: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,088	13,501	13,930	10,816	8,250	9,925

Table 34: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	0	0
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	1,667	3,665	25,782	40,087	48,782	59,888
Installed renewables - Wind - Base land use assumptions (MW)	827	827	9,413	27,115	42,706	42,827	42,827
Installed renewables - Solar - Constrained land use assumptions (MW)	724	1,070	5,050	25,599	35,300	37,387	53,098
Installed renewables - Wind - Constrained land use assumptions (MW)	904	904	18,372	19,705	19,705	19,705	45,105
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		1.49	2.39	24.4	14.9	8.53	10.3
Capital invested - Wind - Base (billion \$2018)		0	11.4	22	18.4	0.135	0

Table 35: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	3,430	6,952	45,355	69,898	84,697	104,264
Wind - Base land use assumptions (GWh)	2,973	2,973	29,483	80,929	121,652	121,927	121,927
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,908	4,131	18,119	88,835	121,824	128,925	184,223
Wind - Constrained land use assumptions (GWh)	5,947	5,947	100,657	107,064	107,064	107,064	258,045
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

Table 36: *E+RE+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377

Table 36: *E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415



Table 36: *E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

Table 37: *E+RE+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

Table 38: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		40.4	32.3	41.2	30.5	10.7	3.26
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62

Table 38: E+RE- scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.05	0.934	0.913	0.882	0.881	0.776
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		180	171	165	140	116	86.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		358	286	365	271	94.9	28.9
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million \$2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		514	467	364	235	132	62.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		18.1	8.24	8.06	7.78	7.77	6.85

Table 38: *E+RE- scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,599	1,517	1,462	1,246	1,032	765

Table 39: *E+RE- scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		999	1,027	933	514	711	1,911
By economic sector - Construction (jobs)		10,077	10,606	11,203	12,805	14,065	16,081
By economic sector - Manufacturing (jobs)		8,773	7,982	7,686	7,706	7,210	7,259
By economic sector - Mining (jobs)		11,219	8,650	6,747	4,565	3,099	1,942
By economic sector - Other (jobs)		426	422	618	789	1,022	1,156
By economic sector - Pipeline (jobs)		1,647	1,833	1,346	1,162	970	998
By economic sector - Professional (jobs)		5,475	4,891	5,613	8,329	9,902	12,145
By economic sector - Trade (jobs)		5,356	4,572	4,505	4,892	5,152	5,627
By economic sector - Utilities (jobs)		12,071	12,189	15,085	31,633	35,973	39,178
By resource sector - Biomass (jobs)		2,412	2,363	2,112	1,234	2,809	8,096
By resource sector - CO2 (jobs)		0	2,981	0	0	255	2,194
By resource sector - Coal (jobs)		1,671	216	17.9	13.2	10.4	0
By resource sector - Grid (jobs)		9,966	9,471	16,157	20,007	24,131	29,067
By resource sector - Natural Gas (jobs)		18,420	16,302	14,912	14,251	11,918	10,231
By resource sector - Nuclear (jobs)		662	651	2,844	22,223	26,048	26,362
By resource sector - Oil (jobs)		19,278	16,571	13,779	9,722	7,155	4,914
By resource sector - Solar (jobs)		1,414	1,340	1,737	1,981	2,689	2,458
By resource sector - Wind (jobs)		2,219	2,276	2,176	2,965	3,090	2,975
By education level - All sectors - High school diploma or less (jobs)		23,197	21,848	22,441	28,738	30,916	34,702
By education level - All sectors - Associates degree or some college (jobs)		16,792	15,841	16,408	21,919	23,645	26,021
By education level - All sectors - Bachelors degree (jobs)		12,641	11,419	11,687	16,887	18,221	19,733
By education level - All sectors - Masters or professional degree (jobs)		3,010	2,707	2,823	4,250	4,649	5,089
By education level - All sectors - Doctoral degree (jobs)		403	357	377	602	674	752
Related work experience - All sectors - None (jobs)		8,017	7,540	7,747	10,131	10,923	12,200
Related work experience - All sectors - Up to 1 year (jobs)		10,725	10,005	10,347	13,694	14,840	16,776
Related work experience - All sectors - 1 to 4 years (jobs)		20,549	19,047	19,600	26,539	28,623	31,444
Related work experience - All sectors - 4 to 10 years (jobs)		13,148	12,256	12,614	17,219	18,551	20,291
Related work experience - All sectors - Over 10 years (jobs)		3,604	3,325	3,427	4,813	5,168	5,587
On-the-Job Training - All sectors - None (jobs)		3,044	2,782	2,860	4,067	4,414	4,854
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,525	34,673	35,657	48,012	51,793	57,410
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,516	10,884	11,247	15,117	16,277	17,813
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,428	3,337	3,470	4,507	4,883	5,426
On-the-Job Training - All sectors - Over 10 years (jobs)		530	496	501	693	738	794
On-Site or In-Plant Training - All sectors - None (jobs)		8,897	8,232	8,467	11,790	12,802	14,160
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,043	31,494	32,413	43,616	47,017	52,036

Table 39: *E+RE- scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,984	8,472	8,747	11,658	12,540	13,746
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,668	3,537	3,653	4,769	5,141	5,678
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		451	437	454	564	605	677
Wage income - All (million \$2019)		3,168	2,981	3,119	4,362	4,785	5,334

Table 40: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

Table 41: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Electricity demand*

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.24	6.43	13.3	14.2	13.1	13.8

Table 42: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 43: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.7	12.8				

Table 44: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
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
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,680	40,065				

Table 45: *E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,334	13,080	14,653	13,647	14,668	12,939
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	2,237	11,261	20,239	27,689
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	552	552	898	1,475	2,848	2,848
Installed renewables - Wind - Base land use assumptions (MW)	827	827	1,016	1,016	1,127	1,127	1,162
Installed renewables - Solar - Constrained land use assumptions (MW)	724	724	724	964	3,339	4,800	4,800
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	1,482	1,482	2,083	2,277	2,425
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0.381	0.599	1.35	0
Capital invested - Wind - Base (billion \$2018)		0	0.252	0	0.132	0	0.036
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.265	2.47	1.43	0
Capital invested - Wind - Constrained (billion \$2018)		0	0.873	0	0.71	0.217	0.157

Table 46: *E+RE- scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	1,454	2,065	3,079	5,499	5,499
Wind - Base land use assumptions (GWh)	2,973	2,973	3,579	3,579	3,937	3,937	4,045
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,454	1,454	1,454	1,879	6,066	8,628	8,628
Wind - Constrained land use assumptions (GWh)	2,973	2,973	4,979	4,979	6,794	7,356	7,799
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

Table 47: *E+RE- scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,070

Table 47: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424



Table 47: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

Table 48: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578

Table 48: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

Table 49: *E-B+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		38.3	22.1	12.3	7.99	4.07	1.32
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	459	446	402	320	220
Premature deaths from air pollution - Gas Stations (deaths)		60.1	60.6	58.5	52.5	41.8	28.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88.3	80.5	71.9	61.1	47	31.3
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		11.1	10.7	10.3	8.94	6.52	4.01
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.5	10.7	10.7	9.99	8.12	5.83
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.2	56.7	54.4	49.1	40.6	30.1
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.76	5.12	4.52	3.82	3.11	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.51	3.12	2.74	2.37	2.02
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.25	0.938	0.926	0.905	0.901	0.874
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	155	128	107	91.1	64.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		339	196	109	70.8	36.1	11.7
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,048	4,080	3,966	3,572	2,847	1,959
Monetary damages from air pollution - Gas Stations (million \$2019)		532	537	518	465	370	256

Table 49: *E-B+ scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		782	713	637	541	417	278
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		98.3	95.2	91.1	79.2	57.8	35.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		93.1	94.5	94.7	88.6	72	51.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		515	502	482	435	359	267
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		51	45.3	40	33.8	27.5	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.6	31	27.6	24.2	21	17.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		19.9	8.28	8.17	7.98	7.95	7.71
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,571	1,374	1,133	947	809	570

Table 50: *E-B+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		997	1,023	935	512	1,507	3,742
By economic sector - Construction (jobs)		9,727	10,738	15,309	14,600	18,737	21,192
By economic sector - Manufacturing (jobs)		9,369	9,845	9,630	8,115	9,334	11,811
By economic sector - Mining (jobs)		11,117	8,400	6,419	4,900	3,590	1,981
By economic sector - Other (jobs)		419	552	1,899	1,940	2,942	3,175
By economic sector - Pipeline (jobs)		1,589	1,644	1,056	873	705	711
By economic sector - Professional (jobs)		5,407	5,230	7,529	7,398	11,747	16,735
By economic sector - Trade (jobs)		5,333	4,803	6,034	5,658	7,289	8,444
By economic sector - Utilities (jobs)		11,366	11,245	12,265	12,322	15,748	19,699
By resource sector - Biomass (jobs)		2,437	2,363	2,117	1,241	6,942	17,800
By resource sector - CO2 (jobs)		0	2,708	0	0	231	1,993
By resource sector - Coal (jobs)		1,708	217	19.6	16	12.7	9.92
By resource sector - Grid (jobs)		9,010	9,595	16,318	17,115	25,709	33,331
By resource sector - Natural Gas (jobs)		17,595	13,619	10,448	8,946	6,457	4,535
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,378	17,062	15,072	13,170	10,891	6,552
By resource sector - Solar (jobs)		1,663	2,624	11,142	10,376	15,007	14,591
By resource sector - Wind (jobs)		2,872	4,641	5,316	4,823	5,727	8,067
By education level - All sectors - High school diploma or less (jobs)		22,915	22,456	25,865	23,660	30,212	37,282
By education level - All sectors - Associates degree or some college (jobs)		16,528	16,170	18,721	17,467	22,098	26,582
By education level - All sectors - Bachelors degree (jobs)		12,514	11,722	12,923	11,881	14,957	18,196
By education level - All sectors - Masters or professional degree (jobs)		2,969	2,763	3,122	2,896	3,758	4,682
By education level - All sectors - Doctoral degree (jobs)		398	369	443	414	574	748

Table 50: E-B+ scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		7,897	7,685	8,805	8,123	10,391	12,794
Related work experience - All sectors - Up to 1 year (jobs)		10,630	10,399	12,171	11,065	14,418	18,229
Related work experience - All sectors - 1 to 4 years (jobs)		20,277	19,478	22,107	20,461	25,888	31,345
Related work experience - All sectors - 4 to 10 years (jobs)		12,955	12,496	14,179	13,162	16,547	19,905
Related work experience - All sectors - Over 10 years (jobs)		3,566	3,422	3,812	3,507	4,354	5,219
On-the-Job Training - All sectors - None (jobs)		3,013	2,874	3,326	3,044	3,907	4,795
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,143	35,744	40,529	37,165	47,512	58,768
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,312	11,036	12,673	11,822	14,779	17,552
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,329	3,306	3,953	3,749	4,740	5,599
On-the-Job Training - All sectors - Over 10 years (jobs)		528	520	593	539	660	777
On-Site or In-Plant Training - All sectors - None (jobs)		8,803	8,497	9,770	8,991	11,568	14,278
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		33,674	32,413	36,784	33,761	43,028	53,002
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,836	8,616	9,891	9,205	11,524	13,726
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,571	3,513	4,115	3,880	4,866	5,741
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		441	440	514	483	613	745
Wage income - All (million \$2019)		3,119	3,027	3,453	3,237	4,132	5,074

Table 51: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663

Table 52: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.04	5.08	6.88	7.14	11.1	11.9

Table 53: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	41.9	304	566	1,780	2,994	5,681	8,368
Vehicle stocks - LDV – All others (1000 units)	10,939	10,939	10,939	10,376	9,813	7,562	5,311
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326		1.12		5.95		16.6
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400

Table 54: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.67	12.6				

Table 55: E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Gas (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,676	40,057				

Table 56: E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,088	12,776	12,232	8,132	6,136	4,715
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

Table 57: 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 power plant (GWh)	0	0	0	0	0	0.179	0.179
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

Table 58: E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	23	65
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	19,240	37,955
Biomass purchases (million \$2018/y)		0	0	0	0	1,897	5,611

Table 59: E-B+ scenario - PILLAR 4: CCUS - CO2 capture

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	24.7	72.9
Annual - BECCS (MMT)		0	0	0	0	24.7	72.9
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	24.7	97.6
Cumulative - BECCS (MMT)		0	0	0	0	24.7	97.6
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

Table 60: E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	477	477	477	477	477
Spur (km)		0	0	0	0	932	2,589
All (km)		0	477	477	477	1,409	3,066
Cumulative investment - Trunk (million \$2018)		0	1,555	1,555	1,555	1,934	1,934
Cumulative investment - Spur (million \$2018)		0	0	0	0	1,080	3,054
Cumulative investment - All (million \$2018)		0	1,555	1,555	1,555	3,014	4,988

Table 61: E-B+ scenario - PILLAR 4: CCUS - CO2 storage

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

Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,070

Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424



Table 62: E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

Table 63: E-B+ scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,772
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,589
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-96.4
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,458
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,772
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,907
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-193
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-6,872

Table 63: *E-B+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,674
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							175
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							3,047
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							7,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							351
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							9,381

Table 64: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		630	419	367	341	330	310
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32.4	37.8	48.5	50.8	48	41.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	465	475	489	502	516
Premature deaths from air pollution - Gas Stations (deaths)		59.9	61.2	62.2	63.8	65.2	66.5
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		87.6	80.6	74.7	70.9	68.7	66.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.7	9.16	6.55	4.04	2.01	0.911
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.1	10.2	10.5	10.7	10.6	10.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.54	6.52	6.47	6.4	6.32	6.21

Table 64: REF scenario - IMPACTS - Health (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.7	57.6	52.8	46.7	43	42.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.91	5.59	5.13	4.61	4.26	4.08
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		4.08	4.16	4.24	4.31	4.38	4.46
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		4.75	3.29	2.65	2.49	2.38	2.21
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		178	188	191	181	179	169
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		5,585	3,709	3,254	3,020	2,928	2,745
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		287	334	430	450	426	367
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,043	4,133	4,226	4,344	4,463	4,584
Monetary damages from air pollution - Gas Stations (million \$2019)		530	542	551	565	578	589
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		777	715	662	629	609	589
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		95.1	81.2	58.1	35.8	17.8	8.07
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		89.9	90.8	93	95	94.2	92.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		57.9	57.7	57.3	56.7	56	55
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		519	510	467	413	381	374
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		52.3	49.5	45.4	40.8	37.7	36.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		36.1	36.8	37.6	38.2	38.8	39.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		41.9	29	23.4	21.9	21	19.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,582	1,668	1,699	1,607	1,590	1,498

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		994	988	988	978	978	981
By economic sector - Construction (jobs)		9,773	9,868	11,384	11,559	11,875	11,903
By economic sector - Manufacturing (jobs)		7,237	7,337	7,693	7,878	7,503	7,008
By economic sector - Mining (jobs)		11,767	9,602	7,983	6,443	5,365	4,218

Table 65: REF scenario - IMPACTS - Jobs (continued)

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		343	379	488	543	573	683
By economic sector - Pipeline (jobs)		1,640	1,727	1,760	1,658	1,672	1,645
By economic sector - Professional (jobs)		5,538	4,990	5,239	5,286	5,242	5,007
By economic sector - Trade (jobs)		5,674	4,859	4,760	4,575	4,422	4,167
By economic sector - Utilities (jobs)		12,720	11,613	13,688	13,941	14,129	13,303
By resource sector - Biomass (jobs)		2,417	2,342	2,272	2,202	2,161	2,124
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		3,300	1,520	777	704	647	325
By resource sector - Grid (jobs)		11,033	9,047	13,499	13,708	13,925	13,439
By resource sector - Natural Gas (jobs)		18,156	18,705	19,033	18,526	18,454	17,161
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,437	17,227	15,483	14,057	12,987	11,451
By resource sector - Solar (jobs)			833	1,072	1,095	1,140	1,980
By resource sector - Wind (jobs)		681	1,037	1,202	1,938	1,823	1,824
By education level - All sectors - High school diploma or less (jobs)		23,075	21,421	22,737	22,366	22,015	20,977
By education level - All sectors - Associates degree or some college (jobs)		16,637	15,452	16,500	16,284	16,038	15,215
By education level - All sectors - Bachelors degree (jobs)		12,564	11,407	11,615	11,198	10,799	10,024
By education level - All sectors - Masters or professional degree (jobs)		3,008	2,718	2,766	2,664	2,570	2,385
By education level - All sectors - Doctoral degree (jobs)		402	363	363	349	337	314
Related work experience - All sectors - None (jobs)		7,966	7,392	7,831	7,700	7,575	7,193
Related work experience - All sectors - Up to 1 year (jobs)		10,619	9,811	10,348	10,168	9,970	9,502
Related work experience - All sectors - 1 to 4 years (jobs)		20,497	18,832	19,717	19,262	18,830	17,738
Related work experience - All sectors - 4 to 10 years (jobs)		13,054	12,053	12,669	12,401	12,142	11,443
Related work experience - All sectors - Over 10 years (jobs)		3,549	3,274	3,415	3,329	3,240	3,040
On-the-Job Training - All sectors - None (jobs)		3,016	2,756	2,841	2,756	2,675	2,522
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,284	34,257	35,787	34,974	34,141	32,198
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,437	10,632	11,325	11,140	10,969	10,392
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,440	3,237	3,526	3,500	3,494	3,349
On-the-Job Training - All sectors - Over 10 years (jobs)		510	481	501	491	479	454
On-Site or In-Plant Training - All sectors - None (jobs)		8,768	8,083	8,436	8,245	8,043	7,591
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		33,868	31,117	32,551	31,816	31,078	29,322
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,925	8,289	8,815	8,667	8,527	8,079
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,677	3,450	3,717	3,673	3,651	3,484
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		447	423	461	461	459	439
Wage income - All (million \$2019)		3,164	2,951	3,132	3,098	3,072	2,931

Table 66: REF scenario - PILLAR 1: Efficiency/Electrification - Overview

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	953	894	818	774	775	799	830

Table 66: REF scenario - PILLAR 1: Efficiency/Electrification - Overview (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	555	517	496	481	472	466	461
Final energy use - Commercial (PJ)	372	372	369	360	351	351	360
Final energy use - Industry (PJ)	602	634	654	668	689	709	731

Table 67: REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.42	5.51	10.6	11.3	10.6	11.1

Table 68: REF scenario - PILLAR 1: Efficiency/Electrification - Residential

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.34	15.8	16.3	17.1	17.8	18.6	19.7
Sales of space heating units - Electric Resistance (%)	15.7	20.7	20.5	20.2	19.5	18.6	17.7
Sales of space heating units - Gas (%)	74.7	55.6	55.9	55.8	55.7	55.8	55.7
Sales of space heating units - Fossil (%)	5.21	7.94	7.37	6.96	6.98	7	6.99
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	32.2	48.7	48.5	48.4	48.4	48.3	48.2
Sales of water heating units - Gas Furnace (%)	67.7	51.2	51.4	51.4	51.5	51.6	51.6
Sales of water heating units - Other (%)	0.083	0.169	0.171	0.171	0.171	0.172	0.172
Sales of cooking units - Electric Resistance (%)	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Sales of cooking units - Gas (%)	38.7	38.7	38.7	38.7	38.7	38.7	38.7
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		9.28	9.99				

Table 69: REF scenario - PILLAR 1: Efficiency/Electrification - Commercial

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	12.6	44.7	71.1	75.4	75.9	75.9
Sales of space heating units - Electric Resistance (%)	4.39	4.3	8.91	17.1	22.8	23.6	23.7
Sales of space heating units - Gas (%)	88.8	80.4	45	11.5	1.77	0.436	0.356
Sales of space heating units - Fossil (%)	5.44	2.76	1.39	0.243	0.027	0.001	0
Sales of water heating units - Electric Heat Pump (%)	0.454	0.344	0.348	0.348	0.342	0.344	0.345
Sales of water heating units - Electric Resistance (%)	4.26	3.24	3.2	3.21	3.19	3.18	3.18
Sales of water heating units - Gas (%)	95	96.2	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	44.2	44.3	44.3	44.3	44.4	44.5
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		36,280	37,607				

Table 70: REF scenario - PILLAR 2: Clean Electricity - Generating capacity

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	5,820	1,455	1,455	1,455	1,455	0
Installed thermal - Natural gas (MW)	13,672	13,364	12,776	14,044	13,055	16,912	16,758
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807

Table 70: REF scenario - PILLAR 2: Clean Electricity - Generating capacity (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Solar - Base land use assumptions (MW)	552	552	552	552	552	552	552
Installed renewables - Wind - Base land use assumptions (MW)	821	821	821	894	1,121	1,156	1,156
Installed renewables - Wind - Constrained land use assumptions (MW)	6	6	6	6	6	6	6

Table 71: REF scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	1,454	1,454	1,454	1,454	1,454
Wind - Base land use assumptions (GWh)	2,973	2,973	2,973	3,209	3,937	4,045	4,045
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

Table 72: REF scenario - PILLAR 6: Land sinks - Forests - REF only

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	0.94		-7.03				-6.29
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.29		-2.32				-2.42
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.352		-9.35				-8.7

Table 73: REF scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296

Table 73: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1

Table 73: REF scenario - PILLAR 6: Land sinks - Forests (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362