



## Net-Zero America - Michigan 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 . . . . .	11
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 . . . . .	19
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 . . . . .	20
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 . . . . .	34
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 . . . . .	35
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 . . . . .	36
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 . . . . .	41
66	REF scenario - PILLAR 1: Efficiency/Electrification - Overview . . . . .	42
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 . . . . .	43
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)		115	0.107	0.105	0.09	0.062	0.005
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32.4	24.8	16.3	14.8	7.91	3.33
Premature deaths from air pollution - Mobile - On-Road (deaths)		300	278	210	121	55.5	22.4
Premature deaths from air pollution - Gas Stations (deaths)		26.2	23.9	17.9	10.4	4.88	2.12
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.4	69.2	50.6	29.8	14.3	4.88
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.85	3.16	2.18	1.27	0.525	0.164
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		9.99	9.78	8.05	5.53	2.99	1.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.87	5.62	5.34	5.04	4.73	4.41
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		53.5	48.5	37.8	24.4	13.4	5.97
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.24	3.51	2.69	1.9	1.27	0.802
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.76	3.14	2.54	1.97	1.44	0.937
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.06	0.38	0.372	0.36	0.358	0.352
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		89	83.3	75.3	58.5	43.2	26.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,018	0.945	0.929	0.796	0.545	0.041
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		287	220	144	131	70.1	29.5
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,671	2,473	1,869	1,078	494	199
Monetary damages from air pollution - Gas Stations (million \$2019)		232	212	158	92.2	43.2	18.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		694	613	449	264	127	43.2
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		34.1	28	19.3	11.2	4.66	1.45
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		88.5	86.6	71.4	49	26.5	11.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		52	49.8	47.3	44.6	41.9	39
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		474	430	335	216	119	52.9

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)		37.6	31	23.8	16.8	11.2	7.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		33.3	27.8	22.5	17.5	12.7	8.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		9.37	3.36	3.28	3.17	3.16	3.11
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		791	740	669	519	383	237

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		775	973	712	420	131	1,044
By economic sector - Construction (jobs)		8,144	9,840	13,819	15,537	15,742	17,879
By economic sector - Manufacturing (jobs)		5,250	5,762	6,727	6,615	5,246	6,546
By economic sector - Mining (jobs)		4,478	3,235	2,220	1,394	828	473
By economic sector - Other (jobs)		434	582	1,383	1,494	1,960	2,162
By economic sector - Pipeline (jobs)		908	962	630	487	340	381
By economic sector - Professional (jobs)		4,949	5,538	7,568	8,942	9,660	12,673
By economic sector - Trade (jobs)		3,861	3,788	4,807	5,244	5,660	6,815
By economic sector - Utilities (jobs)		10,967	11,588	14,535	18,274	16,168	18,870
By resource sector - Biomass (jobs)		2,189	2,402	1,676	1,059	505	4,552
By resource sector - CO2 (jobs)		0	1,568	160	270	348	1,462
By resource sector - Coal (jobs)		1,528	195	0	0	0	0
By resource sector - Grid (jobs)		10,416	12,985	20,915	27,497	25,252	30,297
By resource sector - Natural Gas (jobs)		9,760	7,781	6,815	7,236	4,509	3,508
By resource sector - Nuclear (jobs)		2,009	1,739	1,712	1,685	1,659	1,633
By resource sector - Oil (jobs)		8,747	7,126	5,367	3,718	2,557	1,677
By resource sector - Solar (jobs)		942	1,248	5,493	4,082	6,440	5,738
By resource sector - Wind (jobs)		4,177	7,226	10,262	12,859	14,467	17,975
By education level - All sectors - High school diploma or less (jobs)		16,506	17,781	22,018	24,232	22,851	27,509
By education level - All sectors - Associates degree or some college (jobs)		12,137	13,056	16,524	18,744	17,956	21,267
By education level - All sectors - Bachelors degree (jobs)		8,706	8,934	10,788	11,976	11,521	13,889
By education level - All sectors - Masters or professional degree (jobs)		2,120	2,189	2,684	3,021	2,961	3,616
By education level - All sectors - Doctoral degree (jobs)		297	309	387	433	447	562
Related work experience - All sectors - None (jobs)		5,738	6,131	7,597	8,470	8,043	9,671
Related work experience - All sectors - Up to 1 year (jobs)		7,772	8,378	10,454	11,442	10,901	13,278
Related work experience - All sectors - 1 to 4 years (jobs)		14,444	15,259	18,845	21,067	20,135	24,091
Related work experience - All sectors - 4 to 10 years (jobs)		9,314	9,872	12,264	13,808	13,222	15,722
Related work experience - All sectors - Over 10 years (jobs)		2,499	2,630	3,241	3,619	3,436	4,080
On-the-Job Training - All sectors - None (jobs)		2,169	2,268	2,808	3,079	2,985	3,585
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,471	27,986	34,396	38,049	36,180	43,766

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)		8,216	8,827	11,107	12,595	12,040	14,185
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,543	2,792	3,597	4,147	4,019	4,704
On-the-Job Training - All sectors - Over 10 years (jobs)		369	396	493	536	514	601
On-Site or In-Plant Training - All sectors - None (jobs)		6,385	6,787	8,425	9,361	9,023	10,880
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		24,007	25,385	31,251	34,614	32,900	39,681
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,382	6,847	8,596	9,704	9,261	10,935
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,662	2,888	3,666	4,195	4,047	4,745
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		331	363	463	531	506	600
Wage income - All (million \$2019)		2,283	2,435	3,030	3,441	3,319	4,019

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		161	139	108	79	56.3	40.2
Oil consumption - Cumulative (million bbls)							3,351
Oil production - Annual (million bbls)		7.01	7.03	7.02	5.56	4.52	3.01
Natural gas consumption - Annual (tcf)		747	630	505	380	239	166
Natural gas consumption - Cumulative (tcf)							15,217
Natural gas production - Annual (tcf)		108	102	88.6	74.9	59.4	46.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	808	750	656	541	437	372	341
Final energy use - Residential (PJ)	562	524	489	423	347	286	245
Final energy use - Commercial (PJ)	316	311	299	277	251	231	220
Final energy use - Industry (PJ)	501	510	519	515	526	536	540

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)		5.19	5.33	9.38	9.99	8.85	9.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	38.9	724	1,409	3,808	6,207	8,123	10,040
Vehicle stocks - LDV – All others (1000 units)	8,372	7,972	7,571	5,518	3,464	1,960	456
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,610	4,124	6,688	10,128	11,025	10,511
Public EV charging plugs - DC Fast (1000 units)	0.242		2.84		12.5		20.2
Public EV charging plugs - L2 (1000 units)	0.857		68.2		300		486

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 (%)	2.17	6.93	32.9	84	93.6	94.2	94.2
Sales of space heating units - Electric Resistance (%)	5.77	9.31	7.39	3.21	2.39	2.33	2.44
Sales of space heating units - Gas (%)	85.1	70.8	50	8.51	0.73	0.191	0.189
Sales of space heating units - Fossil (%)	6.93	12.9	9.76	4.29	3.31	3.24	3.18
Sales of water heating units - Electric Heat Pump (%)	0	0.892	12.3	37.3	42	42.4	42.4
Sales of water heating units - Electric Resistance (%)	13.3	25.8	34.3	53.6	57.3	57.5	57.5
Sales of water heating units - Gas Furnace (%)	86.7	73.2	53.3	9.02	0.593	0.008	0
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.089	0.088	0.088	0.089
Sales of cooking units - Electric Resistance (%)	35.7	49.4	91.3	99.6	100	100	100
Sales of cooking units - Gas (%)	64.3	50.6	8.66	0.436	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.71	9.81				

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 (%)	0.384	6.16	30.1	79.2	88.5	89.1	89.1
Sales of space heating units - Electric Resistance (%)	1.64	3.48	5.48	9.74	10.5	10.6	10.6
Sales of space heating units - Gas Furnace (%)	95.4	88	64	11.1	1.06	0.368	0.359
Sales of space heating units - Fossil (%)	2.54	2.36	0.454	0.019	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.161	1.36	14.4	43	48.4	48.8	48.8
Sales of water heating units - Electric Resistance (%)	1.64	4.19	17	45.3	50.6	51	51
Sales of water heating units - Gas Furnace (%)	98.1	94.3	68.5	11.6	0.763	0.01	0
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,341	32,040				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	1,466	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,052	11,221	12,546	14,510	19,696	17,345	16,712
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	3,502	3,502	3,502	3,502
Installed renewables - Rooftop PV (MW)	79.1	119	158	208	269	339	419
Installed renewables - Solar - Base land use assumptions (MW)	76.9	76.9	183	3,593	4,957	8,685	10,405
Installed renewables - Wind - Base land use assumptions (MW)	2,232	2,562	10,468	17,038	25,452	26,285	27,329
Installed renewables - Solar - Constrained land use assumptions (MW)	76.9	76.9	894	1,806	4,938	8,676	12,797
Installed renewables - Wind - Constrained land use assumptions (MW)	2,562	2,562	9,565	11,360	11,512	11,770	12,060
Capital invested - Solar PV - Base (billion \$2018)		0	0.127	3.76	1.42	3.66	1.59

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion \$2018)		0	10.5	8.15	9.94	0.935	1.1
Capital invested - Solar PV - Constrained (billion \$2018)		0.126	0.092	3.16	1.11	4.22	2.15
Capital invested - Wind - Constrained (billion \$2018)		0	9.73	1.89	0.139	0.288	4.17
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)	155	155	336	6,145	8,467	14,755	17,683
Wind - Base land use assumptions (GWh)	9,704	9,704	35,628	56,685	83,224	86,111	89,686
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	155	155	1,549	3,097	8,431	14,731	21,695
Wind - Constrained land use assumptions (GWh)	9,704	9,704	32,156	38,030	38,556	39,428	40,354
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	0	14
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	2
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	0	15,722
Biomass purchases (million \$2018/y)		0	0	0	0	0	999

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.24	3.35	6.64	6.84	24.3
Annual - BECCS (MMT)		0	0	0	0	0	17.2
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	3.24	3.35	6.64	6.84	7.07
Cumulative - All (MMT)		0	3.24	6.59	13.2	20.1	44.4
Cumulative - BECCS (MMT)		0	0	0	0	0	17.2



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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	3.24	6.59	13.2	20.1	27.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	437	437	437	437	437
Spur (km)		0	201	201	314	314	1,452
All (km)		0	638	638	751	751	1,890
Cumulative investment - Trunk (million \$2018)		0	1,376	1,376	1,376	1,376	1,376
Cumulative investment - Spur (million \$2018)		0	202	206	316	322	1,226
Cumulative investment - All (million \$2018)		0	1,578	1,582	1,692	1,698	2,602

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)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-5,042

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-23,011
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,209
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-7,563
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5

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 - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335
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)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,401

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 tCO2e/y)							-699

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,176
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-74
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,949
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-699
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,144
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-148
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,990
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,392
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							135
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,818
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,649
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							269
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,209

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)		115	0.107	0.105	0.09	0.062	0.005
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		29.3	18.6	8.12	3.77	1.15	0.776
Premature deaths from air pollution - Mobile - On-Road (deaths)		306	307	296	265	210	143
Premature deaths from air pollution - Gas Stations (deaths)		26.7	26.8	25.6	22.8	17.9	12.2
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.6	72.5	65.6	56.7	44.5	30.7
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.92	3.8	3.65	3.23	2.45	1.64

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10	10.4	10.6	10.1	8.32	6.07
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.87	5.62	5.34	5.04	4.73	4.41
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		53.6	51.6	49.1	44.4	37	28
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.26	3.89	3.52	3.03	2.48	1.95
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.76	3.36	2.98	2.61	2.25	1.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.02	0.382	0.378	0.37	0.359	0.331
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		88.8	80.1	69.1	60.1	52.9	37
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,018	0.945	0.929	0.796	0.545	0.041
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		259	165	71.9	33.4	10.2	6.87
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,716	2,725	2,633	2,356	1,865	1,273
Monetary damages from air pollution - Gas Stations (million \$2019)		237	237	227	202	159	108
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		696	642	582	502	395	272
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		34.7	33.7	32.4	28.6	21.8	14.6
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		88.9	92.1	93.9	89.4	73.8	53.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		52	49.8	47.3	44.6	41.9	39
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		474	457	434	393	328	248
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		37.7	34.4	31.2	26.8	21.9	17.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		33.3	29.8	26.4	23.1	19.9	16.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		8.99	3.37	3.34	3.27	3.17	2.92
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		789	711	614	534	470	329

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		817	883	677	378	113	1,044
By economic sector - Construction (jobs)		7,668	9,554	11,542	12,529	15,566	18,933
By economic sector - Manufacturing (jobs)		5,240	5,701	5,955	5,961	6,198	7,807
By economic sector - Mining (jobs)		4,555	3,286	2,420	1,762	1,246	724
By economic sector - Other (jobs)		398	537	1,143	1,224	1,995	2,281
By economic sector - Pipeline (jobs)		912	1,079	644	570	495	608
By economic sector - Professional (jobs)		4,765	5,161	6,575	7,606	9,818	13,792
By economic sector - Trade (jobs)		3,824	3,710	4,447	4,748	5,967	7,534
By economic sector - Utilities (jobs)		9,968	10,564	10,915	12,667	14,018	18,178
By resource sector - Biomass (jobs)		2,252	2,133	1,632	1,020	479	4,403
By resource sector - CO2 (jobs)		0	2,688	275	463	597	2,507
By resource sector - Coal (jobs)		1,768	317	0	0	0	0
By resource sector - Grid (jobs)		8,777	10,498	14,658	17,950	21,434	28,609
By resource sector - Natural Gas (jobs)		9,200	6,724	5,262	4,913	3,605	2,625
By resource sector - Nuclear (jobs)		2,009	1,739	1,712	1,685	1,659	1,633
By resource sector - Oil (jobs)		8,835	7,554	6,475	5,338	4,235	2,680
By resource sector - Solar (jobs)		981	1,300	4,521	3,571	7,045	5,810
By resource sector - Wind (jobs)		4,323	7,521	9,783	12,506	16,361	22,632
By education level - All sectors - High school diploma or less (jobs)		15,859	17,045	18,602	19,625	22,692	29,072
By education level - All sectors - Associates degree or some college (jobs)		11,562	12,477	13,772	14,980	17,692	22,482
By education level - All sectors - Bachelors degree (jobs)		8,397	8,572	9,296	9,964	11,608	14,872
By education level - All sectors - Masters or professional degree (jobs)		2,040	2,085	2,306	2,504	2,965	3,863
By education level - All sectors - Doctoral degree (jobs)		288	295	341	374	458	611
Related work experience - All sectors - None (jobs)		5,492	5,865	6,393	6,826	7,951	10,210
Related work experience - All sectors - Up to 1 year (jobs)		7,489	8,030	8,890	9,357	10,894	14,101
Related work experience - All sectors - 1 to 4 years (jobs)		13,858	14,602	15,950	17,131	20,026	25,558
Related work experience - All sectors - 4 to 10 years (jobs)		8,910	9,455	10,339	11,183	13,116	16,686
Related work experience - All sectors - Over 10 years (jobs)		2,397	2,521	2,744	2,950	3,429	4,344
On-the-Job Training - All sectors - None (jobs)		2,092	2,183	2,415	2,555	3,005	3,828
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,476	26,798	29,255	31,118	36,147	46,518
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,822	8,443	9,261	10,064	11,842	14,975
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,399	2,665	2,963	3,262	3,899	4,930
On-the-Job Training - All sectors - Over 10 years (jobs)		356	385	423	447	523	649
On-Site or In-Plant Training - All sectors - None (jobs)		6,139	6,509	7,165	7,672	9,030	11,604
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,087	24,306	26,543	28,252	32,818	42,130
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,086	6,551	7,186	7,776	9,128	11,549
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,521	2,762	3,042	3,328	3,947	4,987
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		313	346	382	418	492	631
Wage income - All (million \$2019)		2,186	2,328	2,559	2,788	3,285	4,250

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	809	757	687	629	583	530	468
Final energy use - Residential (PJ)	562	525	498	472	439	392	339
Final energy use - Commercial (PJ)	316	311	304	297	288	275	260
Final energy use - Industry (PJ)	501	510	521	522	536	546	548

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)		4.21	4.23	5.79	5.99	8.36	8.82

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	30.1	232	433	1,366	2,300	4,365	6,431
Vehicle stocks - LDV – All others (1000 units)	8,406	8,406	8,406	7,974	7,541	5,811	4,081
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	260	547	1,847	5,817	8,473
Public EV charging plugs - DC Fast (1000 units)	0.242		0.872		4.63		13
Public EV charging plugs - L2 (1000 units)	0.857		21		111		311

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 (%)	2.17	5.44	8.25	17.5	39.1	65.5	80.9
Sales of space heating units - Electric Resistance (%)	5.77	9.38	9.14	8.42	6.65	4.54	3.4
Sales of space heating units - Gas (%)	85.1	72	69.7	62.4	45	23.5	11
Sales of space heating units - Fossil (%)	6.93	13.2	12.9	11.7	9.27	6.38	4.68
Sales of water heating units - Electric Heat Pump (%)	0	0.449	1.69	5.81	15.8	28.5	36
Sales of water heating units - Electric Resistance (%)	13.3	25.5	26.2	29.4	37	46.8	52.5
Sales of water heating units - Gas Furnace (%)	86.7	74	72	64.7	47.1	24.6	11.4
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.089	0.089	0.089	0.089
Sales of cooking units - Electric Resistance (%)	35.5	37.1	43	58.6	80.3	93.6	98.3
Sales of cooking units - Gas (%)	64.5	62.9	57	41.4	19.7	6.37	1.71
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.67	9.61				

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 (%)	0.384	4.93	7.53	16.1	36.4	61.5	76.2
Sales of space heating units - Electric Resistance (%)	1.64	3.4	3.62	4.32	6.01	8.19	9.45
Sales of space heating units - Gas Furnace (%)	95.4	88.9	86.3	77.6	56.5	29.8	14.1
Sales of space heating units - Fossil (%)	2.54	2.74	2.58	1.99	1.1	0.499	0.282
Sales of water heating units - Electric Heat Pump (%)	0.161	0.855	2.27	6.98	18.4	32.9	41.5
Sales of water heating units - Electric Resistance (%)	1.64	3.69	5.06	9.72	21	35.3	43.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	98.1	95.3	92.5	83.1	60.4	31.6	14.6
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,338	32,023				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	1,466	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,052	8,327	8,254	7,727	5,417	4,762	4,919
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	3,502	3,502	3,502	3,502

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)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-5,042
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-23,011



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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,209
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-7,563
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335

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 - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,401

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)							-699
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,176
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-74
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,949

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-699
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,144
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-148
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,990
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,392
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							135
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,818
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,649
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							269
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,209

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)		115	0.107	0.105	0.09	0.062	0.005
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		28	20.4	11.8	8.18	2.71	0.698
Premature deaths from air pollution - Mobile - On-Road (deaths)		300	278	210	121	55.5	22.4
Premature deaths from air pollution - Gas Stations (deaths)		26.2	23.9	17.9	10.4	4.88	2.12
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.4	69.2	50.6	29.8	14.3	4.88
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.85	3.16	2.18	1.27	0.525	0.164
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		9.99	9.78	8.05	5.53	2.99	1.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.87	5.62	5.34	5.04	4.73	4.41
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		53.5	48.5	37.8	24.4	13.4	5.97

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.24	3.51	2.69	1.9	1.27	0.802
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.76	3.14	2.54	1.97	1.44	0.937
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.18	0.38	0.371	0.358	0.357	0.305
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		87.5	82	70.3	50.5	30.7	4.48
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,018	0.945	0.929	0.796	0.545	0.041
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		248	181	104	72.5	24	6.19
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,671	2,473	1,869	1,078	494	199
Monetary damages from air pollution - Gas Stations (million \$2019)		232	212	158	92.2	43.2	18.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		694	613	449	264	127	43.2
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		34.1	28	19.3	11.2	4.66	1.45
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		88.5	86.6	71.4	49	26.5	11.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		52	49.8	47.3	44.6	41.9	39
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		474	430	335	216	119	52.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		37.6	31	23.8	16.8	11.2	7.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		33.3	27.8	22.5	17.5	12.7	8.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		10.4	3.36	3.28	3.16	3.15	2.7
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		777	729	625	448	272	39.8

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		776	984	711	399	122	1,040
By economic sector - Construction (jobs)		7,887	11,383	17,729	22,280	47,650	33,875
By economic sector - Manufacturing (jobs)		5,402	6,491	8,408	8,741	11,344	12,042
By economic sector - Mining (jobs)		4,476	3,164	2,045	1,156	584	84.4
By economic sector - Other (jobs)		420	1,013	2,152	3,155	9,762	5,267
By economic sector - Pipeline (jobs)		884	738	520	337	196	76.6
By economic sector - Professional (jobs)		4,850	6,571	9,670	12,787	25,366	22,922

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		3,849	4,367	6,003	7,608	16,292	12,940
By economic sector - Utilities (jobs)		10,316	11,632	16,424	19,721	32,606	30,544
By resource sector - Biomass (jobs)		2,116	2,458	1,651	1,019	478	4,673
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		1,768	317	0	0	0	0
By resource sector - Grid (jobs)		9,671	14,560	25,410	32,280	60,750	57,510
By resource sector - Natural Gas (jobs)		8,929	7,463	5,796	5,132	3,451	2,985
By resource sector - Nuclear (jobs)		2,009	1,739	1,712	1,458	656	0
By resource sector - Oil (jobs)		8,748	7,047	5,164	3,251	1,871	116
By resource sector - Solar (jobs)		1,036	4,550	10,467	14,587	52,097	18,964
By resource sector - Wind (jobs)		4,584	8,209	13,462	18,457	24,618	34,545
By education level - All sectors - High school diploma or less (jobs)		16,153	19,501	26,780	31,696	60,260	48,934
By education level - All sectors - Associates degree or some college (jobs)		11,818	14,313	20,163	24,466	46,715	38,280
By education level - All sectors - Bachelors degree (jobs)		8,527	9,767	12,994	15,486	28,454	24,260
By education level - All sectors - Masters or professional degree (jobs)		2,072	2,410	3,247	3,938	7,348	6,330
By education level - All sectors - Doctoral degree (jobs)		291	351	478	596	1,146	987
Related work experience - All sectors - None (jobs)		5,593	6,696	9,210	11,012	20,968	17,190
Related work experience - All sectors - Up to 1 year (jobs)		7,626	9,290	12,814	15,228	29,134	23,737
Related work experience - All sectors - 1 to 4 years (jobs)		14,114	16,698	22,842	27,363	51,575	42,718
Related work experience - All sectors - 4 to 10 years (jobs)		9,084	10,786	14,873	17,908	33,646	27,929
Related work experience - All sectors - Over 10 years (jobs)		2,444	2,873	3,922	4,671	8,599	7,218
On-the-Job Training - All sectors - None (jobs)		2,126	2,517	3,437	4,115	7,948	6,397
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,927	30,704	41,726	49,600	92,968	77,447
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,991	9,635	13,501	16,332	31,030	25,384
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,454	3,048	4,389	5,412	10,607	8,482
On-the-Job Training - All sectors - Over 10 years (jobs)		363	440	609	723	1,370	1,081
On-Site or In-Plant Training - All sectors - None (jobs)		6,249	7,495	10,301	12,383	23,536	19,383
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,502	27,830	37,898	45,072	84,603	70,277
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,215	7,482	10,449	12,600	23,944	19,564
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,574	3,141	4,451	5,443	10,536	8,488
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		320	395	562	685	1,303	1,079
Wage income - All (million \$2019)		2,226	2,648	3,649	4,415	8,337	7,059

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	808	750	656	541	437	372	341
Final energy use - Residential (PJ)	562	524	489	423	347	286	245
Final energy use - Commercial (PJ)	316	311	299	277	251	231	220
Final energy use - Industry (PJ)	501	510	519	515	526	536	540

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)		5.19	5.33	9.38	9.99	8.85	9.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV - EV (1000 units)	38.9	724	1,409	3,808	6,207	8,123	10,040
Vehicle stocks - LDV - All others (1000 units)	8,372	7,972	7,571	5,518	3,464	1,960	456
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,610	4,124	6,688	10,128	11,025	10,511
Public EV charging plugs - DC Fast (1000 units)	0.242		2.84		12.5		20.2
Public EV charging plugs - L2 (1000 units)	0.857		68.2		300		486

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 (%)	2.17	6.93	32.9	84	93.6	94.2	94.2
Sales of space heating units - Electric Resistance (%)	5.77	9.31	7.39	3.21	2.39	2.33	2.44
Sales of space heating units - Gas (%)	85.1	70.8	50	8.51	0.73	0.191	0.189
Sales of space heating units - Fossil (%)	6.93	12.9	9.76	4.29	3.31	3.24	3.18
Sales of water heating units - Electric Heat Pump (%)	0	0.892	12.3	37.3	42	42.4	42.4
Sales of water heating units - Electric Resistance (%)	13.3	25.8	34.3	53.6	57.3	57.5	57.5
Sales of water heating units - Gas Furnace (%)	86.7	73.2	53.3	9.02	0.593	0.008	0
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.089	0.088	0.088	0.089
Sales of cooking units - Electric Resistance (%)	35.7	49.4	91.3	99.6	100	100	100
Sales of cooking units - Gas (%)	64.3	50.6	8.66	0.436	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.71	9.81				

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 (%)	0.384	6.16	30.1	79.2	88.5	89.1	89.1
Sales of space heating units - Electric Resistance (%)	1.64	3.48	5.48	9.74	10.5	10.6	10.6
Sales of space heating units - Gas Furnace (%)	95.4	88	64	11.1	1.06	0.368	0.359
Sales of space heating units - Fossil (%)	2.54	2.36	0.454	0.019	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.161	1.36	14.4	43	48.4	48.8	48.8
Sales of water heating units - Electric Resistance (%)	1.64	4.19	17	45.3	50.6	51	51
Sales of water heating units - Gas Furnace (%)	98.1	94.3	68.5	11.6	0.763	0.01	0
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,341	32,040				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	2,384	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,052	8,407	11,569	13,872	13,464	14,125	17,370
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	3,502	2,350	0	0
Installed renewables - Rooftop PV (MW)	79.1	119	158	208	269	339	419
Installed renewables - Solar - Base land use assumptions (MW)	76.9	76.9	2,325	8,916	17,217	55,580	58,136
Installed renewables - Wind - Base land use assumptions (MW)	2,562	2,562	13,701	21,814	27,363	28,486	30,287
Installed renewables - Solar - Constrained land use assumptions (MW)	76.9	183	558	7,837	19,135	40,576	46,673
Installed renewables - Wind - Constrained land use assumptions (MW)	2,854	2,854	11,126	11,687	12,028	12,449	31,409
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	2.69	7.27	8.63	37.6	2.37
Capital invested - Wind - Base (billion \$2018)		0	14.8	10.1	6.56	1.26	1.91

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	155	155	3,984	15,147	29,199	94,231	98,602
Wind - Base land use assumptions (GWh)	9,704	9,704	46,048	71,803	89,535	93,442	99,583
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	310	672	1,958	26,565	64,735	137,400	158,179
Wind - Constrained land use assumptions (GWh)	19,408	19,408	72,440	76,306	78,636	81,297	203,238
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)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-5,042
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-23,011
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-1,209
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-7,563
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2



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 - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335
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)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504

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 - High - Total impacted (over 30 years) (1000 hectares)							8,401

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 tCO2e/y)							-699
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,176
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-74
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,949
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-699
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,144
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-148
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,990
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,392
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							135
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,818
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,649
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							269
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,209

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)		115	0.107	0.105	0.09	0.062	0.005

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		31.9	24.2	30.6	22.5	7.76	2.49
Premature deaths from air pollution - Mobile - On-Road (deaths)		300	278	210	121	55.5	22.4
Premature deaths from air pollution - Gas Stations (deaths)		26.2	23.9	17.9	10.4	4.88	2.12
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.4	69.2	50.6	29.8	14.3	4.88
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.85	3.16	2.18	1.27	0.525	0.164
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		9.99	9.78	8.05	5.53	2.99	1.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.87	5.62	5.34	5.04	4.73	4.41
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		53.5	48.5	37.8	24.4	13.4	5.97
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.24	3.51	2.69	1.9	1.27	0.802
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.76	3.14	2.54	1.97	1.44	0.937
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.951	0.379	0.372	0.359	0.358	0.305
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		90.1	86.9	84.7	71.5	59.5	44.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,018	0.945	0.929	0.796	0.545	0.041
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		283	215	271	199	68.7	22.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,671	2,473	1,869	1,078	494	199
Monetary damages from air pollution - Gas Stations (million \$2019)		232	212	158	92.2	43.2	18.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		694	613	449	264	127	43.2
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		34.1	28	19.3	11.2	4.66	1.45
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		88.5	86.6	71.4	49	26.5	11.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		52	49.8	47.3	44.6	41.9	39
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		474	430	335	216	119	52.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		37.6	31	23.8	16.8	11.2	7.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		33.3	27.8	22.5	17.5	12.7	8.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		8.39	3.35	3.28	3.17	3.16	2.69
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		800	771	752	635	528	392

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		803	898	668	391	126	1,046
By economic sector - Construction (jobs)		7,500	8,817	8,963	9,877	11,579	13,344
By economic sector - Manufacturing (jobs)		4,716	4,269	4,117	3,938	4,110	4,291
By economic sector - Mining (jobs)		4,492	3,324	2,417	1,626	1,077	705
By economic sector - Other (jobs)		377	425	538	713	882	1,006
By economic sector - Pipeline (jobs)		933	1,189	772	692	583	744
By economic sector - Professional (jobs)		4,500	4,337	5,303	5,295	8,063	9,199
By economic sector - Trade (jobs)		3,607	3,270	3,390	3,287	4,147	4,477
By economic sector - Utilities (jobs)		9,796	10,624	15,477	13,588	28,243	26,231
By resource sector - Biomass (jobs)		2,134	2,133	1,613	1,035	508	4,444
By resource sector - CO2 (jobs)		0	3,037	311	523	674	2,832
By resource sector - Coal (jobs)		1,346	102	0	0	0	0
By resource sector - Grid (jobs)		8,550	9,566	14,156	16,177	20,170	24,053
By resource sector - Natural Gas (jobs)		9,440	8,224	7,458	7,998	6,827	5,642
By resource sector - Nuclear (jobs)		2,009	1,739	7,445	2,844	20,074	14,129
By resource sector - Oil (jobs)		8,746	7,126	5,367	3,718	2,658	1,921
By resource sector - Solar (jobs)		817	763	749	1,207	1,307	1,277
By resource sector - Wind (jobs)		3,683	4,463	4,547	5,907	6,591	6,744
By education level - All sectors - High school diploma or less (jobs)		15,259	15,703	17,093	16,346	23,052	24,690
By education level - All sectors - Associates degree or some college (jobs)		11,134	11,477	12,764	12,514	18,093	18,869
By education level - All sectors - Bachelors degree (jobs)		8,086	7,813	9,164	8,210	13,627	13,476
By education level - All sectors - Masters or professional degree (jobs)		1,968	1,899	2,299	2,052	3,521	3,491
By education level - All sectors - Doctoral degree (jobs)		277	262	327	286	517	516
Related work experience - All sectors - None (jobs)		5,297	5,427	5,963	5,725	8,218	8,712
Related work experience - All sectors - Up to 1 year (jobs)		7,183	7,307	8,124	7,634	11,147	11,869
Related work experience - All sectors - 1 to 4 years (jobs)		13,345	13,422	15,103	14,256	21,495	22,157
Related work experience - All sectors - 4 to 10 years (jobs)		8,591	8,697	9,801	9,333	14,068	14,423
Related work experience - All sectors - Over 10 years (jobs)		2,308	2,301	2,656	2,462	3,881	3,881
On-the-Job Training - All sectors - None (jobs)		2,013	1,989	2,292	2,084	3,333	3,369
On-the-Job Training - All sectors - Up to 1 year (jobs)		24,478	24,492	27,522	25,697	38,668	40,172
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,557	7,815	8,716	8,488	12,428	12,859
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,334	2,510	2,728	2,779	3,823	4,088

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		342	347	388	361	556	555
On-Site or In-Plant Training - All sectors - None (jobs)		5,903	5,926	6,716	6,281	9,684	9,961
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		22,193	22,252	25,012	23,400	35,152	36,477
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,875	6,055	6,735	6,537	9,529	9,890
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,451	2,599	2,837	2,836	3,978	4,206
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		303	321	346	353	466	508
Wage income - All (million \$2019)		2,112	2,154	2,491	2,358	3,720	3,843

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	808	750	656	541	437	372	341
Final energy use - Residential (PJ)	562	524	489	423	347	286	245
Final energy use - Commercial (PJ)	316	311	299	277	251	231	220
Final energy use - Industry (PJ)	501	510	519	515	526	536	540

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)		5.19	5.33	9.38	9.99	8.85	9.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	38.9	724	1,409	3,808	6,207	8,123	10,040
Vehicle stocks - LDV – All others (1000 units)	8,372	7,972	7,571	5,518	3,464	1,960	456
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,610	4,124	6,688	10,128	11,025	10,511
Public EV charging plugs - DC Fast (1000 units)	0.242		2.84		12.5		20.2
Public EV charging plugs - L2 (1000 units)	0.857		68.2		300		486

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 (%)	2.17	6.93	32.9	84	93.6	94.2	94.2
Sales of space heating units - Electric Resistance (%)	5.77	9.31	7.39	3.21	2.39	2.33	2.44
Sales of space heating units - Gas (%)	85.1	70.8	50	8.51	0.73	0.191	0.189
Sales of space heating units - Fossil (%)	6.93	12.9	9.76	4.29	3.31	3.24	3.18
Sales of water heating units - Electric Heat Pump (%)	0	0.892	12.3	37.3	42	42.4	42.4
Sales of water heating units - Electric Resistance (%)	13.3	25.8	34.3	53.6	57.3	57.5	57.5
Sales of water heating units - Gas Furnace (%)	86.7	73.2	53.3	9.02	0.593	0.008	0
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.089	0.088	0.088	0.089
Sales of cooking units - Electric Resistance (%)	35.7	49.4	91.3	99.6	100	100	100
Sales of cooking units - Gas (%)	64.3	50.6	8.66	0.436	0	0	0

Table 43: E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.71	9.81				

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 (%)	0.384	6.16	30.1	79.2	88.5	89.1	89.1
Sales of space heating units - Electric Resistance (%)	1.64	3.48	5.48	9.74	10.5	10.6	10.6
Sales of space heating units - Gas Furnace (%)	95.4	88	64	11.1	1.06	0.368	0.359
Sales of space heating units - Fossil (%)	2.54	2.36	0.454	0.019	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.161	1.36	14.4	43	48.4	48.8	48.8
Sales of water heating units - Electric Resistance (%)	1.64	4.19	17	45.3	50.6	51	51
Sales of water heating units - Gas Furnace (%)	98.1	94.3	68.5	11.6	0.763	0.01	0
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,341	32,040				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	769	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,058	8,028	8,948	9,964	12,233	15,630	16,222
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	5,910	5,910	13,398	16,867
Installed renewables - Rooftop PV (MW)	79.1	119	158	208	269	339	419
Installed renewables - Solar - Base land use assumptions (MW)	76.9	76.9	76.9	76.9	576	1,124	1,124
Installed renewables - Wind - Base land use assumptions (MW)	2,562	2,939	6,519	6,519	7,423	7,656	7,839
Installed renewables - Solar - Constrained land use assumptions (MW)	76.9	76.9	76.9	308	308	1,260	1,260
Installed renewables - Wind - Constrained land use assumptions (MW)	2,562	2,705	5,436	5,505	6,268	6,657	6,817
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	0.519	0.537	0
Capital invested - Wind - Base (billion \$2018)		0.555	4.61	0	0.985	0.262	0.194
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.254	0	0.933	0
Capital invested - Wind - Constrained (billion \$2018)		0.211	3.64	0.086	0.901	0.436	0.169

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	155	155	155	155	1,006	1,937	1,937
Wind - Base land use assumptions (GWh)	9,704	11,014	22,540	22,540	25,227	25,977	26,570
Offshore Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

Table 46: E+RE- scenario - PILLAR 2: Clean Electricity - Generation (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Constrained land use assumptions (GWh)	155	155	155	549	549	2,170	2,170
Wind - Constrained land use assumptions (GWh)	9,704	10,194	19,079	19,327	21,853	23,145	23,668
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 tCO2e/y)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-5,042
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-23,011
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,209
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-7,563

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335
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)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169



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 - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,401

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 tCO2e/y)							-699
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,176
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-74
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,949
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-699
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,144
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-148
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,990

Table 48: E+RE- 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)							292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,392
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							135
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,818
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,649
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							269
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,209

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)		115	0.107	0.105	0.09	0.062	0.005
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		29.7	16.9	10	6.95	3.15	1.05
Premature deaths from air pollution - Mobile - On-Road (deaths)		306	307	296	265	210	143
Premature deaths from air pollution - Gas Stations (deaths)		26.7	26.8	25.6	22.8	17.9	12.2
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.6	72.5	65.6	56.7	44.5	30.7
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.92	3.8	3.65	3.23	2.45	1.64
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10	10.4	10.6	10.1	8.32	6.07
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.87	5.62	5.34	5.04	4.73	4.41
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		53.6	51.6	49.1	44.4	37	28
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.26	3.89	3.52	3.03	2.48	1.95
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.76	3.36	2.98	2.61	2.25	1.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.06	0.382	0.378	0.371	0.369	0.358

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		88.8	80.1	69.1	60.1	52.9	37
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,018	0,945	0,929	0,796	0,545	0,041
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		263	150	88.6	61.6	27.9	9.31
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,716	2,725	2,633	2,356	1,865	1,273
Monetary damages from air pollution - Gas Stations (million \$2019)		237	237	227	202	159	108
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		696	642	582	502	395	272
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		34.7	33.7	32.4	28.6	21.8	14.6
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		88.9	92.1	93.9	89.4	73.8	53.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		52	49.8	47.3	44.6	41.9	39
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		474	457	434	393	328	248
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		37.7	34.4	31.2	26.8	21.9	17.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		33.3	29.8	26.4	23.1	19.9	16.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		9.33	3.37	3.34	3.27	3.26	3.16
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		789	711	614	534	470	329

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		797	883	675	387	115	1,702
By economic sector - Construction (jobs)		7,567	9,664	11,084	10,800	12,787	16,493
By economic sector - Manufacturing (jobs)		5,231	5,752	5,539	4,583	4,714	7,077
By economic sector - Mining (jobs)		4,486	3,283	2,434	1,822	1,244	685
By economic sector - Other (jobs)		393	545	1,057	1,002	1,493	1,901
By economic sector - Pipeline (jobs)		903	1,086	653	587	488	598
By economic sector - Professional (jobs)		4,696	5,201	6,320	6,477	7,813	12,817
By economic sector - Trade (jobs)		3,747	3,735	4,303	4,175	4,820	6,574
By economic sector - Utilities (jobs)		9,727	10,605	10,692	11,181	12,614	16,757
By resource sector - Biomass (jobs)		2,216	2,134	1,631	1,058	514	8,123
By resource sector - CO2 (jobs)		0	2,759	282	475	613	2,573
By resource sector - Coal (jobs)		1,528	195	0	0	0	0
By resource sector - Grid (jobs)		8,443	10,633	14,151	14,972	18,608	25,878
By resource sector - Natural Gas (jobs)		9,109	6,712	5,373	5,031	3,886	2,719
By resource sector - Nuclear (jobs)		2,009	1,739	1,712	1,685	1,659	1,633
By resource sector - Oil (jobs)		8,835	7,554	6,475	5,550	4,263	2,531

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Solar (jobs)		971	1,286	3,910	2,690	4,744	5,241
By resource sector - Wind (jobs)		4,435	7,741	9,223	9,553	11,802	15,905
By education level - All sectors - High school diploma or less (jobs)		15,595	17,168	17,939	16,973	18,911	26,772
By education level - All sectors - Associates degree or some college (jobs)		11,374	12,567	13,271	12,883	14,692	20,152
By education level - All sectors - Bachelors degree (jobs)		8,281	8,624	8,986	8,657	9,655	13,577
By education level - All sectors - Masters or professional degree (jobs)		2,012	2,098	2,231	2,176	2,458	3,537
By education level - All sectors - Doctoral degree (jobs)		285	297	330	325	373	565
Related work experience - All sectors - None (jobs)		5,404	5,905	6,172	5,912	6,632	9,356
Related work experience - All sectors - Up to 1 year (jobs)		7,370	8,089	8,561	8,059	9,003	13,060
Related work experience - All sectors - 1 to 4 years (jobs)		13,636	14,700	15,397	14,833	16,684	23,222
Related work experience - All sectors - 4 to 10 years (jobs)		8,773	9,520	9,980	9,668	10,919	15,048
Related work experience - All sectors - Over 10 years (jobs)		2,363	2,539	2,646	2,543	2,852	3,919
On-the-Job Training - All sectors - None (jobs)		2,062	2,198	2,329	2,214	2,485	3,509
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,077	26,979	28,222	26,900	30,040	42,741
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,697	8,503	8,936	8,687	9,874	13,393
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,358	2,685	2,863	2,829	3,260	4,382
On-the-Job Training - All sectors - Over 10 years (jobs)		352	388	407	383	429	579
On-Site or In-Plant Training - All sectors - None (jobs)		6,050	6,554	6,904	6,613	7,462	10,571
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		22,722	24,470	25,610	24,433	27,300	38,646
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,988	6,598	6,932	6,714	7,611	10,366
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,479	2,782	2,942	2,894	3,306	4,453
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		308	348	368	360	411	567
Wage income - All (million \$2019)		2,152	2,343	2,475	2,423	2,750	3,868

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	809	757	687	629	583	530	468
Final energy use - Residential (PJ)	562	525	498	472	439	392	339
Final energy use - Commercial (PJ)	316	311	304	297	288	275	260
Final energy use - Industry (PJ)	501	510	521	522	536	546	548

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)		4.21	4.23	5.79	5.99	8.36	8.82

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	30.1	232	433	1,366	2,300	4,365	6,431
Vehicle stocks - LDV – All others (1000 units)	8,406	8,406	8,406	7,974	7,541	5,811	4,081
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	260	547	1,847	5,817	8,473
Public EV charging plugs - DC Fast (1000 units)	0.242		0.872		4.63		13
Public EV charging plugs - L2 (1000 units)	0.857		21		111		311

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 (%)	2.17	5.44	8.25	17.5	39.1	65.5	80.9
Sales of space heating units - Electric Resistance (%)	5.77	9.38	9.14	8.42	6.65	4.54	3.4
Sales of space heating units - Gas (%)	85.1	72	69.7	62.4	45	23.5	11
Sales of space heating units - Fossil (%)	6.93	13.2	12.9	11.7	9.27	6.38	4.68
Sales of water heating units - Electric Heat Pump (%)	0	0.449	1.69	5.81	15.8	28.5	36
Sales of water heating units - Electric Resistance (%)	13.3	25.5	26.2	29.4	37	46.8	52.5
Sales of water heating units - Gas Furnace (%)	86.7	74	72	64.7	47.1	24.6	11.4
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.089	0.089	0.089	0.089
Sales of cooking units - Electric Resistance (%)	35.5	37.1	43	58.6	80.3	93.6	98.3
Sales of cooking units - Gas (%)	64.5	62.9	57	41.4	19.7	6.37	1.71
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.67	9.61				

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 (%)	0.384	4.93	7.53	16.1	36.4	61.5	76.2
Sales of space heating units - Electric Resistance (%)	1.64	3.4	3.62	4.32	6.01	8.19	9.45
Sales of space heating units - Gas Furnace (%)	95.4	88.9	86.3	77.6	56.5	29.8	14.1
Sales of space heating units - Fossil (%)	2.54	2.74	2.58	1.99	1.1	0.499	0.282
Sales of water heating units - Electric Heat Pump (%)	0.161	0.855	2.27	6.98	18.4	32.9	41.5
Sales of water heating units - Electric Resistance (%)	1.64	3.69	5.06	9.72	21	35.3	43.8
Sales of water heating units - Gas Furnace (%)	98.1	95.3	92.5	83.1	60.4	31.6	14.6
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,338	32,023				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	2,384	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,052	8,407	8,334	7,807	5,707	7,034	6,924
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	3,502	3,502	3,502	3,502

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

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

Table 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	0
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	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	18
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	8
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	1
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	0	25,514
Biomass purchases (million \$2018/y)		0	0	0	0	0	2,362

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.24	3.35	6.64	6.84	28.4
Annual - BECCS (MMT)		0	0	0	0	0	21.4
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	3.24	3.35	6.64	6.84	7.07
Cumulative - All (MMT)		0	3.24	6.59	13.2	20.1	48.5
Cumulative - BECCS (MMT)		0	0	0	0	0	21.4
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	3.24	6.59	13.2	20.1	27.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	437	437	437	437	437
Spur (km)		0	201	201	314	314	1,173
All (km)		0	638	638	751	751	1,610
Cumulative investment - Trunk (million \$2018)		0	1,376	1,376	1,376	1,716	1,716
Cumulative investment - Spur (million \$2018)		0	200	204	315	320	1,128
Cumulative investment - All (million \$2018)		0	1,576	1,580	1,691	2,036	2,844

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 tCO2e/y)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-5,042
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-23,011
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,209

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-7,563
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335
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)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169



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 - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,401

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 tCO2e/y)							-809
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,042
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-69.1
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,920
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-809
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,890

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-138
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,837
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							462
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,306
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							126
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							9.95
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							39
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,943
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							462
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							6,140
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							251
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							9.95
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							39
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							6,902

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)		378	231	179	156	148	140
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		27.2	30.1	40.2	37.9	34.6	30.8
Premature deaths from air pollution - Mobile - On-Road (deaths)		305	310	315	321	327	333
Premature deaths from air pollution - Gas Stations (deaths)		26.6	27	27.2	27.7	28	28.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		78.1	72.6	67.7	64.2	61.8	59.6
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.81	3.27	2.37	1.51	0.816	0.434
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		9.73	10	10.4	10.8	10.7	10.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.14	6.15	6.13	6.08	6.03	5.94
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		54.1	52.6	47.9	42.2	38.7	37.8
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		4.39	4.31	4.08	3.75	3.5	3.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.92	3.99	4.06	4.11	4.16	4.21
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.35	1.61	1.29	1.22	1.17	1.08
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		89.3	94	96	91.6	90.7	84.7
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		3,353	2,045	1,583	1,384	1,308	1,245
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		241	267	356	336	306	272
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,712	2,758	2,801	2,856	2,909	2,963
Monetary damages from air pollution - Gas Stations (million \$2019)		236	239	241	245	248	250
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		692	643	600	569	548	528
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		33.8	29	21	13.4	7.24	3.85
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		86.2	88.8	92.6	95.4	94.5	92.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		54.3	54.5	54.3	53.9	53.3	52.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		479	466	424	373	343	335
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		38.9	38.1	36.1	33.2	31	29.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		34.7	35.3	35.9	36.4	36.8	37.3
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		20.8	14.2	11.4	10.7	10.3	9.57

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		793	835	852	813	806	752

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		786	765	763	730	730	742
By economic sector - Construction (jobs)		7,184	7,300	8,251	9,286	9,845	9,796
By economic sector - Manufacturing (jobs)		3,600	3,704	3,958	4,342	4,190	3,996
By economic sector - Mining (jobs)		4,737	3,825	3,167	2,569	2,168	1,740
By economic sector - Other (jobs)		321	347	423	537	591	658
By economic sector - Pipeline (jobs)		929	970	984	928	939	930
By economic sector - Professional (jobs)		4,390	4,036	4,278	4,871	5,052	4,942
By economic sector - Trade (jobs)		3,779	3,296	3,273	3,474	3,522	3,400
By economic sector - Utilities (jobs)		10,542	9,554	11,053	12,543	12,921	11,834
By resource sector - Biomass (jobs)		2,148	2,060	1,974	1,871	1,858	1,843
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		2,411	1,219	845	804	767	294
By resource sector - Grid (jobs)		9,620	9,004	11,456	13,655	14,956	14,402
By resource sector - Natural Gas (jobs)		9,510	9,371	10,307	10,756	10,553	9,594
By resource sector - Nuclear (jobs)		2,009	1,739	1,712	1,685	1,435	1,096
By resource sector - Oil (jobs)		8,870	7,678	6,808	6,280	5,934	5,581
By resource sector - Solar (jobs)			438	569	567	595	1,055
By resource sector - Wind (jobs)		1,700	2,287	2,480	3,662	3,860	4,171
By education level - All sectors - High school diploma or less (jobs)		15,068	14,167	15,229	16,524	16,869	16,143
By education level - All sectors - Associates degree or some college (jobs)		10,985	10,295	11,180	12,294	12,570	11,975
By education level - All sectors - Bachelors degree (jobs)		7,993	7,308	7,626	8,181	8,218	7,743
By education level - All sectors - Masters or professional degree (jobs)		1,952	1,781	1,861	2,007	2,023	1,912
By education level - All sectors - Doctoral degree (jobs)		271	247	254	274	276	264
Related work experience - All sectors - None (jobs)		5,247	4,908	5,280	5,748	5,865	5,597
Related work experience - All sectors - Up to 1 year (jobs)		7,040	6,606	7,058	7,657	7,796	7,469
Related work experience - All sectors - 1 to 4 years (jobs)		13,233	12,278	13,103	14,217	14,448	13,725
Related work experience - All sectors - 4 to 10 years (jobs)		8,489	7,901	8,468	9,227	9,388	8,916
Related work experience - All sectors - Over 10 years (jobs)		2,259	2,103	2,241	2,431	2,460	2,331
On-the-Job Training - All sectors - None (jobs)		1,981	1,831	1,923	2,069	2,089	1,987
On-the-Job Training - All sectors - Up to 1 year (jobs)		24,155	22,435	23,853	25,810	26,182	24,902
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,473	7,010	7,605	8,339	8,528	8,121
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,336	2,213	2,440	2,705	2,798	2,683
On-the-Job Training - All sectors - Over 10 years (jobs)		325	309	329	356	360	344
On-Site or In-Plant Training - All sectors - None (jobs)		5,776	5,376	5,718	6,207	6,292	5,988
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		21,932	20,377	21,693	23,486	23,840	22,675

Table 65: REF 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)		5,810	5,447	5,896	6,453	6,595	6,283
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,451	2,313	2,529	2,786	2,870	2,746
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		300	285	314	349	361	346
Wage income - All (million \$2019)		2,100	1,974	2,136	2,347	2,417	2,324

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	808	759	697	659	657	674	697
Final energy use - Residential (PJ)	562	526	505	490	480	473	466
Final energy use - Commercial (PJ)	316	316	313	306	298	298	306
Final energy use - Industry (PJ)	502	527	542	555	576	598	623

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)		4.63	4.71	5.78	5.97	5.98	6.15

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 (%)	1.35	8.6	8.97	9.55	9.94	10.2	10.7
Sales of space heating units - Electric Resistance (%)	5.84	9.06	8.98	8.84	8.56	8.18	7.87
Sales of space heating units - Gas (%)	85.6	70	70	69.8	69.7	69.7	69.7
Sales of space heating units - Fossil (%)	7.19	12.3	12	11.8	11.8	11.8	11.8
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	13.3	25.1	24.9	24.9	24.9	24.8	24.8
Sales of water heating units - Gas Furnace (%)	86.7	74.8	75	75	75	75.1	75.1
Sales of water heating units - Other (%)	0.036	0.089	0.089	0.09	0.09	0.09	0.09
Sales of cooking units - Electric Resistance (%)	34.9	34.9	34.9	34.9	34.9	34.9	34.9
Sales of cooking units - Gas (%)	65.1	65.1	65.1	65.1	65.1	65.1	65.1
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		7.41	7.89				

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 (%)	0.384	11.5	43.9	70.8	75.3	75.8	75.8
Sales of space heating units - Electric Resistance (%)	1.64	4.29	8.99	17.2	22.8	23.7	23.8
Sales of space heating units - Gas Furnace (%)	95.4	81.7	45.8	11.7	1.81	0.444	0.359
Sales of space heating units - Fossil (%)	2.54	2.52	1.3	0.232	0.026	0.001	0
Sales of water heating units - Electric Heat Pump (%)	0.161	0.341	0.345	0.344	0.338	0.341	0.34
Sales of water heating units - Electric Resistance (%)	1.64	3.18	3.15	3.16	3.15	3.14	3.14
Sales of water heating units - Gas Furnace (%)	98.1	96.3	96.3	96.3	96.3	96.3	96.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	0.093	0.184	0.185	0.186	0.185	0.186	0.186
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)		29,025	30,109				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,466	4,847	2,384	2,384	2,384	2,384	0
Installed thermal - Natural gas (MW)	7,049	8,929	9,203	13,083	16,416	20,770	20,966
Installed thermal - Nuclear (MW)	4,314	3,502	3,502	3,502	3,502	2,350	2,350
Installed renewables - Rooftop PV (MW)	79.1	119	158	208	269	339	419
Installed renewables - Solar - Base land use assumptions (MW)	76.9	76.9	76.9	76.9	76.9	76.9	76.9
Installed renewables - Wind - Base land use assumptions (MW)	2,489	2,489	4,587	5,175	7,424	7,649	7,841
Installed renewables - Wind - Constrained land use assumptions (MW)	72.8	72.8	72.8	72.8	72.8	72.8	72.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	155	155	155	155	155	155	155
Wind - Base land use assumptions (GWh)	9,704	9,704	16,851	18,794	25,463	26,190	26,812
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)	-36.6		-17.7				-15.8
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-2.06		-3.7				-3.85
Business-as-usual carbon sink - Total (Mt CO2e/y)	-38.7		-21.4				-19.7

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)							-202
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-518
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,236
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-615
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,521
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-529
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-472
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-361
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,529

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-10,983
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-303
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,812
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-7,632
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-901
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-5,042
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,020
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-708
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,560
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,033
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-23,011
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-403
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,106
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,028
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,209
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-7,563
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,511
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,759
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-35,061
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,537
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							33
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,155
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							223
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)							75.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							31.2
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							910
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,845
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							49.5
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							408
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,889
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							335
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)							110
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							46.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,833
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,840
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							66
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							421
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							5,624
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							445
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)							144
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,504
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,401