



Net-Zero America - New York data

October 29, 2021 (updated January 9, 2022)

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:

E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, Final Report, Princeton University, Princeton, NJ, 29 October 2021. Report available at <https://net-zeroamerica.princeton.edu>.

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	6
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	9
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	13
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	18
29	E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview	19
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	24
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	28
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	34
52	E-B+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	34
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	35
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	36
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	40
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	43
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	44

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)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		252	184	131	124	95.9	35.9
Premature deaths from air pollution - Mobile - On-Road (deaths)		823	813	653	397	188	74.4
Premature deaths from air pollution - Gas Stations (deaths)		51.2	49.4	38.8	23.6	11.4	4.84
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		459	413	304	182	92	36.1
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		173	147	104	62.6	28.4	8.24
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27	25.6	20.7	14.6	8.51	4.56
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		210	203	168	121	79.4	44.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		45.9	39.2	29.1	18.8	13	9.75
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.13	6.93	5.63	4.29	2.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.92	1.04	1.06	1.08	1.13	1.15
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		147	138	123	97.4	70.7	43.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,231	1,632	1,159	1,101	849	318
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,317	7,231	5,804	3,530	1,675	662
Monetary damages from air pollution - Gas Stations (million \$2019)		453	437	343	209	101	42.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,068	3,662	2,692	1,616	815	320
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,534	1,303	924	555	252	73.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		240	227	184	129	75.4	40.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,861	1,795	1,488	1,070	703	393

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)		406	347	258	166	115	86.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	72	61.3	49.9	37.9	25.8
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.9	9.17	9.39	9.53	9.95	10.2
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,307	1,222	1,089	865	627	384

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		481	669	432	268	106	400
By economic sector - Construction (jobs)		20,440	21,337	26,486	31,946	38,153	45,770
By economic sector - Manufacturing (jobs)		6,921	8,482	10,733	10,260	11,877	16,371
By economic sector - Mining (jobs)		4,807	3,439	2,289	1,447	864	516
By economic sector - Other (jobs)		2,528	2,816	3,215	4,424	6,277	8,091
By economic sector - Pipeline (jobs)		1,235	1,063	877	669	460	416
By economic sector - Professional (jobs)		8,877	9,709	12,299	15,433	19,282	26,494
By economic sector - Trade (jobs)		6,740	6,787	7,866	9,610	12,131	15,960
By economic sector - Utilities (jobs)		16,075	16,512	26,590	32,247	37,657	60,547
By resource sector - Biomass (jobs)		1,481	1,701	1,050	700	400	1,756
By resource sector - CO2 (jobs)		0	120	359	357	356	1,028
By resource sector - Coal (jobs)		481	139	10.1	9.64	9.2	3.53
By resource sector - Grid (jobs)		16,450	21,706	44,364	54,262	63,369	76,676
By resource sector - Natural Gas (jobs)		14,747	10,460	8,380	9,432	7,326	5,695
By resource sector - Nuclear (jobs)		2,016	1,688	1,661	1,635	3,961	26,080
By resource sector - Oil (jobs)		10,343	8,327	6,120	4,320	3,031	2,063
By resource sector - Solar (jobs)		18,963	19,121	16,124	21,661	32,068	39,329
By resource sector - Wind (jobs)		3,620	7,552	12,719	13,925	16,288	21,934
By education level - All sectors - High school diploma or less (jobs)		28,841	30,149	38,510	44,810	53,157	71,550
By education level - All sectors - Associates degree or some college (jobs)		21,434	22,374	29,204	34,507	41,155	55,487
By education level - All sectors - Bachelors degree (jobs)		13,932	14,277	18,000	20,970	25,183	36,712
By education level - All sectors - Masters or professional degree (jobs)		3,398	3,501	4,453	5,271	6,389	9,425
By education level - All sectors - Doctoral degree (jobs)		496	513	620	745	923	1,390
Related work experience - All sectors - None (jobs)		9,895	10,294	13,246	15,547	18,491	25,046
Related work experience - All sectors - Up to 1 year (jobs)		13,600	14,292	18,101	21,088	25,244	34,603
Related work experience - All sectors - 1 to 4 years (jobs)		24,505	25,409	32,602	38,203	45,577	62,989
Related work experience - All sectors - 4 to 10 years (jobs)		15,945	16,501	21,269	24,990	29,770	41,004
Related work experience - All sectors - Over 10 years (jobs)		4,157	4,317	5,568	6,474	7,724	10,922
On-the-Job Training - All sectors - None (jobs)		3,759	3,875	4,820	5,642	6,821	9,699
On-the-Job Training - All sectors - Up to 1 year (jobs)		44,389	46,250	59,021	68,747	82,069	114,023

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)		14,494	15,047	19,607	23,143	27,509	37,199
On-the-Job Training - All sectors - 4 to 10 years (jobs)		4,788	4,947	6,483	7,786	9,228	11,998
On-the-Job Training - All sectors - Over 10 years (jobs)		671	696	854	985	1,180	1,645
On-Site or In-Plant Training - All sectors - None (jobs)		11,040	11,484	14,514	17,007	20,427	28,552
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		40,381	42,041	53,774	62,683	74,792	103,710
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		11,218	11,658	15,152	17,843	21,213	28,680
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		4,874	5,013	6,524	7,791	9,219	12,130
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		590	618	823	978	1,154	1,493
Wage income - All (million \$2019)		4,314	4,508	5,889	7,005	8,449	11,957

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		230	202	160	122	91.3	66.3
Oil consumption - Cumulative (million bbls)							4,947
Oil production - Annual (million bbls)		0.286	0.287	0.287	0.227	0.185	0.123
Natural gas consumption - Annual (tcf)		1,045	881	707	532	335	232
Natural gas consumption - Cumulative (tcf)							21,286
Natural gas production - Annual (tcf)		14.4	13.6	11.9	10	7.95	6.18

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

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)		7.59	7.79	18.2	19.6	18.4	19.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV – All others (1000 units)	11,462	10,914	10,366	7,554	4,742	2,683	624
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,187	5,658	9,084	13,794	14,977	14,299
Public EV charging plugs - DC Fast (1000 units)	0.56		3.54		15		24.1
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

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 (%)	3.63	16.2	66.1	89	91.7	91.9	92
Sales of space heating units - Electric Resistance (%)	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06
Sales of water heating units - Electric Heat Pump (%)	0	6.54	37.2	51.7	53.5	53.6	53.6
Sales of water heating units - Electric Resistance (%)	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Sales of water heating units - Gas Furnace (%)	71.1	52	21.9	2.85	0.155	0	0
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric Resistance (%)	34.6	48.6	91.2	99.6	100	100	100
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		14.3	15.2				

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 (%)	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Sales of space heating units - Electric Resistance (%)	2.13	4.73	12.8	18	19.1	18.8	18.9
Sales of space heating units - Gas Furnace (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.224	7.35	41	58.7	61	61.2	61.2
Sales of water heating units - Electric Resistance (%)	1.34	5.14	22.3	36.4	38.5	38.7	38.7
Sales of water heating units - Gas Furnace (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		89,684	98,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	28.6	0
Installed thermal - Natural gas (MW)	22,655	14,488	15,963	18,699	34,255	30,475	28,214
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,398	3,399	3,830	14,525
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	2,155	6,680	11,974	14,471	20,687	35,011	43,162
Installed renewables - Wind - Base land use assumptions (MW)	2,381	3,284	5,438	8,739	9,320	11,024	11,567
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	139	309	8,081	13,377	20,097	28,635
Installed renewables - Solar - Constrained land use assumptions (MW)	502	6,292	16,239	20,774	27,836	37,360	43,108
Installed renewables - Wind - Constrained land use assumptions (MW)	3,284	3,284	5,424	8,833	9,661	11,413	11,966

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	276	448	7,937	13,288	19,102	28,495
Capital invested - Solar PV - Base (billion \$2018)		6.82	6.34	2.75	6.46	14.1	7.55
Capital invested - Wind - Base (billion \$2018)		0	5.05	7.37	1.23	3.44	1.04
Capital invested - Offshore Wind - Base (billion \$2018)		0.393	0.409	15.9	10.9	11	11.3
Capital invested - Solar PV - Constrained (billion \$2018)		11.5	11.2	5.23	7.17	8.6	3.67
Capital invested - Wind - Constrained (billion \$2018)		0	8.47	7.67	1.8	3.59	1.05
Capital invested - Offshore Wind - Constrained (billion \$2018)		0.782	0.412	15.4	10.8	9.53	12.4
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	0.005	0.001	0	0.013
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.008	0	0.001	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)	2,912	11,655	20,663	24,823	35,288	59,625	73,457
Wind - Base land use assumptions (GWh)	14,244	14,244	22,135	34,055	36,123	42,123	44,018
OffshoreWind - Base land use assumptions (GWh)	0	562	1,250	32,760	54,963	83,187	119,377
Solar - Constrained land use assumptions (GWh)	935	10,867	27,846	35,424	47,307	63,297	72,937
Wind - Constrained land use assumptions (GWh)	14,244	14,244	22,057	34,233	37,112	43,214	45,113
OffshoreWind - Constrained land use assumptions (GWh)	0	562	1,250	32,760	54,963	83,187	119,377
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	8.55	8.55	9.28	9.28	9.28
Biomass w/ccu allam power plant (GWh)	0	0	0	4.5	5.42	5.42	18.8

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	1	1	1	1	1
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	1	1	3
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	2
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	2
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	7.03	19.2	4.22	0	4,926
Biomass purchases (million \$2018/y)		0	0.322	0.902	1.04	1.04	235

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	3.38	3.35	3.45	7.35
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	3.8
Annual - NGCC (MMT)		0	0	0.01	0.01	0.01	0.01
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0.01	3.39	6.74	10.2	17.5
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	3.87
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.03	0.04
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	63	63	63	63	63
Spur (km)		0	216	374	549	549	1,246
All (km)		0	279	437	612	612	1,309
Cumulative investment - Trunk (million \$2018)		0	114	114	114	114	114
Cumulative investment - Spur (million \$2018)		0	111	288	379	382	791
Cumulative investment - All (million \$2018)		0	225	402	493	496	905

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							361
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
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)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146

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)							-264
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,224
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-44.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,532
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-264
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,322
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,675
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							785
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							953
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,489
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							163
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,738

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)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		248	140	63.4	25	6.42	8.81
Premature deaths from air pollution - Mobile - On-Road (deaths)		838	898	923	874	730	526
Premature deaths from air pollution - Gas Stations (deaths)		52.4	55.7	56.4	52.8	43.6	31.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		463	461	439	385	305	214
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		176	179	181	167	131	87.5
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27.4	28.9	30	28.8	24.1	18
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		211	224	232	226	204	170
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.2	43.9	41.4	36.4	31.6	26.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.72	8.12	7.45	6.71	5.93
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.86	1.04	1.07	1.1	1.13	1.12
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		147	130	108	90.4	78	57.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,199	1,243	562	221	56.9	78.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,451	7,988	8,203	7,769	6,492	4,675
Monetary damages from air pollution - Gas Stations (million \$2019)		464	493	500	468	386	275
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,102	4,088	3,893	3,409	2,700	1,897
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,561	1,585	1,605	1,477	1,159	775
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		243	256	266	255	213	160
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,870	1,983	2,054	2,001	1,803	1,502
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		409	389	367	323	280	235
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	77.2	71.9	65.9	59.4	52.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.4	9.19	9.47	9.67	9.96	9.87

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,303	1,157	957	803	693	510

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		520	586	401	229	89.1	400
By economic sector - Construction (jobs)		20,559	21,028	22,609	26,502	39,381	46,704
By economic sector - Manufacturing (jobs)		7,006	8,574	9,393	9,190	14,039	19,083
By economic sector - Mining (jobs)		4,877	3,523	2,583	1,870	1,307	795
By economic sector - Other (jobs)		2,577	2,845	2,862	3,847	6,536	8,240
By economic sector - Pipeline (jobs)		1,239	1,043	905	776	655	646
By economic sector - Professional (jobs)		8,955	9,515	10,736	14,042	20,787	25,962
By economic sector - Trade (jobs)		6,837	6,833	7,246	8,834	13,063	16,236
By economic sector - Utilities (jobs)		15,741	15,313	20,431	28,694	41,553	48,786
By resource sector - Biomass (jobs)		1,541	1,451	1,015	673	379	1,701
By resource sector - CO2 (jobs)		0	206	615	612	610	1,762
By resource sector - Coal (jobs)		651	225	10.1	3.66	0	0
By resource sector - Grid (jobs)		15,576	19,775	32,051	37,475	61,567	76,247
By resource sector - Natural Gas (jobs)		14,789	9,210	6,942	5,761	5,617	4,508
By resource sector - Nuclear (jobs)		2,016	1,908	1,922	9,828	11,264	11,150
By resource sector - Oil (jobs)		10,452	8,869	7,534	6,164	4,842	3,259
By resource sector - Solar (jobs)		19,555	19,757	15,081	19,926	34,318	39,600
By resource sector - Wind (jobs)		3,731	7,861	11,994	13,543	18,813	28,625
By education level - All sectors - High school diploma or less (jobs)		28,954	29,496	32,684	38,966	57,127	69,385
By education level - All sectors - Associates degree or some college (jobs)		21,472	21,811	24,584	29,782	44,032	53,609
By education level - All sectors - Bachelors degree (jobs)		13,977	14,016	15,517	19,557	28,082	33,963
By education level - All sectors - Masters or professional degree (jobs)		3,408	3,429	3,830	4,947	7,123	8,629
By education level - All sectors - Doctoral degree (jobs)		500	507	549	734	1,046	1,268
Related work experience - All sectors - None (jobs)		9,921	10,045	11,214	13,518	19,846	24,133
Related work experience - All sectors - Up to 1 year (jobs)		13,670	14,025	15,455	18,673	27,373	33,364
Related work experience - All sectors - 1 to 4 years (jobs)		24,577	24,844	27,721	33,882	49,466	60,000
Related work experience - All sectors - 4 to 10 years (jobs)		15,979	16,120	18,042	22,078	32,238	39,065
Related work experience - All sectors - Over 10 years (jobs)		4,165	4,227	4,733	5,834	8,487	10,291
On-the-Job Training - All sectors - None (jobs)		3,778	3,817	4,164	5,191	7,530	9,107
On-the-Job Training - All sectors - Up to 1 year (jobs)		44,552	45,292	50,336	61,307	89,425	108,815
On-the-Job Training - All sectors - 1 to 4 years (jobs)		14,514	14,663	16,504	20,046	29,477	35,700
On-the-Job Training - All sectors - 4 to 10 years (jobs)		4,792	4,800	5,420	6,542	9,673	11,656
On-the-Job Training - All sectors - Over 10 years (jobs)		676	688	739	900	1,304	1,574
On-Site or In-Plant Training - All sectors - None (jobs)		11,088	11,261	12,418	15,299	22,324	27,140
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		40,518	41,158	45,807	55,773	81,392	98,958

Table 18: E- 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)		11,237	11,370	12,774	15,475	22,751	27,570
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		4,878	4,872	5,479	6,627	9,734	11,713
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		589	599	685	812	1,208	1,473
Wage income - All (million \$2019)		4,322	4,400	4,992	6,229	9,183	11,248

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,163	1,112	1,033	964	905	837	757
Final energy use - Residential (PJ)	880	823	783	735	664	579	494
Final energy use - Commercial (PJ)	690	679	673	667	654	636	618
Final energy use - Industry (PJ)	488	505	514	526	531	538	538

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)		6.03	6.04	8.86	9.2	14.7	15.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	121	394	667	1,933	3,200	6,002	8,804
Vehicle stocks - LDV – All others (1000 units)	11,509	11,509	11,509	10,916	10,324	7,956	5,588
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	363	742	2,526	7,889	11,514
Public EV charging plugs - DC Fast (1000 units)	0.56		1.17		5.61		15.4
Public EV charging plugs - L2 (1000 units)	4.23		28.1		135		371

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 (%)	3.63	7.47	12.9	28.9	55.2	75.3	83.7
Sales of space heating units - Electric Resistance (%)	8.47	11.2	10.6	9.22	6.74	4.65	3.8
Sales of space heating units - Gas (%)	63.7	45.1	42.4	34.7	21.5	10.4	5.47
Sales of space heating units - Fossil (%)	24.2	36.3	34	27.2	16.6	9.64	6.99
Sales of water heating units - Electric Heat Pump (%)	0	1.21	4.63	14.7	31.2	43.9	49.3
Sales of water heating units - Electric Resistance (%)	18.7	35.3	35.6	36.9	39.6	42.6	44.2
Sales of water heating units - Gas Furnace (%)	71.1	56.8	53.6	43.7	26.7	12.4	5.95
Sales of water heating units - Other (%)	10.3	6.7	6.2	4.75	2.54	1.09	0.587
Sales of cooking units - Electric Resistance (%)	34.4	36.1	42.1	57.9	80	93.5	98.3
Sales of cooking units - Gas (%)	65.6	63.9	57.9	42.1	20	6.47	1.74
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		14.3	16.3				

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 (%)	0.625	10	13.9	25.5	45.9	63.9	72.2
Sales of space heating units - Electric Resistance (%)	2.13	3.41	4.29	6.96	11.7	15.4	17.3
Sales of space heating units - Gas Furnace (%)	78.2	69.8	65.6	54.7	35.3	17.8	8.88
Sales of space heating units - Fossil (%)	19.1	16.8	16.2	12.8	7.04	2.9	1.58
Sales of water heating units - Electric Heat Pump (%)	0.224	1.65	5.4	16.4	34.9	49.5	55.9
Sales of water heating units - Electric Resistance (%)	1.34	2.6	4.47	10.1	20.3	29.6	34
Sales of water heating units - Gas Furnace (%)	97	94.4	88.8	72.4	44.1	20.6	9.85
Sales of water heating units - Other (%)	1.45	1.35	1.33	1.05	0.642	0.377	0.282
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		89,637	97,820				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	28.6	0
Installed thermal - Natural gas (MW)	22,658	14,293	13,298	12,830	12,846	9,237	10,654
Installed thermal - Nuclear (MW)	4,410	3,398	3,489	3,580	7,039	9,889	12,767

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642

Table 25: 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)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47

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 - Avoid deforestation (over 30 years) (1000 hectares)							361
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
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)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146

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)							-264

Table 26: 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)							-1,224
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-44.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,532
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-264
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,322
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,675
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							785
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							953
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,489
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							163
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,738

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)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		239	174	98.7	81.2	34.1	7.95
Premature deaths from air pollution - Mobile - On-Road (deaths)		823	813	653	397	188	74.4
Premature deaths from air pollution - Gas Stations (deaths)		51.2	49.4	38.8	23.6	11.4	4.84
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		459	413	304	182	92	36.1
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		173	147	104	62.6	28.4	8.24

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27	25.6	20.7	14.6	8.51	4.56
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		210	203	168	121	79.4	44.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		45.9	39.2	29.1	18.8	13	9.75
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.13	6.93	5.63	4.29	2.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.07	1.04	1.06	1.08	1.13	1.08
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		144	135	112	81.3	47	4.74
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,116	1,541	875	719	302	70.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,317	7,231	5,804	3,530	1,675	662
Monetary damages from air pollution - Gas Stations (million \$2019)		453	437	343	209	101	42.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,068	3,662	2,692	1,616	815	320
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,534	1,303	924	555	252	73.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		240	227	184	129	75.4	40.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,861	1,795	1,488	1,070	703	393
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		406	347	258	166	115	86.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	72	61.3	49.9	37.9	25.8
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		18.2	9.17	9.38	9.52	9.94	9.52
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,276	1,197	996	722	417	42.1

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		482	679	431	247	97.3	394
By economic sector - Construction (jobs)		22,033	23,286	35,004	39,377	46,754	59,277
By economic sector - Manufacturing (jobs)		7,251	9,176	14,974	12,703	15,735	20,776
By economic sector - Mining (jobs)		4,752	3,355	2,100	1,201	588	76.7
By economic sector - Other (jobs)		2,823	3,235	4,746	5,728	7,538	9,278
By economic sector - Pipeline (jobs)		1,201	1,005	711	470	273	105
By economic sector - Professional (jobs)		9,476	10,614	16,276	19,579	24,530	32,400
By economic sector - Trade (jobs)		7,098	7,312	10,217	11,961	15,045	19,595
By economic sector - Utilities (jobs)		16,674	16,878	32,461	37,552	43,448	59,861
By resource sector - Biomass (jobs)		1,412	1,753	1,025	662	374	1,784
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		481	139	10.1	9.64	3.59	0
By resource sector - Grid (jobs)		17,792	23,118	58,153	67,750	81,191	117,419
By resource sector - Natural Gas (jobs)		14,462	9,887	7,024	7,049	5,589	4,349
By resource sector - Nuclear (jobs)		2,016	1,557	1,347	1,326	1,015	346
By resource sector - Oil (jobs)		10,345	8,231	5,909	3,842	2,119	9.43
By resource sector - Solar (jobs)		21,459	22,696	26,292	28,785	37,059	37,862
By resource sector - Wind (jobs)		3,823	8,159	17,159	19,395	26,659	39,993
By education level - All sectors - High school diploma or less (jobs)		30,459	32,205	49,730	54,272	64,565	84,493
By education level - All sectors - Associates degree or some college (jobs)		22,632	23,891	37,709	41,830	50,165	65,826
By education level - All sectors - Bachelors degree (jobs)		14,606	15,165	22,989	25,383	30,416	39,813
By education level - All sectors - Masters or professional degree (jobs)		3,568	3,727	5,691	6,414	7,736	10,171
By education level - All sectors - Doctoral degree (jobs)		524	552	800	922	1,126	1,459
Related work experience - All sectors - None (jobs)		10,430	10,973	17,036	18,798	22,442	29,433
Related work experience - All sectors - Up to 1 year (jobs)		14,387	15,323	23,517	25,693	30,738	40,175
Related work experience - All sectors - 1 to 4 years (jobs)		25,806	27,070	41,891	46,249	55,298	72,488
Related work experience - All sectors - 4 to 10 years (jobs)		16,794	17,579	27,316	30,245	36,163	47,377
Related work experience - All sectors - Over 10 years (jobs)		4,372	4,595	7,159	7,835	9,368	12,289
On-the-Job Training - All sectors - None (jobs)		3,966	4,147	6,231	6,863	8,230	10,679
On-the-Job Training - All sectors - Up to 1 year (jobs)		46,747	49,318	76,030	83,347	99,688	130,749
On-the-Job Training - All sectors - 1 to 4 years (jobs)		15,296	16,044	25,221	27,993	33,434	43,823
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,070	5,284	8,323	9,419	11,228	14,681
On-the-Job Training - All sectors - Over 10 years (jobs)		711	747	1,113	1,197	1,429	1,830
On-Site or In-Plant Training - All sectors - None (jobs)		11,650	12,281	18,764	20,673	24,811	32,366
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		42,529	44,821	69,242	75,965	90,808	119,113
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		11,838	12,433	19,504	21,591	25,782	33,793
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,150	5,345	8,350	9,408	11,193	14,624
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		623	659	1,058	1,184	1,415	1,866
Wage income - All (million \$2019)		4,540	4,795	7,533	8,464	10,222	13,599

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

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)		7.59	7.79	18.2	19.6	18.4	19.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV – All others (1000 units)	11,462	10,914	10,366	7,554	4,742	2,683	624
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,187	5,658	9,084	13,794	14,977	14,299
Public EV charging plugs - DC Fast (1000 units)	0.56		3.54		15		24.1
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

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 (%)	3.63	16.2	66.1	89	91.7	91.9	92
Sales of space heating units - Electric Resistance (%)	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06
Sales of water heating units - Electric Heat Pump (%)	0	6.54	37.2	51.7	53.5	53.6	53.6
Sales of water heating units - Electric Resistance (%)	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Sales of water heating units - Gas Furnace (%)	71.1	52	21.9	2.85	0.155	0	0
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric Resistance (%)	34.6	48.6	91.2	99.6	100	100	100
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		14.3	15.2				

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 (%)	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Sales of space heating units - Electric Resistance (%)	2.13	4.73	12.8	18	19.1	18.8	18.9
Sales of space heating units - Gas Furnace (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.224	7.35	41	58.7	61	61.2	61.2
Sales of water heating units - Electric Resistance (%)	1.34	5.14	22.3	36.4	38.5	38.7	38.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		89,684	98,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	28.6	28.6	28.6	0	0
Installed thermal - Natural gas (MW)	22,780	14,968	15,595	17,729	28,320	24,804	22,239
Installed thermal - Nuclear (MW)	4,410	3,398	2,757	2,757	2,757	1,259	0
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	2,251	8,767	15,348	24,283	32,896	45,191	49,822
Installed renewables - Wind - Base land use assumptions (MW)	3,284	3,284	5,438	9,320	10,718	14,723	17,362
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	139	309	12,773	21,321	32,657	54,102
Installed renewables - Solar - Constrained land use assumptions (MW)	1,695	10,801	18,130	25,729	34,147	44,054	48,474
Installed renewables - Wind - Constrained land use assumptions (MW)	3,772	3,772	5,867	10,104	11,586	15,429	17,782
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	276	448	12,684	19,162	19,162	48,394
Capital invested - Solar PV - Base (billion \$2018)		8.73	8.17	9.85	8.95	12.1	4.29
Capital invested - Wind - Base (billion \$2018)		0	5.05	8.67	2.98	8.08	5.03
Capital invested - Offshore Wind - Base (billion \$2018)		0.393	0.409	25.7	17.3	18.6	28.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	4,001	15,206	26,732	41,754	56,384	77,233	85,092
Wind - Base land use assumptions (GWh)	14,244	14,244	22,135	36,123	41,060	54,852	63,691
OffshoreWind - Base land use assumptions (GWh)	0	562	1,250	52,451	88,396	136,296	230,708
Solar - Constrained land use assumptions (GWh)	6,158	37,136	61,989	87,519	115,785	149,206	164,118
Wind - Constrained land use assumptions (GWh)	28,488	28,488	44,113	74,224	84,489	110,679	126,529
OffshoreWind - Constrained land use assumptions (GWh)	0	2,243	3,631	103,763	158,978	158,978	413,290

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317

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 - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							361
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0

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 - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146

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)							-264
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,224
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-44.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,532
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-264
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,322
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,675
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							785
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							953
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,489
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							163

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,738

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)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		240	147	178	157	109	17.6
Premature deaths from air pollution - Mobile - On-Road (deaths)		823	813	653	397	188	74.4
Premature deaths from air pollution - Gas Stations (deaths)		51.2	49.4	38.8	23.6	11.4	4.84
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		459	413	304	182	92	36.1
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		173	147	104	62.6	28.4	8.24
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27	25.6	20.7	14.6	8.51	4.56
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		210	203	168	121	79.4	44.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		45.9	39.2	29.1	18.8	13	9.75
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.13	6.93	5.63	4.29	2.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.77	1.04	1.06	1.08	1.13	1.08
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		150	146	145	130	112	85.8
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,124	1,301	1,573	1,388	962	156
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,317	7,231	5,804	3,530	1,675	662
Monetary damages from air pollution - Gas Stations (million \$2019)		453	437	343	209	101	42.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,068	3,662	2,692	1,616	815	320
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,534	1,303	924	555	252	73.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		240	227	184	129	75.4	40.4

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 - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,861	1,795	1,488	1,070	703	393
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		406	347	258	166	115	86.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	72	61.3	49.9	37.9	25.8
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		15.6	9.16	9.38	9.52	9.95	9.51
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,329	1,296	1,290	1,152	991	762

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		507	600	392	241	101	405
By economic sector - Construction (jobs)		17,345	15,857	20,590	21,442	21,417	34,482
By economic sector - Manufacturing (jobs)		8,288	6,218	7,624	6,120	5,498	9,108
By economic sector - Mining (jobs)		4,863	3,526	2,488	1,684	1,113	758
By economic sector - Other (jobs)		1,823	1,643	2,216	2,449	2,743	6,951
By economic sector - Pipeline (jobs)		1,269	1,139	1,087	947	776	804
By economic sector - Professional (jobs)		7,809	7,175	8,911	10,460	11,906	17,700
By economic sector - Trade (jobs)		6,003	5,272	6,004	6,406	6,907	11,595
By economic sector - Utilities (jobs)		16,454	15,549	22,682	29,722	36,011	35,925
By resource sector - Biomass (jobs)		1,428	1,451	997	682	404	1,730
By resource sector - CO2 (jobs)		0	232	695	692	689	1,991
By resource sector - Coal (jobs)		481	133	1.06	1.01	0.965	0.37
By resource sector - Grid (jobs)		17,136	19,241	34,533	36,539	35,158	46,930
By resource sector - Natural Gas (jobs)		15,165	11,418	10,669	11,115	9,756	7,951
By resource sector - Nuclear (jobs)		2,016	1,688	1,662	9,147	18,865	11,248
By resource sector - Oil (jobs)		10,341	8,327	6,120	4,319	3,133	2,387
By resource sector - Solar (jobs)		12,479	8,949	10,424	10,593	11,633	37,918
By resource sector - Wind (jobs)		5,313	5,538	6,892	6,383	6,832	7,570
By education level - All sectors - High school diploma or less (jobs)		27,151	24,143	30,584	32,952	34,996	49,042
By education level - All sectors - Associates degree or some college (jobs)		20,245	17,971	23,163	25,420	27,282	37,771
By education level - All sectors - Bachelors degree (jobs)		13,303	11,627	14,268	16,392	18,702	23,899
By education level - All sectors - Masters or professional degree (jobs)		3,209	2,839	3,506	4,132	4,798	6,109
By education level - All sectors - Doctoral degree (jobs)		451	398	472	576	693	905
Related work experience - All sectors - None (jobs)		9,341	8,314	10,558	11,532	12,359	17,131
Related work experience - All sectors - Up to 1 year (jobs)		12,735	11,280	14,207	15,466	16,707	23,535
Related work experience - All sectors - 1 to 4 years (jobs)		23,211	20,544	25,902	28,725	31,383	42,349
Related work experience - All sectors - 4 to 10 years (jobs)		15,090	13,346	16,910	18,801	20,529	27,532

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - Over 10 years (jobs)		3,983	3,495	4,415	4,949	5,494	7,179
On-the-Job Training - All sectors - None (jobs)		3,503	3,072	3,794	4,277	4,801	6,532
On-the-Job Training - All sectors - Up to 1 year (jobs)		42,164	37,226	46,706	51,525	56,292	76,412
On-the-Job Training - All sectors - 1 to 4 years (jobs)		13,661	12,153	15,628	17,239	18,569	25,263
On-the-Job Training - All sectors - 4 to 10 years (jobs)		4,404	3,985	5,195	5,697	6,000	8,408
On-the-Job Training - All sectors - Over 10 years (jobs)		628	542	669	734	809	1,112
On-Site or In-Plant Training - All sectors - None (jobs)		10,385	9,135	11,421	12,737	14,073	19,189
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		38,331	33,875	42,607	46,999	51,286	69,579
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		10,579	9,406	12,067	13,263	14,262	19,490
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		4,508	4,061	5,241	5,766	6,118	8,434
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		556	501	657	706	732	1,034
Wage income - All (million \$2019)		4,080	3,671	4,702	5,341	5,969	7,983

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,161	1,104	995	858	731	647	604
Final energy use - Residential (PJ)	880	819	735	612	496	413	364
Final energy use - Commercial (PJ)	690	677	650	604	560	538	533
Final energy use - Industry (PJ)	488	505	512	521	523	530	532

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)		7.59	7.79	18.2	19.6	18.4	19.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV - EV (1000 units)	156	1,087	2,018	5,278	8,537	11,141	13,746
Vehicle stocks - LDV - All others (1000 units)	11,462	10,914	10,366	7,554	4,742	2,683	624
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,187	5,658	9,084	13,794	14,977	14,299
Public EV charging plugs - DC Fast (1000 units)	0.56		3.54		15		24.1
Public EV charging plugs - L2 (1000 units)	4.23		85.1		360		579

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 (%)	3.63	16.2	66.1	89	91.7	91.9	92
Sales of space heating units - Electric Resistance (%)	8.47	10.5	6.04	3.28	2.89	2.96	3.08
Sales of space heating units - Gas (%)	63.7	41.2	17.6	3.03	0.991	0.876	0.88
Sales of space heating units - Fossil (%)	24.2	32.1	10.3	4.74	4.39	4.24	4.06

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	0	6.54	37.2	51.7	53.5	53.6	53.6
Sales of water heating units - Electric Resistance (%)	18.7	35.7	39.8	45.4	46.3	46.4	46.3
Sales of water heating units - Gas Furnace (%)	71.1	52	21.9	2.85	0.155	0	0
Sales of water heating units - Other (%)	10.3	5.8	1.12	0.083	0.037	0.038	0.038
Sales of cooking units - Electric Resistance (%)	34.6	48.6	91.2	99.6	100	100	100
Sales of cooking units - Gas (%)	65.4	51.4	8.8	0.443	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		14.3	15.2				

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 (%)	0.625	15.6	51.1	76.3	79.8	80.3	80.2
Sales of space heating units - Electric Resistance (%)	2.13	4.73	12.8	18	19.1	18.8	18.9
Sales of space heating units - Gas Furnace (%)	78.2	65.2	33.3	5.6	1.11	0.87	0.863
Sales of space heating units - Fossil (%)	19.1	14.5	2.85	0.124	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.224	7.35	41	58.7	61	61.2	61.2
Sales of water heating units - Electric Resistance (%)	1.34	5.14	22.3	36.4	38.5	38.7	38.7
Sales of water heating units - Gas Furnace (%)	97	86.3	36.3	4.73	0.256	0	0
Sales of water heating units - Other (%)	1.45	1.19	0.377	0.184	0.175	0.176	0.176
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		89,684	98,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	993	3	3	3	3	0
Installed thermal - Natural gas (MW)	22,618	14,288	17,384	21,870	31,069	27,401	25,317
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,399	6,604	12,838	14,592
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	1,770	3,077	3,154	3,913	4,547	6,200	21,559
Installed renewables - Wind - Base land use assumptions (MW)	3,284	3,284	3,284	3,936	5,913	8,535	10,412
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	2,517	5,120	9,765	11,219	11,271	13,433
Installed renewables - Solar - Constrained land use assumptions (MW)	993	1,397	1,397	1,983	3,128	4,436	23,861
Installed renewables - Wind - Constrained land use assumptions (MW)	3,484	3,484	3,514	4,094	6,121	8,742	10,604
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	2,625	5,214	9,983	11,439	11,439	13,408
Capital invested - Solar PV - Base (billion \$2018)		1.75	0.092	0.837	0.659	1.62	14.5
Capital invested - Wind - Base (billion \$2018)		0	0	1.36	4.2	5.29	3.58

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Base (billion \$2018)		7.13	6.26	9.69	2.94	0.085	2.86
Capital invested - Solar PV - Constrained (billion \$2018)		0.54	0	0.646	1.19	1.28	18
Capital invested - Wind - Constrained (billion \$2018)		0	0.072	1.29	4.31	5.29	3.55
Capital invested - Offshore Wind - Constrained (billion \$2018)		7.43	6.23	9.75	2.95	0	2.61

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	3,185	5,445	5,572	6,857	7,941	10,748	37,215
Wind - Base land use assumptions (GWh)	14,244	14,244	14,244	16,565	23,892	33,329	39,994
OffshoreWind - Base land use assumptions (GWh)	0	10,024	20,550	40,051	46,037	46,254	55,195
Solar - Constrained land use assumptions (GWh)	1,883	2,594	2,594	3,592	5,589	7,799	40,573
Wind - Constrained land use assumptions (GWh)	14,244	14,244	14,355	16,576	24,025	33,355	39,881
OffshoreWind - Constrained land use assumptions (GWh)	0	10,664	21,171	40,651	46,697	46,697	54,922

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							361

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 - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
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)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146

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)							-264
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,224

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-44.8
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,532
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-264
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,322
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-89.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,675
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							785
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							953
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							85.7
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,489
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							163
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,738

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)		212	0.228	0.227	0.215	0.134	0.007
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		251	138	73.4	62.3	43.6	12.3
Premature deaths from air pollution - Mobile - On-Road (deaths)		838	898	923	874	730	526
Premature deaths from air pollution - Gas Stations (deaths)		52.4	55.7	56.4	52.8	43.6	31.1
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		463	461	439	385	305	214
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		176	179	181	167	131	87.5
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		27.4	28.9	30	28.8	24.1	18

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.39	4.3	4.2	4.08	3.94	3.78
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		211	224	232	226	204	170
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.2	43.9	41.4	36.4	31.6	26.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.23	8.72	8.12	7.45	6.71	5.93
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.91	1.04	1.07	1.1	1.14	1.16
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		147	130	108	90.4	78	57.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,881	2.02	2.01	1.9	1.18	0.064
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,222	1,223	650	552	386	109
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,451	7,988	8,203	7,769	6,492	4,675
Monetary damages from air pollution - Gas Stations (million \$2019)		464	493	500	468	386	275
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,102	4,088	3,893	3,409	2,700	1,897
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,561	1,585	1,605	1,477	1,159	775
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		243	256	266	255	213	160
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		38.8	38.1	37.2	36.1	34.9	33.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,870	1,983	2,054	2,001	1,803	1,502
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		409	389	367	323	280	235
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		81.7	77.2	71.9	65.9	59.4	52.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.9	9.19	9.47	9.68	10.1	10.2
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,303	1,157	957	803	693	510

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		502	584	396	236	94.1	928
By economic sector - Construction (jobs)		20,409	21,062	21,690	22,725	30,153	40,795

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		6,965	8,618	8,628	6,867	9,673	16,068
By economic sector - Mining (jobs)		4,821	3,520	2,597	1,939	1,302	756
By economic sector - Other (jobs)		2,558	2,839	2,732	3,288	4,957	7,391
By economic sector - Pipeline (jobs)		1,226	1,042	919	798	644	628
By economic sector - Professional (jobs)		8,884	9,534	10,250	11,141	15,021	24,038
By economic sector - Trade (jobs)		6,767	6,846	6,986	7,487	9,879	14,516
By economic sector - Utilities (jobs)		15,547	15,271	19,334	19,719	26,809	48,557
By resource sector - Biomass (jobs)		1,506	1,448	1,007	701	426	4,424
By resource sector - CO2 (jobs)		0	211	631	628	626	1,808
By resource sector - Coal (jobs)		481	139	10.1	9.64	9.2	3.53
By resource sector - Grid (jobs)		15,398	19,849	30,175	31,088	46,237	63,942
By resource sector - Natural Gas (jobs)		14,612	9,436	6,998	6,506	5,964	4,281
By resource sector - Nuclear (jobs)		2,016	1,688	1,661	1,635	1,486	18,943
By resource sector - Oil (jobs)		10,452	8,869	7,534	6,417	4,876	3,110
By resource sector - Solar (jobs)		19,398	19,587	14,342	16,977	25,561	37,275
By resource sector - Wind (jobs)		3,816	8,090	11,173	10,235	13,347	19,888
By education level - All sectors - High school diploma or less (jobs)		28,675	29,524	31,157	31,254	41,469	63,462
By education level - All sectors - Associates degree or some college (jobs)		21,272	21,845	23,416	23,771	31,882	48,674
By education level - All sectors - Bachelors degree (jobs)		13,857	14,013	14,785	14,889	19,538	32,097
By education level - All sectors - Masters or professional degree (jobs)		3,379	3,427	3,651	3,736	4,927	8,214
By education level - All sectors - Doctoral degree (jobs)		497	506	524	549	718	1,228
Related work experience - All sectors - None (jobs)		9,827	10,057	10,694	10,812	14,382	22,114
Related work experience - All sectors - Up to 1 year (jobs)		13,542	14,032	14,719	14,789	19,666	30,777
Related work experience - All sectors - 1 to 4 years (jobs)		24,347	24,862	26,422	26,695	35,415	55,331
Related work experience - All sectors - 4 to 10 years (jobs)		15,835	16,136	17,196	17,398	23,092	35,913
Related work experience - All sectors - Over 10 years (jobs)		4,128	4,229	4,501	4,505	5,978	9,541
On-the-Job Training - All sectors - None (jobs)		3,745	3,816	3,970	4,022	5,313	8,547
On-the-Job Training - All sectors - Up to 1 year (jobs)		44,136	45,319	47,943	48,153	63,844	100,695
On-the-Job Training - All sectors - 1 to 4 years (jobs)		14,381	14,683	15,732	15,966	21,302	32,505
On-the-Job Training - All sectors - 4 to 10 years (jobs)		4,747	4,810	5,183	5,358	7,150	10,475
On-the-Job Training - All sectors - Over 10 years (jobs)		670	688	704	701	923	1,453
On-Site or In-Plant Training - All sectors - None (jobs)		10,990	11,267	11,827	11,952	15,870	25,171
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		40,139	41,183	43,636	43,855	58,164	91,483
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		11,134	11,385	12,176	12,335	16,449	25,114
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		4,833	4,881	5,240	5,390	7,154	10,594
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		584	600	654	666	895	1,314
Wage income - All (million \$2019)		4,283	4,403	4,761	4,882	6,542	10,439

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,163	1,112	1,033	964	905	837	757
Final energy use - Residential (PJ)	880	823	783	735	664	579	494
Final energy use - Commercial (PJ)	690	679	673	667	654	636	618
Final energy use - Industry (PJ)	488	505	514	526	531	538	538

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)		6.03	6.04	8.86	9.2	14.7	15.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	121	394	667	1,933	3,200	6,002	8,804
Vehicle stocks - LDV – All others (1000 units)	11,509	11,509	11,509	10,916	10,324	7,956	5,588
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	363	742	2,526	7,889	11,514
Public EV charging plugs - DC Fast (1000 units)	0.56		1.17		5.61		15.4
Public EV charging plugs - L2 (1000 units)	4.23		28.1		135		371

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 (%)	3.63	7.47	12.9	28.9	55.2	75.3	83.7
Sales of space heating units - Electric Resistance (%)	8.47	11.2	10.6	9.22	6.74	4.65	3.8
Sales of space heating units - Gas (%)	63.7	45.1	42.4	34.7	21.5	10.4	5.47
Sales of space heating units - Fossil (%)	24.2	36.3	34	27.2	16.6	9.64	6.99
Sales of water heating units - Electric Heat Pump (%)	0	1.21	4.63	14.7	31.2	43.9	49.3
Sales of water heating units - Electric Resistance (%)	18.7	35.3	35.6	36.9	39.6	42.6	44.2
Sales of water heating units - Gas Furnace (%)	71.1	56.8	53.6	43.7	26.7	12.4	5.95
Sales of water heating units - Other (%)	10.3	6.7	6.2	4.75	2.54	1.09	0.587
Sales of cooking units - Electric Resistance (%)	34.4	36.1	42.1	57.9	80	93.5	98.3
Sales of cooking units - Gas (%)	65.6	63.9	57.9	42.1	20	6.47	1.74
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		14.3	16.3				

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 (%)	0.625	10	13.9	25.5	45.9	63.9	72.2
Sales of space heating units - Electric Resistance (%)	2.13	3.41	4.29	6.96	11.7	15.4	17.3
Sales of space heating units - Gas Furnace (%)	78.2	69.8	65.6	54.7	35.3	17.8	8.88
Sales of space heating units - Fossil (%)	19.1	16.8	16.2	12.8	7.04	2.9	1.58
Sales of water heating units - Electric Heat Pump (%)	0.224	1.65	5.4	16.4	34.9	49.5	55.9
Sales of water heating units - Electric Resistance (%)	1.34	2.6	4.47	10.1	20.3	29.6	34

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	97	94.4	88.8	72.4	44.1	20.6	9.85
Sales of water heating units - Other (%)	1.45	1.35	1.33	1.05	0.642	0.377	0.282
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		89,637	97,820				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	1,642	28.6	28.6	0	0	0
Installed thermal - Natural gas (MW)	22,657	14,490	13,442	13,449	16,736	13,344	11,703
Installed thermal - Nuclear (MW)	4,410	3,398	3,398	3,398	3,399	2,757	10,530
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	0.005	0.001	0	0.011
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.007	0	0.001	0	0.011

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	8.38	8.38	9.01	9.12	21.7
Biomass w/ccu allam power plant (GWh)	0	0	0	4.49	5.23	5.45	16.9

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	1	1	1	1	1
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel (quantity)	0	0	0	0	0	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	1	13
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	6.95	22.2	4.22	47.7	12,245
Biomass purchases (million \$2018/y)		0	0.652	1.94	2.2	6.27	1,070

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	3.38	3.35	3.45	3.67
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.03	0.12
Annual - NGCC (MMT)		0	0	0.01	0.01	0.01	0.01
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0.01	3.39	6.74	10.2	13.9
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.08	0.2
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.03	0.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	63	63	63	63	63
Spur (km)		0	216	549	549	374	549
All (km)		0	279	612	612	437	612
Cumulative investment - Trunk (million \$2018)		0	114	114	114	114	114
Cumulative investment - Spur (million \$2018)		0	109	376	375	286	385
Cumulative investment - All (million \$2018)		0	223	490	489	400	499

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-724

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47

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 - Avoid deforestation (over 30 years) (1000 hectares)							361
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
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)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146

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)							-414

Table 63: E-B+ 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)							-1,160
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-42.4
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)							-1,616
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-414
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,200
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-84.9
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)							-2,698
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							172
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							744
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							77.2
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							1.31
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							78.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,072
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							172
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,483
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							154
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							1.31

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							78.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,889

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)		583	364	336	325	319	286
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		187	180	246	244	279	309
Premature deaths from air pollution - Mobile - On-Road (deaths)		836	909	981	1,061	1,143	1,231
Premature deaths from air pollution - Gas Stations (deaths)		52.1	56.1	60	64.4	68.8	73.1
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		454	459	470	490	513	531
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		170	150	113	79	53.2	38.1
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		26.4	27.3	28.1	29.2	30.2	31.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		4.58	4.71	4.82	4.92	5.02	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		213	231	242	251	272	306
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.4	43.4	38.2	30.1	25.1	22.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		9.65	10.3	11	11.7	12.4	13.1
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		3.61	2.71	2.36	2.32	2.34	2.29
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		148	163	172	169	173	171
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		5,166	3,222	2,981	2,884	2,824	2,537
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		1,653	1,596	2,181	2,162	2,472	2,733
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		7,434	8,078	8,725	9,431	10,167	10,949
Monetary damages from air pollution - Gas Stations (million \$2019)		462	497	531	571	609	647
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,026	4,069	4,169	4,340	4,544	4,706
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		1,503	1,331	1,005	700	472	338

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		234	242	249	258	268	277
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		40.6	41.7	42.7	43.6	44.5	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		1,889	2,049	2,138	2,221	2,410	2,710
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		410	384	338	267	222	197
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		85.4	91.6	97.8	104	110	116
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		31.9	24	20.8	20.5	20.6	20.2
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,313	1,444	1,530	1,496	1,539	1,515

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		491	471	469	437	437	449
By economic sector - Construction (jobs)		9,942	13,759	16,430	16,835	18,156	23,849
By economic sector - Manufacturing (jobs)		4,560	4,945	7,383	5,162	5,450	8,355
By economic sector - Mining (jobs)		4,948	4,059	3,353	2,735	2,328	1,947
By economic sector - Other (jobs)		451	1,363	1,699	1,887	2,113	3,951
By economic sector - Pipeline (jobs)		1,265	1,323	1,345	1,271	1,287	1,278
By economic sector - Professional (jobs)		5,098	5,892	7,006	7,339	8,049	10,808
By economic sector - Trade (jobs)		4,396	4,806	5,265	5,407	5,809	7,920
By economic sector - Utilities (jobs)		14,507	12,859	16,665	17,055	19,185	21,418
By resource sector - Biomass (jobs)		1,442	1,375	1,308	1,224	1,223	1,220
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		651	458	352	335	319	123
By resource sector - Grid (jobs)		13,388	14,028	21,572	22,621	25,335	30,463
By resource sector - Natural Gas (jobs)		15,382	12,318	12,950	12,615	14,401	14,178
By resource sector - Nuclear (jobs)		1,883	1,369	1,224	1,031	843	587
By resource sector - Oil (jobs)		10,559	9,139	8,128	7,577	7,245	7,010
By resource sector - Solar (jobs)			7,974	8,679	9,069	9,297	20,041
By resource sector - Wind (jobs)		2,354	2,817	5,403	3,657	4,150	6,354
By education level - All sectors - High school diploma or less (jobs)		18,911	20,980	25,375	24,688	26,637	34,025
By education level - All sectors - Associates degree or some college (jobs)		14,218	15,502	18,946	18,562	20,199	25,814
By education level - All sectors - Bachelors degree (jobs)		9,836	10,184	12,002	11,628	12,478	15,706
By education level - All sectors - Masters or professional degree (jobs)		2,376	2,466	2,899	2,856	3,077	3,883
By education level - All sectors - Doctoral degree (jobs)		317	345	394	395	422	547
Related work experience - All sectors - None (jobs)		6,652	7,223	8,726	8,551	9,269	11,796
Related work experience - All sectors - Up to 1 year (jobs)		8,681	9,745	11,773	11,417	12,290	15,925
Related work experience - All sectors - 1 to 4 years (jobs)		16,663	17,881	21,484	20,974	22,664	28,745

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - 4 to 10 years (jobs)		10,813	11,597	13,966	13,654	14,780	18,684
Related work experience - All sectors - Over 10 years (jobs)		2,850	3,032	3,667	3,532	3,810	4,825
On-the-Job Training - All sectors - None (jobs)		2,446	2,686	3,173	3,089	3,311	4,283
On-the-Job Training - All sectors - Up to 1 year (jobs)		30,027	32,338	38,909	37,723	40,670	51,877
On-the-Job Training - All sectors - 1 to 4 years (jobs)		9,676	10,526	12,786	12,562	13,648	17,269
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,095	3,456	4,181	4,216	4,608	5,795
On-the-Job Training - All sectors - Over 10 years (jobs)		414	472	566	539	576	751
On-Site or In-Plant Training - All sectors - None (jobs)		7,249	7,912	9,493	9,219	9,940	12,790
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		27,320	29,442	35,438	34,405	37,109	47,279
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		7,483	8,154	9,898	9,706	10,532	13,353
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,212	3,539	4,255	4,270	4,654	5,825
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		394	431	531	527	578	730
Wage income - All (million \$2019)		2,964	3,198	3,879	3,858	4,226	5,371

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,162	1,127	1,072	1,042	1,053	1,087	1,129
Final energy use - Residential (PJ)	880	816	779	749	730	718	709
Final energy use - Commercial (PJ)	690	686	690	689	696	725	772
Final energy use - Industry (PJ)	488	516	537	550	569	586	604

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)		6.35	6.41	12.1	12.8	14.6	15.5

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 (%)	1.94	19.2	20	21	21.5	22.1	22.9
Sales of space heating units - Electric Resistance (%)	8.69	9.88	9.71	9.54	9.43	8.85	8.05
Sales of space heating units - Gas (%)	64.8	40.9	54.3	61.9	62.2	62.3	62.3
Sales of space heating units - Fossil (%)	24.6	30	16	7.63	6.8	6.76	6.79
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	18.7	35.1	35	35	35	34.9	34.9
Sales of water heating units - Gas Furnace (%)	71.1	58	58.1	58.1	58.1	58.2	58.2
Sales of water heating units - Other (%)	10.3	6.88	6.87	6.87	6.88	6.87	6.87
Sales of cooking units - Electric Resistance (%)	33.8	33.8	33.8	33.8	33.8	33.8	33.8
Sales of cooking units - Gas (%)	66.2	66.2	66.2	66.2	66.2	66.2	66.2

Table 68: REF 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)		13.5	14.1				

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 (%)	0.625	14.7	40.7	61.9	65.1	65.7	65.5
Sales of space heating units - Electric Resistance (%)	2.13	4.03	8.89	21.3	31.8	33.3	33.6
Sales of space heating units - Gas Furnace (%)	78.2	65	37.7	11	2.19	0.952	0.86
Sales of space heating units - Fossil (%)	19.1	16.3	12.8	5.74	0.874	0.07	0
Sales of water heating units - Electric Heat Pump (%)	0.224	0.326	0.327	0.328	0.329	0.331	0.331
Sales of water heating units - Electric Resistance (%)	1.34	1.93	1.92	1.93	1.93	1.92	1.93
Sales of water heating units - Gas Furnace (%)	97	96.4	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	1.45	1.38	1.45	1.44	1.45	1.49	1.49
Sales of cooking units - Electric Resistance (%)	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		88,595	91,263				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1,642	1,642	993	993	993	993	0
Installed thermal - Natural gas (MW)	20,926	16,044	15,600	17,565	21,630	27,691	35,070
Installed thermal - Nuclear (MW)	4,410	2,757	2,757	2,143	2,143	1,259	1,259
Installed renewables - Rooftop PV (MW)	2,262	3,350	4,275	5,350	6,543	7,836	9,243
Installed renewables - Solar - Base land use assumptions (MW)	692	692	692	692	692	692	692
Installed renewables - Wind - Base land use assumptions (MW)	3,274	3,274	3,274	4,239	5,070	5,858	5,858
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	675	2,100	4,641	5,528	5,828	7,073
Installed renewables - Solar - Constrained land use assumptions (MW)	21.3	21.3	21.3	21.3	21.3	21.3	21.3
Installed renewables - Wind - Constrained land use assumptions (MW)	9.6	9.6	9.6	54.6	54.6	54.6	54.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,394	1,394	1,394	1,394	1,394	1,394	1,394
Wind - Base land use assumptions (GWh)	14,244	14,244	14,244	17,903	20,983	23,892	23,892
Offshore Wind - 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)	-10.2		-16.4				-14.7
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.49		-2.67				-2.78

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Total (Mt CO2e/y)	-11.7		-19.1				-17.5

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)							-192
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-459
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,555
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-307
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,821
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-375
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-136
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-418
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,184
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,448
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-287
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,605
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,206
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,642
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-724
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-205
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,967
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,349
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-20,436
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-383
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,752
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-11,858
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-604
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,464
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,072
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-273

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,516
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,435
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,513
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31.3
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							350
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,317
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							111
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)							53.6
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.02
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							705
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,603
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							361
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,182
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							167
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)							77.7
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							13.5
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							196
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,419
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							6,464

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 - Accelerate regeneration (1000 hectares)							62.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							373
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,047
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							223
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)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							18
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							157
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,164
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							8,146