



Net-Zero America - Massachusetts 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:

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Contents

1	E+ scenario - IMPACTS - Health	1
2	E+ scenario - IMPACTS - Jobs	2
3	E+ scenario - IMPACTS - Fossil fuel industries	3
4	E+ scenario - PILLAR 1: Efficiency/Electrification - Overview	3
5	E+ scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	3
6	E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation	3
7	E+ scenario - PILLAR 1: Efficiency/Electrification - Residential	3
8	E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial	4
9	E+ scenario - PILLAR 2: Clean Electricity - Generating capacity	4
10	E+ scenario - PILLAR 2: Clean Electricity - Generation	5
11	E+ scenario - PILLAR 3: Clean fuels - Bioenergy	5
12	E+ scenario - PILLAR 4: CCUS - CO2 capture	5
13	E+ scenario - PILLAR 4: CCUS - CO2 pipelines	6
14	E+ scenario - PILLAR 4: CCUS - CO2 storage	6
15	E+ scenario - PILLAR 6: Land sinks - Forests	6
16	E+ scenario - PILLAR 6: Land sinks - Agriculture	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	33
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	35
61	E-B+ scenario - PILLAR 4: CCUS - CO2 storage	36
62	E-B+ scenario - PILLAR 6: Land sinks - Forests	36
63	E-B+ scenario - PILLAR 6: Land sinks - Agriculture	38
64	REF scenario - IMPACTS - Health	39
65	REF scenario - IMPACTS - Jobs	41
66	REF scenario - PILLAR 1: Efficiency/Electrification - Overview	42
67	REF scenario - PILLAR 1: Efficiency/Electrification - Electricity demand	42
68	REF scenario - PILLAR 1: Efficiency/Electrification - Residential	42
69	REF scenario - PILLAR 1: Efficiency/Electrification - Commercial	42
70	REF scenario - PILLAR 2: Clean Electricity - Generating capacity	43
71	REF scenario - PILLAR 2: Clean Electricity - Generation	43
72	REF scenario - PILLAR 6: Land sinks - Forests - REF only	43
73	REF scenario - PILLAR 6: Land sinks - Forests	43

Table 1: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32.5	17.5	12.1	12.2	7.46	4.02
Premature deaths from air pollution - Mobile - On-Road (deaths)		228	211	158	90.4	40	14.3
Premature deaths from air pollution - Gas Stations (deaths)		13.8	12.5	9.24	5.3	2.38	0.93
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		46	39.6	28.2	16.1	7.83	3.06
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		93.9	74.1	49.2	27.7	11.8	3.56
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		7.22	6.55	5.09	3.36	1.87	0.938
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.31	1.25	1.18	1.11	1.04	0.961
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		49	43.2	34.4	24.5	15.7	8.36
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		48.2	40	28.3	17.6	12	8.87
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.28	4.42	3.59	2.79	2.03	1.31
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.488	0.248	0.244	0.239	0.24	0.235
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		35.1	31.9	27.6	21.3	15	8.91
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		558	0.599	0.598	0.568	0.345	0.018
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		288	155	107	108	66.1	35.6
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,027	1,872	1,408	804	356	128
Monetary damages from air pollution - Gas Stations (million \$2019)		122	111	81.8	46.9	21.1	8.24
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		407	351	249	143	69.4	27.1
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		832	656	436	246	104	31.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		63.9	58	45.1	29.8	16.6	8.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		11.6	11	10.4	9.81	9.18	8.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		434	382	305	217	139	74

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)		427	354	251	156	107	78.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		46.7	39.2	31.8	24.7	17.9	11.6
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.31	2.19	2.16	2.11	2.12	2.08
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		311	283	245	189	133	79.2

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		112	363	215	171	129	235
By economic sector - Construction (jobs)		13,252	10,319	13,705	18,272	18,074	17,824
By economic sector - Manufacturing (jobs)		2,875	4,008	5,193	5,420	5,768	6,458
By economic sector - Mining (jobs)		1,719	1,228	795	484	273	151
By economic sector - Other (jobs)		2,207	1,526	2,019	2,873	3,349	4,688
By economic sector - Pipeline (jobs)		423	387	281	208	135	113
By economic sector - Professional (jobs)		4,876	4,324	5,625	7,612	7,743	8,593
By economic sector - Trade (jobs)		3,639	2,943	3,675	4,912	5,206	6,191
By economic sector - Utilities (jobs)		5,309	7,530	12,552	18,119	16,451	10,794
By resource sector - Biomass (jobs)		482	1,002	612	516	471	1,004
By resource sector - CO2 (jobs)		0	243	2.22	5.64	5.63	185
By resource sector - Grid (jobs)		6,936	12,257	23,887	34,466	31,822	20,312
By resource sector - Natural Gas (jobs)		4,338	3,538	2,624	3,481	2,501	1,617
By resource sector - Nuclear (jobs)		0	0.012	0.027	0.03	0.058	0.074
By resource sector - Oil (jobs)		3,930	3,107	2,204	1,475	957	589
By resource sector - Solar (jobs)		18,327	11,119	12,061	15,975	19,310	28,044
By resource sector - Wind (jobs)		401	1,362	2,670	2,150	2,059	3,297
By education level - All sectors - High school diploma or less (jobs)		14,954	14,101	19,003	24,939	24,525	23,531
By education level - All sectors - Associates degree or some college (jobs)		10,920	10,386	14,259	18,966	18,656	17,846
By education level - All sectors - Bachelors degree (jobs)		6,654	6,364	8,442	11,043	10,861	10,597
By education level - All sectors - Masters or professional degree (jobs)		1,630	1,553	2,075	2,752	2,712	2,669
By education level - All sectors - Doctoral degree (jobs)		256	223	282	371	373	404
Related work experience - All sectors - None (jobs)		5,013	4,777	6,475	8,573	8,429	8,099
Related work experience - All sectors - Up to 1 year (jobs)		7,142	6,649	8,897	11,645	11,552	11,409
Related work experience - All sectors - 1 to 4 years (jobs)		12,257	11,684	15,778	20,812	20,443	19,624
Related work experience - All sectors - 4 to 10 years (jobs)		7,967	7,554	10,243	13,545	13,274	12,653
Related work experience - All sectors - Over 10 years (jobs)		2,035	1,964	2,667	3,495	3,429	3,263
On-the-Job Training - All sectors - None (jobs)		1,949	1,767	2,334	3,059	3,048	3,078
On-the-Job Training - All sectors - Up to 1 year (jobs)		22,199	21,268	28,578	37,466	36,926	35,813
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,370	6,966	9,550	12,706	12,429	11,709

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,535	2,308	3,184	4,307	4,194	3,910
On-the-Job Training - All sectors - Over 10 years (jobs)		360	319	415	533	531	537
On-Site or In-Plant Training - All sectors - None (jobs)		5,651	5,271	7,021	9,209	9,120	9,031
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		20,213	19,343	26,063	34,224	33,703	32,560
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,714	5,405	7,394	9,816	9,614	9,088
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,536	2,321	3,180	4,281	4,163	3,879
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		300	288	402	540	527	489
Wage income - All (million \$2019)		2,149	2,078	2,862	3,843	3,802	3,631

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		88.4	76.2	58.5	42.2	29.3	19.2
Oil consumption - Cumulative (million bbls)							1,813
Oil production - Annual (million bbls)		0	0	0	0	0	0
Natural gas consumption - Annual (tcf)		340	286	230	173	109	75.5
Natural gas consumption - Cumulative (tcf)							6,921
Natural gas production - Annual (tcf)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Commercial (PJ)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4

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)		2.59	2.67	6.63	7.17	6.63	7.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV - EV (1000 units)	78.7	488	898	2,333	3,767	4,913	6,059
Vehicle stocks - LDV - All others (1000 units)	5,053	4,811	4,569	3,330	2,090	1,183	275
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		962	2,495	3,997	6,074	6,591	6,294
Public EV charging plugs - DC Fast (1000 units)	0.317		1.49		6.24		10
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241

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 (%)	6.91	13.1	53.5	87.8	93.1	93.4	93.4

Table 7: E+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Resistance (%)	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of water heating units - Electric Heat Pump (%)	0	1.22	12.2	31.8	35.2	35.4	35.4
Sales of water heating units - Electric Resistance (%)	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Sales of water heating units - Gas Furnace (%)	60	44.2	31.9	5.09	0.3	0	0
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103
Sales of cooking units - Electric Resistance (%)	64.1	71.7	95.2	99.8	100	100	100
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.62	6.19				

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 (%)	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Sales of space heating units - Electric Resistance (%)	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Sales of space heating units - Gas Furnace (%)	69.9	54.9	39.2	6.26	0.372	0	0
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of water heating units - Electric Heat Pump (%)	2.04	3.48	15.8	41.1	45.6	46	45.9
Sales of water heating units - Electric Resistance (%)	10.2	12.4	23.9	48	52.3	52.5	52.5
Sales of water heating units - Gas Furnace (%)	84.8	80.4	58.4	9.31	0.551	0	0
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58
Sales of cooking units - Electric Resistance (%)	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,317	14,546				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,800	6,106	5,789	5,794	10,422	8,683	8,476
Installed thermal - Nuclear (MW)	0	0	0.005	0.015	0.025	0.045	0.068
Installed renewables - Rooftop PV (MW)	2,978	5,185	6,070	7,104	8,278	9,583	11,044
Installed renewables - Solar - Base land use assumptions (MW)	672	672	1,786	3,515	7,733	13,671	13,671
Installed renewables - Wind - Base land use assumptions (MW)	125	165	878	1,096	1,247	1,247	1,361
Installed renewables - Offshore Wind - Base land use assumptions (MW)	127	758	3,920	10,140	19,410	25,645	26,167
Installed renewables - Solar - Constrained land use assumptions (MW)	543	543	2,561	5,507	9,647	17,362	17,362
Installed renewables - Wind - Constrained land use assumptions (MW)	125	165	964	1,082	1,170	1,254	1,397
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	3,320	10,164	17,552	17,552	21,182
Capital invested - Solar PV - Base (billion \$2018)		0	1.33	1.91	4.38	5.83	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion \$2018)		0.105	1.71	0.488	0.32	0	0.218
Capital invested - Offshore Wind - Base (billion \$2018)		1.95	8.25	14.1	18.8	9.71	0.655
Capital invested - Solar PV - Constrained (billion \$2018)		0.202	0.495	3.92	2.72	7.22	0
Capital invested - Wind - Constrained (billion \$2018)		0.105	1.92	0.167	0.279	0.17	0.21
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	8.66	15.6	15	0	4.55
Capital invested - Biomass power plant (billion \$2018)	0	0	1.13	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.005	0.001	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.006	0	0.001	0	0.015

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	744	744	2,706	5,783	13,162	23,466	23,466
Wind - Base land use assumptions (GWh)	502	655	3,259	4,034	4,572	4,572	4,977
OffshoreWind - Base land use assumptions (GWh)	282	3,054	15,934	42,263	81,669	108,977	111,425
Solar - Constrained land use assumptions (GWh)	0	0	3,587	8,733	15,925	29,321	29,321
Wind - Constrained land use assumptions (GWh)	502	655	3,559	3,981	4,288	4,586	5,084
OffshoreWind - Constrained land use assumptions (GWh)	282	3,054	15,934	42,263	81,669	108,977	111,425
Biomass power plant (GWh)	0	0	2,220	2,220	2,220	2,220	2,220
Biomass w/ccu power plant (GWh)	0	0	6.99	6.99	7.72	7.72	24.1
Biomass w/ccu allam power plant (GWh)	0	0	0	5.42	6.26	6.26	6.26

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	2	2	2	2	2
Number of facilities - Power ccu (quantity)	0	0	1	1	1	1	2
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	2
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	2
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Sng (quantity)	0	0	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	1,267	43.3	12.5	12.6	2,040
Biomass purchases (million \$2018/y)		0	73.3	74.6	75	75.5	151

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	0.02	0.03	0.03	1.32
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	1.31

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - NGCC (MMT)		0	0	0.01	0.01	0	0.01
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0.01	0.03	0.06	0.09	1.41
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	1.38
Cumulative - NGCC (MMT)		0	0	0.01	0.02	0.02	0.03
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	135	135	135	135	135
Spur (km)		0	36.2	179	179	179	414
All (km)		0	171	314	314	314	549
Cumulative investment - Trunk (million \$2018)		0	245	245	245	245	245
Cumulative investment - Spur (million \$2018)		0	19.1	94.2	94.2	94.2	249
Cumulative investment - All (million \$2018)		0	264	339	339	339	494

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111

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)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
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)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-55
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-1.64
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-56.7
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-105
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-3.29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-109
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							33.2
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							2.99
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							36.2
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							63.5
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							5.98
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							69.5

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)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32	13.9	5.34	2.25	0.674	1.11
Premature deaths from air pollution - Mobile - On-Road (deaths)		232	233	224	199	157	106
Premature deaths from air pollution - Gas Stations (deaths)		14.1	14.1	13.5	11.9	9.28	6.24

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)		46.2	42.5	38	31.8	24.1	16
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		95.4	89.8	84.6	72.4	52.7	32.4
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		7.3	7.16	6.93	6.3	5.09	3.68
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.31	1.25	1.18	1.11	1.04	0.961
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		49.1	46.7	44.1	40	34.3	27.5
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		48.6	45.5	42.2	36.1	29.9	23.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.28	4.74	4.21	3.69	3.17	2.68
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.473	0.249	0.247	0.242	0.24	0.228
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		35	30.2	24.3	19.9	16.7	11.9
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		558	0.599	0.598	0.568	0.345	0.018
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		284	123	47.3	19.9	5.97	9.82
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,064	2,069	1,991	1,771	1,392	941
Monetary damages from air pollution - Gas Stations (million \$2019)		125	125	119	105	82.2	55.2
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		409	377	337	282	214	141
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		846	796	749	641	467	287
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		64.7	63.4	61.4	55.8	45.1	32.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		11.6	11	10.4	9.81	9.18	8.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		434	414	390	354	303	243
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		430	403	373	319	264	205
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		46.7	42	37.3	32.6	28.1	23.7
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.18	2.19	2.18	2.14	2.12	2.01

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)		310	268	216	177	148	106

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		137	738	305	232	151	236
By economic sector - Construction (jobs)		13,169	10,323	12,036	15,811	19,333	17,930
By economic sector - Manufacturing (jobs)		2,917	4,233	4,621	4,912	7,016	8,049
By economic sector - Mining (jobs)		1,734	1,272	930	664	453	260
By economic sector - Other (jobs)		2,204	1,534	1,863	2,606	3,502	4,679
By economic sector - Pipeline (jobs)		425	401	287	243	199	181
By economic sector - Professional (jobs)		4,859	4,672	5,123	6,780	8,286	8,630
By economic sector - Trade (jobs)		3,633	3,028	3,464	4,514	5,632	6,274
By economic sector - Utilities (jobs)		5,153	7,299	9,851	14,066	17,484	10,619
By resource sector - Biomass (jobs)		519	1,984	1,013	974	643	972
By resource sector - CO2 (jobs)		0	417	3.81	9.68	9.65	316
By resource sector - Grid (jobs)		6,466	11,707	18,495	27,348	34,480	19,904
By resource sector - Natural Gas (jobs)		4,462	3,346	2,248	2,136	2,117	1,596
By resource sector - Nuclear (jobs)		0	0.031	0.056	0.077	0.1	0.099
By resource sector - Oil (jobs)		3,976	3,338	2,810	2,258	1,722	1,076
By resource sector - Solar (jobs)		18,389	11,284	11,511	15,010	20,301	28,070
By resource sector - Wind (jobs)		419	1,424	2,402	2,093	2,785	4,923
By education level - All sectors - High school diploma or less (jobs)		14,880	14,558	16,626	21,448	26,685	24,342
By education level - All sectors - Associates degree or some college (jobs)		10,851	10,536	12,329	16,121	20,192	18,392
By education level - All sectors - Bachelors degree (jobs)		6,623	6,560	7,441	9,551	11,839	10,979
By education level - All sectors - Masters or professional degree (jobs)		1,622	1,610	1,828	2,377	2,938	2,735
By education level - All sectors - Doctoral degree (jobs)		255	236	257	330	402	410
Related work experience - All sectors - None (jobs)		4,986	4,911	5,647	7,339	9,141	8,343
Related work experience - All sectors - Up to 1 year (jobs)		7,111	6,897	7,833	10,083	12,575	11,810
Related work experience - All sectors - 1 to 4 years (jobs)		12,191	11,994	13,777	17,846	22,206	20,257
Related work experience - All sectors - 4 to 10 years (jobs)		7,920	7,698	8,906	11,569	14,396	13,051
Related work experience - All sectors - Over 10 years (jobs)		2,023	2,000	2,318	2,990	3,739	3,396
On-the-Job Training - All sectors - None (jobs)		1,941	1,819	2,068	2,663	3,312	3,174
On-the-Job Training - All sectors - Up to 1 year (jobs)		22,094	21,979	25,063	32,285	40,229	37,123
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,322	7,056	8,246	10,782	13,443	12,041
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,516	2,321	2,737	3,634	4,494	3,957
On-the-Job Training - All sectors - Over 10 years (jobs)		359	324	366	463	579	562
On-Site or In-Plant Training - All sectors - None (jobs)		5,627	5,441	6,172	7,946	9,905	9,340
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		20,112	19,942	22,824	29,454	36,700	33,722

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)		5,677	5,487	6,399	8,350	10,412	9,358
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,518	2,339	2,742	3,622	4,472	3,937
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		297	291	345	455	568	501
Wage income - All (million \$2019)		2,135	2,126	2,487	3,280	4,121	3,733

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	501	471	433	400	373	341	304
Final energy use - Residential (PJ)	286	270	259	248	231	207	181
Final energy use - Commercial (PJ)	253	241	235	230	223	216	207
Final energy use - Industry (PJ)	81.4	79.4	79.8	80.8	82.8	83.9	85.2

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)		1.91	1.91	3.04	3.17	5.62	6.03

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	61	181	301	858	1,415	2,648	3,881
Vehicle stocks - LDV – All others (1000 units)	5,073	5,073	5,073	4,812	4,551	3,507	2,463
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	161	327	1,113	3,470	5,067
Public EV charging plugs - DC Fast (1000 units)	0.317		0.499		2.34		6.43
Public EV charging plugs - L2 (1000 units)	2.26		12		56.3		154

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 (%)	6.91	7.36	12	26	51.8	76	88
Sales of space heating units - Electric Resistance (%)	6.17	9.22	8.85	8.12	6.41	4.13	2.94
Sales of space heating units - Gas (%)	54.5	36.7	35.3	31.3	21.9	10.3	3.54
Sales of space heating units - Fossil (%)	32.4	46.7	43.8	34.6	19.9	9.61	5.55
Sales of water heating units - Electric Heat Pump (%)	0	0.459	1.73	5.83	15.1	26.1	32.4
Sales of water heating units - Electric Resistance (%)	30.5	48.3	49	51.2	55.6	60.5	63.2
Sales of water heating units - Gas Furnace (%)	60	44.6	43.2	38.4	27	12.6	4.1
Sales of water heating units - Other (%)	9.47	6.6	6.08	4.62	2.32	0.811	0.288
Sales of cooking units - Electric Resistance (%)	64	64.9	68.2	76.9	89	96.4	99
Sales of cooking units - Gas (%)	36	35.1	31.8	23.1	11	3.56	0.957
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.63	6.47				

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 (%)	4.31	7.58	10.8	20.7	40.6	61.6	72.9
Sales of space heating units - Electric Resistance (%)	2.07	2.47	3.76	7.71	14.2	19.1	21
Sales of space heating units - Gas Furnace (%)	69.9	55.4	53.1	47.2	33.3	15.5	5.06
Sales of space heating units - Fossil (%)	23.7	34.5	32.4	24.4	11.9	3.8	0.998
Sales of water heating units - Electric Heat Pump (%)	2.04	2.9	4.29	8.99	20.1	34	42
Sales of water heating units - Electric Resistance (%)	10.2	11.8	12.9	17.6	28.1	41.1	48.8
Sales of water heating units - Gas Furnace (%)	84.8	81.2	79	70.2	49.4	23.1	7.53
Sales of water heating units - Other (%)	2.99	4.09	3.78	3.24	2.41	1.82	1.65
Sales of cooking units - Electric Resistance (%)	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,315	14,553				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,851	6,147	4,542	4,546	4,588	3,104	4,901
Installed thermal - Nuclear (MW)	0	0	0.013	0.034	0.06	0.091	0.116

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345

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)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47

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)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
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)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371

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)							0

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)							-55
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-1.64
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-56.7
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-105
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-3.29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-109
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							33.2
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							2.99
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							36.2
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							63.5
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							5.98
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							69.5

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)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		30.8	15.5	8.67	7.84	2.71	1.39
Premature deaths from air pollution - Mobile - On-Road (deaths)		228	211	158	90.4	40	14.3
Premature deaths from air pollution - Gas Stations (deaths)		13.8	12.5	9.24	5.3	2.38	0.93
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		46	39.6	28.2	16.1	7.83	3.06
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		93.9	74.1	49.2	27.7	11.8	3.56

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)		7.22	6.55	5.09	3.36	1.87	0.938
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.31	1.25	1.18	1.11	1.04	0.961
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		49	43.2	34.4	24.5	15.7	8.36
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		48.2	40	28.3	17.6	12	8.87
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.28	4.42	3.59	2.79	2.03	1.31
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.527	0.248	0.244	0.238	0.24	0.22
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		34.3	31.2	25.3	17.8	10	1.01
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		558	0.599	0.598	0.568	0.345	0.018
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		273	137	76.8	69.5	24	12.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,027	1,872	1,408	804	356	128
Monetary damages from air pollution - Gas Stations (million \$2019)		122	111	81.8	46.9	21.1	8.24
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		407	351	249	143	69.4	27.1
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		832	656	436	246	104	31.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		63.9	58	45.1	29.8	16.6	8.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		11.6	11	10.4	9.81	9.18	8.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		434	382	305	217	139	74
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		427	354	251	156	107	78.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		46.7	39.2	31.8	24.7	17.9	11.6
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.65	2.19	2.15	2.1	2.11	1.94
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		304	277	225	158	89	9.01

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		113	234	204	151	112	232
By economic sector - Construction (jobs)		13,219	10,987	18,576	22,164	14,998	18,029
By economic sector - Manufacturing (jobs)		2,993	4,301	7,662	6,577	6,636	7,781
By economic sector - Mining (jobs)		1,702	1,198	729	394	176	24.2
By economic sector - Other (jobs)		2,209	1,703	2,715	3,772	2,997	4,863
By economic sector - Pipeline (jobs)		412	343	241	155	85.8	34.1
By economic sector - Professional (jobs)		4,851	4,471	7,593	9,284	6,674	8,958
By economic sector - Trade (jobs)		3,623	3,111	4,826	6,022	4,494	6,358
By economic sector - Utilities (jobs)		5,260	7,516	17,836	20,317	12,481	10,508
By resource sector - Biomass (jobs)		439	661	548	493	417	1,020
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Grid (jobs)		6,886	12,738	35,220	39,433	23,497	19,999
By resource sector - Natural Gas (jobs)		4,249	3,222	2,261	2,910	2,313	1,342
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		3,931	3,067	2,117	1,276	625	0.176
By resource sector - Solar (jobs)		18,502	12,797	16,345	22,084	18,650	28,891
By resource sector - Wind (jobs)		375	1,379	3,890	2,640	3,153	5,535
By education level - All sectors - High school diploma or less (jobs)		14,946	14,638	26,043	29,581	20,860	24,230
By education level - All sectors - Associates degree or some college (jobs)		10,911	10,812	19,619	22,480	15,861	18,415
By education level - All sectors - Bachelors degree (jobs)		6,644	6,581	11,515	13,064	9,310	10,969
By education level - All sectors - Masters or professional degree (jobs)		1,626	1,603	2,826	3,262	2,302	2,754
By education level - All sectors - Doctoral degree (jobs)		255	231	377	448	322	418
Related work experience - All sectors - None (jobs)		5,007	4,948	8,867	10,149	7,145	8,327
Related work experience - All sectors - Up to 1 year (jobs)		7,140	6,922	12,196	13,897	9,924	11,814
Related work experience - All sectors - 1 to 4 years (jobs)		12,244	12,110	21,606	24,632	17,371	20,219
Related work experience - All sectors - 4 to 10 years (jobs)		7,956	7,842	14,040	16,024	11,272	13,041
Related work experience - All sectors - Over 10 years (jobs)		2,034	2,043	3,671	4,134	2,942	3,386
On-the-Job Training - All sectors - None (jobs)		1,947	1,843	3,179	3,659	2,619	3,181
On-the-Job Training - All sectors - Up to 1 year (jobs)		22,187	22,044	39,163	44,416	31,607	37,041
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,361	7,242	13,118	15,026	10,493	12,035
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,527	2,400	4,353	5,095	3,468	3,970
On-the-Job Training - All sectors - Over 10 years (jobs)		360	335	568	640	467	561
On-Site or In-Plant Training - All sectors - None (jobs)		5,648	5,478	9,603	10,970	7,848	9,360
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		20,199	20,058	35,727	40,556	28,786	33,640
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,707	5,620	10,156	11,614	8,129	9,346
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,528	2,410	4,342	5,057	3,451	3,940
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		299	299	554	637	442	501
Wage income - All (million \$2019)		2,145	2,151	3,922	4,536	3,203	3,727

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Commercial (PJ)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4

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)		2.59	2.67	6.63	7.17	6.63	7.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	78.7	488	898	2,333	3,767	4,913	6,059
Vehicle stocks - LDV – All others (1000 units)	5,053	4,811	4,569	3,330	2,090	1,183	275
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		962	2,495	3,997	6,074	6,591	6,294
Public EV charging plugs - DC Fast (1000 units)	0.317		1.49		6.24		10
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241

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 (%)	6.91	13.1	53.5	87.8	93.1	93.4	93.4
Sales of space heating units - Electric Resistance (%)	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of water heating units - Electric Heat Pump (%)	0	1.22	12.2	31.8	35.2	35.4	35.4
Sales of water heating units - Electric Resistance (%)	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Sales of water heating units - Gas Furnace (%)	60	44.2	31.9	5.09	0.3	0	0
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103
Sales of cooking units - Electric Resistance (%)	64.1	71.7	95.2	99.8	100	100	100
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.62	6.19				

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 (%)	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Sales of space heating units - Electric Resistance (%)	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Sales of space heating units - Gas Furnace (%)	69.9	54.9	39.2	6.26	0.372	0	0
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of water heating units - Electric Heat Pump (%)	2.04	3.48	15.8	41.1	45.6	46	45.9
Sales of water heating units - Electric Resistance (%)	10.2	12.4	23.9	48	52.3	52.5	52.5

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 (%)	84.8	80.4	58.4	9.31	0.551	0	0
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58
Sales of cooking units - Electric Resistance (%)	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,317	14,546				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,927	6,106	6,015	6,021	9,307	8,416	8,204
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	2,978	5,185	6,070	7,104	8,278	9,583	11,044
Installed renewables - Solar - Base land use assumptions (MW)	672	672	2,747	7,224	15,150	17,225	17,225
Installed renewables - Wind - Base land use assumptions (MW)	125	165	878	1,096	1,247	1,247	1,361
Installed renewables - Offshore Wind - Base land use assumptions (MW)	70.3	678	3,840	15,289	24,408	26,167	26,167
Installed renewables - Solar - Constrained land use assumptions (MW)	672	672	2,652	5,325	9,816	11,585	11,585
Installed renewables - Wind - Constrained land use assumptions (MW)	142	182	981	1,099	1,187	1,271	1,527
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	3,241	15,392	17,552	17,552	21,182
Capital invested - Solar PV - Base (billion \$2018)		0	2.48	4.94	8.24	2.04	0
Capital invested - Wind - Base (billion \$2018)		0.105	1.71	0.488	0.32	0	0.218
Capital invested - Offshore Wind - Base (billion \$2018)		1.72	8.25	26	18.5	2.74	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	744	744	4,409	12,176	25,995	29,584	29,584
Wind - Base land use assumptions (GWh)	502	655	3,259	4,034	4,572	4,572	4,977
OffshoreWind - Base land use assumptions (GWh)	282	2,728	15,604	63,855	103,414	111,425	111,425
Solar - Constrained land use assumptions (GWh)	1,489	1,489	8,456	17,820	33,440	39,534	39,534
Wind - Constrained land use assumptions (GWh)	1,003	1,310	7,117	7,963	8,576	9,173	10,953
OffshoreWind - Constrained land use assumptions (GWh)	0	0	26,329	129,043	148,281	148,281	180,138

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0

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)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382

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)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
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)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-55
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-1.64
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-56.7
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-105
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-3.29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-109
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							33.2
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							2.99
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							36.2
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							63.5
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							5.98

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)							69.5

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)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32.3	18.1	19.4	14.5	7.5	1.74
Premature deaths from air pollution - Mobile - On-Road (deaths)		228	211	158	90.4	40	14.3
Premature deaths from air pollution - Gas Stations (deaths)		13.8	12.5	9.24	5.3	2.38	0.93
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		46	39.6	28.2	16.1	7.83	3.06
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		93.9	74.1	49.2	27.7	11.8	3.56
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		7.22	6.55	5.09	3.36	1.87	0.938
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.31	1.25	1.18	1.11	1.04	0.961
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		49	43.2	34.4	24.5	15.7	8.36
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		48.2	40	28.3	17.6	12	8.87
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.28	4.42	3.59	2.79	2.03	1.31
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.45	0.248	0.244	0.239	0.24	0.22
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		35.7	33.8	32.6	28.2	23.5	17.5
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		558	0.599	0.598	0.568	0.345	0.018
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		286	161	172	129	66.5	15.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,027	1,872	1,408	804	356	128
Monetary damages from air pollution - Gas Stations (million \$2019)		122	111	81.8	46.9	21.1	8.24
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		407	351	249	143	69.4	27.1
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		832	656	436	246	104	31.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		63.9	58	45.1	29.8	16.6	8.31

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)		11.6	11	10.4	9.81	9.18	8.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		434	382	305	217	139	74
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		427	354	251	156	107	78.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		46.7	39.2	31.8	24.7	17.9	11.6
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.97	2.19	2.16	2.11	2.12	1.94
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		317	300	290	251	209	155

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		128	790	303	202	136	238
By economic sector - Construction (jobs)		14,176	10,030	11,397	11,384	10,196	16,622
By economic sector - Manufacturing (jobs)		3,710	2,980	3,675	2,743	2,174	3,941
By economic sector - Mining (jobs)		1,737	1,256	860	560	355	233
By economic sector - Other (jobs)		2,299	1,484	1,696	1,886	1,938	4,383
By economic sector - Pipeline (jobs)		434	436	336	286	226	223
By economic sector - Professional (jobs)		5,252	4,483	5,368	5,276	4,819	8,592
By economic sector - Trade (jobs)		3,828	2,880	3,316	3,337	3,157	5,952
By economic sector - Utilities (jobs)		6,557	7,076	13,237	12,794	11,033	14,253
By resource sector - Biomass (jobs)		450	2,026	1,039	754	534	989
By resource sector - CO2 (jobs)		0	471	4.3	10.9	10.9	357
By resource sector - Grid (jobs)		9,227	10,900	17,053	17,115	14,434	16,629
By resource sector - Natural Gas (jobs)		4,668	3,747	3,409	3,549	3,046	2,179
By resource sector - Nuclear (jobs)		0	0.877	4,803	4,004	3,605	6,552
By resource sector - Oil (jobs)		3,929	3,107	2,204	1,475	1,000	714
By resource sector - Solar (jobs)		18,425	10,067	10,137	10,799	10,828	26,225
By resource sector - Wind (jobs)		1,421	1,095	1,538	760	576	793
By education level - All sectors - High school diploma or less (jobs)		16,546	13,669	16,903	16,177	14,271	22,712
By education level - All sectors - Associates degree or some college (jobs)		12,141	9,877	12,698	12,277	10,890	17,318
By education level - All sectors - Bachelors degree (jobs)		7,360	6,124	8,225	7,766	6,868	11,103
By education level - All sectors - Masters or professional degree (jobs)		1,797	1,520	2,065	1,966	1,750	2,860
By education level - All sectors - Doctoral degree (jobs)		275	225	297	283	255	445
Related work experience - All sectors - None (jobs)		5,554	4,625	5,820	5,604	4,964	7,908
Related work experience - All sectors - Up to 1 year (jobs)		7,881	6,450	8,039	7,675	6,801	11,113
Related work experience - All sectors - 1 to 4 years (jobs)		13,582	11,260	14,469	13,844	12,246	19,529
Related work experience - All sectors - 4 to 10 years (jobs)		8,833	7,225	9,380	8,995	7,952	12,602
Related work experience - All sectors - Over 10 years (jobs)		2,269	1,855	2,480	2,351	2,071	3,285

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - None (jobs)		2,135	1,706	2,214	2,114	1,886	3,139
On-the-Job Training - All sectors - Up to 1 year (jobs)		24,621	20,529	26,219	24,955	22,052	35,450
On-the-Job Training - All sectors - 1 to 4 years (jobs)		8,180	6,647	8,572	8,279	7,324	11,504
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,788	2,233	2,799	2,759	2,453	3,813
On-the-Job Training - All sectors - Over 10 years (jobs)		396	300	383	362	320	531
On-Site or In-Plant Training - All sectors - None (jobs)		6,238	5,094	6,516	6,217	5,519	9,024
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		22,418	18,640	23,869	22,750	20,105	32,231
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,340	5,162	6,626	6,390	5,651	8,901
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,790	2,244	2,831	2,775	2,461	3,820
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		334	275	345	338	299	461
Wage income - All (million \$2019)		2,383	2,004	2,633	2,560	2,292	3,659

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	500	466	414	349	289	250	231
Final energy use - Residential (PJ)	286	269	250	218	185	159	144
Final energy use - Commercial (PJ)	253	241	230	215	199	188	181
Final energy use - Industry (PJ)	81.4	79.3	79.4	79.4	80.6	81.8	83.4

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)		2.59	2.67	6.63	7.17	6.63	7.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	78.7	488	898	2,333	3,767	4,913	6,059
Vehicle stocks - LDV – All others (1000 units)	5,053	4,811	4,569	3,330	2,090	1,183	275
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		962	2,495	3,997	6,074	6,591	6,294
Public EV charging plugs - DC Fast (1000 units)	0.317		1.49		6.24		10
Public EV charging plugs - L2 (1000 units)	2.26		35.7		150		241

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 (%)	6.91	13.1	53.5	87.8	93.1	93.4	93.4
Sales of space heating units - Electric Resistance (%)	6.17	9.15	7.14	3.07	2.34	2.27	2.46
Sales of space heating units - Gas (%)	54.5	36.2	25.6	4.29	0.5	0.264	0.249
Sales of space heating units - Fossil (%)	32.4	41.6	13.8	4.85	4.07	4.05	3.91
Sales of water heating units - Electric Heat Pump (%)	0	1.22	12.2	31.8	35.2	35.4	35.4

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 Resistance (%)	30.5	48.9	54.7	62.9	64.4	64.5	64.5
Sales of water heating units - Gas Furnace (%)	60	44.2	31.9	5.09	0.3	0	0
Sales of water heating units - Other (%)	9.47	5.72	1.16	0.145	0.102	0.103	0.103
Sales of cooking units - Electric Resistance (%)	64.1	71.7	95.2	99.8	100	100	100
Sales of cooking units - Gas (%)	35.9	28.3	4.84	0.243	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.62	6.19				

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 (%)	4.31	10.7	38.6	72.2	77.8	78.1	78.1
Sales of space heating units - Electric Resistance (%)	2.07	4.58	16.4	21.3	21.9	21.9	21.9
Sales of space heating units - Gas Furnace (%)	69.9	54.9	39.2	6.26	0.372	0	0
Sales of space heating units - Fossil (%)	23.7	29.9	5.74	0.244	0	0	0
Sales of water heating units - Electric Heat Pump (%)	2.04	3.48	15.8	41.1	45.6	46	45.9
Sales of water heating units - Electric Resistance (%)	10.2	12.4	23.9	48	52.3	52.5	52.5
Sales of water heating units - Gas Furnace (%)	84.8	80.4	58.4	9.31	0.551	0	0
Sales of water heating units - Other (%)	2.99	3.76	1.89	1.58	1.56	1.56	1.58
Sales of cooking units - Electric Resistance (%)	36.9	49.9	81.2	87.4	87.7	87.7	87.7
Sales of cooking units - Gas (%)	63.1	50.1	18.8	12.6	12.3	12.3	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,317	14,546				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,827	5,720	6,530	6,574	7,703	5,654	5,159
Installed thermal - Nuclear (MW)	0	0	0.363	2,018	3,312	4,195	6,218
Installed renewables - Rooftop PV (MW)	2,978	5,185	6,070	7,104	8,278	9,583	11,044
Installed renewables - Solar - Base land use assumptions (MW)	672	1,037	2,286	2,785	3,611	3,986	5,235
Installed renewables - Wind - Base land use assumptions (MW)	125	165	563	563	563	563	954
Installed renewables - Offshore Wind - Base land use assumptions (MW)	70.3	2,304	4,387	7,139	8,525	9,293	10,445
Installed renewables - Solar - Constrained land use assumptions (MW)	1,710	1,710	1,710	1,710	1,710	2,970	4,415
Installed renewables - Wind - Constrained land use assumptions (MW)	125	165	528	528	528	642	964
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	1,364	3,797	6,889	8,356	9,123	10,698
Capital invested - Solar PV - Base (billion \$2018)		0.489	1.5	0.551	0.859	0.368	1.16
Capital invested - Wind - Base (billion \$2018)		0.105	0.866	0	0	0	0.67
Capital invested - Offshore Wind - Base (billion \$2018)		6.33	5.44	6.44	2.81	1.2	1.44
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0	0	1.24	1.34

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Constrained (billion \$2018)		0.105	0.871	0	0	0.229	0.615
Capital invested - Offshore Wind - Constrained (billion \$2018)		3.86	6.35	7.03	2.97	1.19	1.97

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	744	1,390	3,583	4,461	5,906	6,565	8,762
Wind - Base land use assumptions (GWh)	502	655	1,991	1,991	1,991	1,991	3,259
OffshoreWind - Base land use assumptions (GWh)	282	9,335	17,830	29,632	35,720	39,074	43,861
Solar - Constrained land use assumptions (GWh)	2,577	2,577	2,577	2,577	2,577	4,764	7,272
Wind - Constrained land use assumptions (GWh)	502	655	2,000	2,000	2,000	2,407	3,559
OffshoreWind - Constrained land use assumptions (GWh)	0	5,479	15,454	28,171	34,272	37,485	44,149

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0

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 - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
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)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-55
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-1.64
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-56.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-105
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-3.29
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-109
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							33.2
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							2.99
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							36.2
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							63.5
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							5.98
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							69.5

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)		62.9	0.068	0.067	0.064	0.039	0.002
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32	13.1	6.2	4.9	2.99	1.63
Premature deaths from air pollution - Mobile - On-Road (deaths)		232	233	224	199	157	106
Premature deaths from air pollution - Gas Stations (deaths)		14.1	14.1	13.5	11.9	9.28	6.24
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		46.2	42.5	38	31.8	24.1	16
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		95.4	89.8	84.6	72.4	52.7	32.4
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		7.3	7.16	6.93	6.3	5.09	3.68
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.31	1.25	1.18	1.11	1.04	0.961
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		49.1	46.7	44.1	40	34.3	27.5

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 - Oil (deaths)		48.6	45.5	42.2	36.1	29.9	23.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.28	4.74	4.21	3.69	3.17	2.68
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.486	0.249	0.247	0.243	0.244	0.238
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		35	30.2	24.3	19.9	16.7	11.9
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		558	0.599	0.598	0.568	0.345	0.018
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		283	116	54.9	43.4	26.5	14.5
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,064	2,069	1,991	1,771	1,392	941
Monetary damages from air pollution - Gas Stations (million \$2019)		125	125	119	105	82.2	55.2
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		409	377	337	282	214	141
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		846	796	749	641	467	287
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		64.7	63.4	61.4	55.8	45.1	32.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		11.6	11	10.4	9.81	9.18	8.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		434	414	390	354	303	243
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		430	403	373	319	264	205
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		46.7	42	37.3	32.6	28.1	23.7
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.29	2.19	2.18	2.14	2.15	2.1
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		310	268	216	177	148	106

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		125	251	108	84.4	71.6	380
By economic sector - Construction (jobs)		13,097	10,225	11,308	12,806	15,350	17,222
By economic sector - Manufacturing (jobs)		2,893	4,077	4,086	3,424	4,822	6,662
By economic sector - Mining (jobs)		1,728	1,271	934	692	452	245
By economic sector - Other (jobs)		2,199	1,523	1,783	2,242	2,871	4,543
By economic sector - Pipeline (jobs)		421	402	291	250	195	174
By economic sector - Professional (jobs)		4,825	4,116	4,596	5,350	6,557	8,595

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		3,618	2,941	3,252	3,764	4,570	6,119
By economic sector - Utilities (jobs)		5,027	7,195	8,928	10,318	13,329	9,992
By resource sector - Biomass (jobs)		498	676	365	354	331	1,791
By resource sector - CO2 (jobs)		0	428	3.91	9.93	9.91	325
By resource sector - Grid (jobs)		6,271	11,529	16,551	19,346	25,456	18,542
By resource sector - Natural Gas (jobs)		4,383	3,319	2,289	2,281	2,392	1,606
By resource sector - Nuclear (jobs)		0	0.022	0.031	0.035	0.067	0.082
By resource sector - Oil (jobs)		3,976	3,338	2,810	2,366	1,734	1,013
By resource sector - Solar (jobs)		18,373	11,240	11,149	13,332	16,545	27,370
By resource sector - Wind (jobs)		433	1,470	2,118	1,243	1,749	3,285
By education level - All sectors - High school diploma or less (jobs)		14,751	13,834	15,217	16,736	20,693	23,077
By education level - All sectors - Associates degree or some college (jobs)		10,754	10,202	11,351	12,597	15,695	17,377
By education level - All sectors - Bachelors degree (jobs)		6,566	6,236	6,816	7,474	9,215	10,446
By education level - All sectors - Masters or professional degree (jobs)		1,608	1,512	1,669	1,861	2,295	2,630
By education level - All sectors - Doctoral degree (jobs)		253	216	234	264	319	403
Related work experience - All sectors - None (jobs)		4,941	4,681	5,174	5,734	7,110	7,930
Related work experience - All sectors - Up to 1 year (jobs)		7,053	6,518	7,155	7,874	9,749	11,229
Related work experience - All sectors - 1 to 4 years (jobs)		12,083	11,454	12,636	13,950	17,266	19,215
Related work experience - All sectors - 4 to 10 years (jobs)		7,850	7,415	8,191	9,048	11,201	12,364
Related work experience - All sectors - Over 10 years (jobs)		2,005	1,932	2,129	2,326	2,892	3,194
On-the-Job Training - All sectors - None (jobs)		1,927	1,738	1,902	2,103	2,588	3,030
On-the-Job Training - All sectors - Up to 1 year (jobs)		21,900	20,842	22,908	25,163	31,190	35,212
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,256	6,841	7,602	8,434	10,461	11,383
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,494	2,264	2,536	2,866	3,528	3,779
On-the-Job Training - All sectors - Over 10 years (jobs)		356	316	339	366	450	527
On-Site or In-Plant Training - All sectors - None (jobs)		5,581	5,169	5,654	6,228	7,706	8,870
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		19,935	18,963	20,883	22,964	28,463	31,980
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,627	5,309	5,893	6,529	8,097	8,847
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,496	2,277	2,539	2,856	3,510	3,759
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		294	282	317	355	442	475
Wage income - All (million \$2019)		2,116	2,035	2,282	2,559	3,206	3,548

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	501	471	433	400	373	341	304
Final energy use - Residential (PJ)	286	270	259	248	231	207	181
Final energy use - Commercial (PJ)	253	241	235	230	223	216	207
Final energy use - Industry (PJ)	81.4	79.4	79.8	80.8	82.8	83.9	85.2

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)		1.91	1.91	3.04	3.17	5.62	6.03

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	61	181	301	858	1,415	2,648	3,881
Vehicle stocks - LDV – All others (1000 units)	5,073	5,073	5,073	4,812	4,551	3,507	2,463
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	161	327	1,113	3,470	5,067
Public EV charging plugs - DC Fast (1000 units)	0.317		0.499		2.34		6.43
Public EV charging plugs - L2 (1000 units)	2.26		12		56.3		154

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 (%)	6.91	7.36	12	26	51.8	76	88
Sales of space heating units - Electric Resistance (%)	6.17	9.22	8.85	8.12	6.41	4.13	2.94
Sales of space heating units - Gas (%)	54.5	36.7	35.3	31.3	21.9	10.3	3.54
Sales of space heating units - Fossil (%)	32.4	46.7	43.8	34.6	19.9	9.61	5.55
Sales of water heating units - Electric Heat Pump (%)	0	0.459	1.73	5.83	15.1	26.1	32.4
Sales of water heating units - Electric Resistance (%)	30.5	48.3	49	51.2	55.6	60.5	63.2
Sales of water heating units - Gas Furnace (%)	60	44.6	43.2	38.4	27	12.6	4.1
Sales of water heating units - Other (%)	9.47	6.6	6.08	4.62	2.32	0.811	0.288
Sales of cooking units - Electric Resistance (%)	64	64.9	68.2	76.9	89	96.4	99
Sales of cooking units - Gas (%)	36	35.1	31.8	23.1	11	3.56	0.957
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.63	6.47				

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 (%)	4.31	7.58	10.8	20.7	40.6	61.6	72.9
Sales of space heating units - Electric Resistance (%)	2.07	2.47	3.76	7.71	14.2	19.1	21
Sales of space heating units - Gas Furnace (%)	69.9	55.4	53.1	47.2	33.3	15.5	5.06
Sales of space heating units - Fossil (%)	23.7	34.5	32.4	24.4	11.9	3.8	0.998
Sales of water heating units - Electric Heat Pump (%)	2.04	2.9	4.29	8.99	20.1	34	42
Sales of water heating units - Electric Resistance (%)	10.2	11.8	12.9	17.6	28.1	41.1	48.8
Sales of water heating units - Gas Furnace (%)	84.8	81.2	79	70.2	49.4	23.1	7.53
Sales of water heating units - Other (%)	2.99	4.09	3.78	3.24	2.41	1.82	1.65
Sales of cooking units - Electric Resistance (%)	36.9	40.7	44.7	56.5	72.7	82.9	86.4
Sales of cooking units - Gas (%)	63.1	59.3	55.3	43.5	27.3	17.1	13.6
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,315	14,553				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,827	5,685	4,542	4,546	5,245	5,158	5,979
Installed thermal - Nuclear (MW)	0	0	0.009	0.02	0.031	0.054	0.079
Capital invested - Biomass power plant (billion \$2018)	0	0	0.403	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.006	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.006	0	0	0	0

Table 57: E-B+ scenario - PILLAR 2: Clean Electricity - Generation

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	792	792	792	792	792
Biomass w/ccu power plant (GWh)	0	0	7.09	7.09	7.22	7.57	7.57
Biomass w/ccu allam power plant (GWh)	0	0	0	5.53	5.81	6.24	6.24

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	1	1	1	1	1
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	2
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	3
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Sng (quantity)	0	0	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	456	66.9	44.2	19.3	4,630
Biomass purchases (million \$2018/y)		0	48.1	52	54.9	56.1	376

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.01	0.02	0.03	0.03	2.76
Annual - BECCS (MMT)		0	0.01	0.02	0.02	0.02	2.75
Annual - NGCC (MMT)		0	0	0	0	0	0.01
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0.01	0.03	0.06	0.09	2.85
Cumulative - BECCS (MMT)		0	0.01	0.03	0.05	0.07	2.82
Cumulative - NGCC (MMT)		0	0	0	0	0	0.01
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	135	135	135	135	135
Spur (km)		0	36.2	179	179	179	257
All (km)		0	171	314	314	314	393
Cumulative investment - Trunk (million \$2018)		0	245	245	245	245	245

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative investment - Spur (million \$2018)		0	19.1	94.2	94.2	94.2	162
Cumulative investment - All (million \$2018)		0	264	339	339	339	407

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0

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 - Increase trees outside forests (1000 hectares)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
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)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-55
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-1.64
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

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-56.7
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-105
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-3.29
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)							-109
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							33.2
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							2.99
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							1.5
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							37.7
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							157
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							5.98
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							1.5
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							164

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)		176	111	103	100	98	86.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		25.2	18.3	23.8	28.4	25.8	23.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		232	235	238	242	245	248
Premature deaths from air pollution - Gas Stations (deaths)		14	14.2	14.3	14.5	14.7	14.7
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		46.1	44.8	45.5	46.4	46.7	45.9
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		92.7	75.1	50.7	31.2	18.4	11.6
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		7.23	7.07	6.87	6.74	6.62	6.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.37	1.36	1.35	1.34	1.32	1.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		50.2	50.9	50.2	49.4	49.9	51.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		48.6	44.1	36.7	27	20.9	16.8
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		5.51	5.63	5.73	5.81	5.87	5.91
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.933	0.672	0.56	0.532	0.515	0.484
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		35.2	37.6	38.6	36.6	36.5	34.7
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,561	980	910	886	868	768
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		223	162	211	251	229	208
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		2,059	2,091	2,116	2,147	2,176	2,204
Monetary damages from air pollution - Gas Stations (million \$2019)		124	126	127	129	130	130
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		409	397	403	411	414	407
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		821	665	449	277	163	103
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		64.1	62.6	60.9	59.8	58.7	57.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		12.1	12.1	12	11.9	11.7	11.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		444	451	445	437	441	457
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		430	390	325	239	185	148

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		48.8	49.8	50.7	51.4	51.9	52.3
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		8.23	5.93	4.94	4.7	4.55	4.27
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		313	334	343	325	324	308

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		119	106	105	85.6	85.5	92.7
By economic sector - Construction (jobs)		3,250	7,663	8,701	8,964	9,796	20,803
By economic sector - Manufacturing (jobs)		1,656	1,947	3,132	2,043	2,240	4,837
By economic sector - Mining (jobs)		1,758	1,433	1,175	958	816	692
By economic sector - Other (jobs)		135	1,168	1,386	1,558	1,750	4,356
By economic sector - Pipeline (jobs)		433	449	455	431	436	434
By economic sector - Professional (jobs)		1,529	2,979	3,464	3,729	4,134	8,982
By economic sector - Trade (jobs)		1,413	2,346	2,598	2,778	3,061	6,575
By economic sector - Utilities (jobs)		4,320	4,441	6,009	6,572	7,884	16,789
By resource sector - Biomass (jobs)		458	429	398	356	364	370
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Grid (jobs)		5,366	5,774	8,805	9,266	12,224	31,550
By resource sector - Natural Gas (jobs)		4,408	4,069	4,303	4,837	4,663	3,962
By resource sector - Nuclear (jobs)		0	0.003	0.006	0.006	0.013	0.021
By resource sector - Oil (jobs)		4,013	3,435	3,032	2,820	2,697	2,613
By resource sector - Solar (jobs)			8,348	8,988	9,449	9,781	23,322
By resource sector - Wind (jobs)		367	478	1,498	391	475	1,744
By education level - All sectors - High school diploma or less (jobs)		6,106	9,690	11,622	11,585	12,905	27,226
By education level - All sectors - Associates degree or some college (jobs)		4,548	7,133	8,649	8,736	9,769	20,692
By education level - All sectors - Bachelors degree (jobs)		3,119	4,461	5,287	5,294	5,862	12,150
By education level - All sectors - Masters or professional degree (jobs)		742	1,088	1,284	1,312	1,459	3,058
By education level - All sectors - Doctoral degree (jobs)		96	162	184	191	208	435
Related work experience - All sectors - None (jobs)		2,133	3,295	3,961	3,999	4,466	9,405
Related work experience - All sectors - Up to 1 year (jobs)		2,768	4,552	5,455	5,421	6,025	12,835
Related work experience - All sectors - 1 to 4 years (jobs)		5,349	8,093	9,693	9,749	10,863	22,795
Related work experience - All sectors - 4 to 10 years (jobs)		3,452	5,245	6,287	6,334	7,051	14,756
Related work experience - All sectors - Over 10 years (jobs)		910	1,347	1,630	1,615	1,798	3,771
On-the-Job Training - All sectors - None (jobs)		775	1,250	1,472	1,478	1,633	3,448
On-the-Job Training - All sectors - Up to 1 year (jobs)		9,625	14,604	17,545	17,494	19,483	41,014
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,097	4,822	5,805	5,874	6,558	13,794
On-the-Job Training - All sectors - 4 to 10 years (jobs)		985	1,633	1,937	2,013	2,246	4,717

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		131	224	266	259	283	589
On-Site or In-Plant Training - All sectors - None (jobs)		2,303	3,649	4,358	4,360	4,830	10,177
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		8,759	13,301	15,978	15,955	17,780	37,444
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		2,402	3,738	4,499	4,541	5,070	10,675
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,022	1,647	1,949	2,016	2,246	4,683
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		126	197	240	246	276	582
Wage income - All (million \$2019)		946	1,439	1,743	1,785	2,018	4,286

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	501	474	444	426	429	442	458
Final energy use - Residential (PJ)	286	272	264	261	258	256	255
Final energy use - Commercial (PJ)	253	246	249	250	251	258	269
Final energy use - Industry (PJ)	81.4	81.9	84.8	88.8	94.4	99.2	104

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)		1.9	1.89	4.44	4.74	4.91	5.2

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 (%)	6.66	9.84	10.2	10.6	10.9	11.2	11.6
Sales of space heating units - Electric Resistance (%)	6.21	8.92	8.73	8.57	8.52	8.08	7.76
Sales of space heating units - Gas (%)	54.6	40.4	58.5	71.1	71.7	71.9	71.8
Sales of space heating units - Fossil (%)	32.5	40.9	22.6	9.73	8.85	8.82	8.8
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	30.5	48.1	48.1	48.2	48.2	48.2	48.2
Sales of water heating units - Gas Furnace (%)	60	45.1	45.1	45	45	45	45
Sales of water heating units - Other (%)	9.47	6.78	6.78	6.83	6.83	6.84	6.85
Sales of cooking units - Electric Resistance (%)	63.6	63.6	63.6	63.6	63.6	63.6	63.6
Sales of cooking units - Gas (%)	36.4	36.4	36.4	36.4	36.4	36.4	36.4
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.48	5.7				

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 (%)	4.31	12.9	41	64	67.7	68.1	68.2
Sales of space heating units - Electric Resistance (%)	2.07	2.89	7.66	20	30.1	31.7	31.8
Sales of space heating units - Gas Furnace (%)	69.9	50.9	27.8	6.73	0.854	0.047	0
Sales of space heating units - Fossil (%)	23.7	33.3	23.6	9.31	1.33	0.106	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	2.04	2.38	2.35	2.36	2.34	2.36	2.35
Sales of water heating units - Electric Resistance (%)	10.2	11.3	11.1	11.3	11.2	11.1	11.1
Sales of water heating units - Gas Furnace (%)	84.8	82.1	82.5	82.3	82.3	82.6	82.5
Sales of water heating units - Other (%)	2.99	4.16	4.05	4.05	4.14	3.96	4.03
Sales of cooking units - Electric Resistance (%)	36.9	39	38.6	38.5	38.3	38.5	38.4
Sales of cooking units - Gas (%)	63.1	61	61.4	61.5	61.7	61.5	61.6
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		13,153	13,534				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Natural gas (MW)	7,760	6,106	6,106	7,126	7,202	7,351	7,885
Installed thermal - Nuclear (MW)	0	0	0.001	0.003	0.005	0.01	0.017
Installed renewables - Rooftop PV (MW)	2,978	5,185	6,070	7,104	8,278	9,583	11,044
Installed renewables - Solar - Base land use assumptions (MW)	663	663	663	663	663	663	663
Installed renewables - Wind - Base land use assumptions (MW)	163	163	242	242	242	455	490
Installed renewables - Offshore Wind - Base land use assumptions (MW)	70.3	172	277	447	598	2,384	13,478
Installed renewables - Solar - Constrained land use assumptions (MW)	8.11	8.11	8.11	8.11	8.11	8.11	8.11
Installed renewables - Wind - Constrained land use assumptions (MW)	2.3	2.3	2.3	2.3	2.3	2.3	2.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	744	744	744	744	744	744	744
Wind - Base land use assumptions (GWh)	655	655	956	956	956	1,745	1,871
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)	-4.85		-2.63				-2.35
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.141		-0.253				-0.263
Business-as-usual carbon sink - Total (Mt CO2e/y)	-4.99		-2.89				-2.62

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)							-18.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-191
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-751
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							0

Table 73: REF 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)							-173
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-73.7
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-23.3
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-187
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-1,417
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-27.4
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-669
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-1,353
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-345
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-142
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-165
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-371
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-3,072
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-36.4
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,146
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-1,955
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							0
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-518
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-210
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-307
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-4,728
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-555
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							2.98
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							146
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							382

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							0
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)							10.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							1.51
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							111
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							654
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							4.47
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							150
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							689
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							0
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)							15.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							10.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							224
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,095
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							5.96
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							155
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							997
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0

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 - Increase trees outside forests (1000 hectares)							20
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							8.73
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							184
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,371