



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

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

Table 1: E+ scenario - IMPACTS - Health

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		69.4	51.1	33.2	30.3	19.2	7.67
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.9	3.3	3.23	3.14	3.14	3.07
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		435	383	319	242	164	94
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		615	453	294	268	170	68
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million \$2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		754	692	546	371	230	126

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)		226	181	129	80.9	54.3	40
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		52.1	29.1	28.5	27.7	27.7	27.1
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,861	3,403	2,832	2,153	1,456	835

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		375	568	326	211	97.7	657
By economic sector - Construction (jobs)		16,874	17,876	25,137	32,395	39,563	49,956
By economic sector - Manufacturing (jobs)		11,738	12,934	15,397	15,122	13,208	15,880
By economic sector - Mining (jobs)		13,345	9,256	6,636	4,454	2,850	1,740
By economic sector - Other (jobs)		883	1,157	2,917	4,991	7,450	10,794
By economic sector - Pipeline (jobs)		2,600	2,426	1,920	1,378	931	741
By economic sector - Professional (jobs)		8,378	8,290	11,351	15,244	19,237	25,675
By economic sector - Trade (jobs)		6,647	6,077	7,850	10,192	12,977	17,340
By economic sector - Utilities (jobs)		23,130	21,976	25,303	29,754	33,410	39,793
By resource sector - Biomass (jobs)		1,243	1,475	817	568	365	2,835
By resource sector - CO2 (jobs)		0	1,596	1,020	136	246	1,446
By resource sector - Coal (jobs)		5,457	2,203	1,748	1,519	1,367	1,211
By resource sector - Grid (jobs)		17,453	18,532	29,221	40,411	51,903	68,299
By resource sector - Natural Gas (jobs)		34,052	28,380	22,686	19,157	13,137	8,283
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,034
By resource sector - Oil (jobs)		11,169	9,436	7,556	5,500	4,056	2,774
By resource sector - Solar (jobs)		4,732	6,671	18,297	29,417	41,459	57,515
By resource sector - Wind (jobs)		5,437	8,450	11,735	13,335	13,549	17,180
By education level - All sectors - High school diploma or less (jobs)		34,992	33,767	40,914	48,025	54,705	68,697
By education level - All sectors - Associates degree or some college (jobs)		26,243	25,395	30,900	36,617	41,955	52,558
By education level - All sectors - Bachelors degree (jobs)		17,874	16,838	19,633	22,707	25,661	31,979
By education level - All sectors - Masters or professional degree (jobs)		4,288	4,022	4,737	5,594	6,455	8,129
By education level - All sectors - Doctoral degree (jobs)		572	537	652	797	947	1,214
Related work experience - All sectors - None (jobs)		12,012	11,602	13,989	16,507	18,904	23,786
Related work experience - All sectors - Up to 1 year (jobs)		16,102	15,581	19,139	22,673	26,027	32,975
Related work experience - All sectors - 1 to 4 years (jobs)		30,691	29,258	34,921	40,911	46,614	58,301
Related work experience - All sectors - 4 to 10 years (jobs)		19,796	18,985	22,708	26,631	30,306	37,760
Related work experience - All sectors - Over 10 years (jobs)		5,367	5,134	6,079	7,019	7,871	9,755
On-the-Job Training - All sectors - None (jobs)		4,443	4,244	5,148	6,107	7,055	8,918
On-the-Job Training - All sectors - Up to 1 year (jobs)		55,356	52,964	63,357	74,028	84,096	105,614

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		17,859	17,209	20,771	24,501	27,988	34,841
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,515	5,361	6,608	8,001	9,346	11,671
On-the-Job Training - All sectors - Over 10 years (jobs)		796	781	951	1,104	1,238	1,534
On-Site or In-Plant Training - All sectors - None (jobs)		13,303	12,843	15,532	18,330	20,978	26,406
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		50,422	48,181	57,653	67,395	76,608	96,124
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,808	13,301	16,064	18,933	21,622	26,955
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,736	5,544	6,740	8,072	9,353	11,636
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		701	690	846	1,011	1,162	1,455
Wage income - All (million \$2019)		4,838	4,669	5,619	6,664	7,688	9,713

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		181	162	132	104	81	62
Oil consumption - Cumulative (million bbls)							4,048
Oil production - Annual (million bbls)		8.39	8.42	8.41	6.66	5.42	3.6
Natural gas consumption - Annual (tcf)		1,128	951	763	574	361	251
Natural gas consumption - Cumulative (tcf)							22,977
Natural gas production - Annual (tcf)		7,475	7,066	6,154	5,204	4,126	3,205

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.8	12.5				

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 (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas Furnace (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas Furnace (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	23,592	22,975	23,637	25,286	22,365	20,256
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	4,809
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	1,009	2,921	13,557	31,631	59,894	96,038
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Solar - Constrained land use assumptions (MW)	81.2	3,242	7,508	18,931	35,187	76,526	105,204
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	7,092	46,761	46,761	46,761
Capital invested - Solar PV - Base (billion \$2018)		1.23	2.29	11.7	18.8	27.7	33.5

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	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.076	2.55	12.2	15.2	34.6	27.8
Capital invested - Wind - Constrained (billion \$2018)		0	0	15.8	85.7	0	0
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0.031
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	1,829	5,236	23,739	54,746	102,925	164,663
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	72.1	5,753	13,458	33,323	61,312	131,716	180,658
Wind - Constrained land use assumptions (GWh)	6,912	6,912	6,912	27,090	155,738	155,738	155,738
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	30.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	9
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	0	9,012
Biomass purchases (million \$2018/y)		0	0	0	0	0	446

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	6.84	18.6
Annual - BECCS (MMT)		0	0	0	0	0	11.5
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	32.1
Cumulative - BECCS (MMT)		0	0	0	0	0	11.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	515	669	669	669	669
Spur (km)		0	107	332	157	241	1,333
All (km)		0	622	1,001	826	909	2,002
Cumulative investment - Trunk (million \$2018)		0	1,614	2,529	2,529	2,529	2,529
Cumulative investment - Spur (million \$2018)		0	54.5	190	97.7	180	1,010
Cumulative investment - All (million \$2018)		0	1,668	2,719	2,627	2,709	3,539

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		66.5	42.4	18.8	8.74	2.84	1.83
Premature deaths from air pollution - Mobile - On-Road (deaths)		477	480	466	418	332	228
Premature deaths from air pollution - Gas Stations (deaths)		27.4	27.5	26.3	23.4	18.5	12.7
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		104	93.8	82.3	67.9	50.8	33.4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		73.2	68.9	64.6	55.7	41.2	25.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		13	12.9	12.6	11.6	9.44	6.95
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.5	85.6	84	77.5	65.8	51.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.7	22.8	20.2	16.8	13.9	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	6.31	5.59	4.88	4.2	3.56
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.74	3.31	3.25	3.18	3.15	3
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		433	359	272	209	167	121
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		589	376	166	77.4	25.1	16.2
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,245	4,272	4,139	3,715	2,952	2,023
Monetary damages from air pollution - Gas Stations (million \$2019)		243	243	233	207	164	112
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		921	831	729	602	450	296
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		649	611	573	493	365	228
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		116	114	112	103	83.6	61.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		757	758	743	686	583	455
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		228	202	179	149	123	98.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		62.5	55.9	49.5	43.2	37.2	31.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		50.7	29.2	28.7	28	27.8	26.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,845	3,187	2,412	1,853	1,479	1,071

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		416	480	293	170	79.8	657
By economic sector - Construction (jobs)		16,601	17,749	22,148	27,824	40,742	52,322
By economic sector - Manufacturing (jobs)		11,939	13,098	13,614	14,024	15,923	19,817
By economic sector - Mining (jobs)		13,290	9,010	6,363	4,563	3,314	2,194
By economic sector - Other (jobs)		872	1,160	2,495	4,309	7,935	11,063
By economic sector - Pipeline (jobs)		2,598	2,439	1,815	1,291	1,062	1,066
By economic sector - Professional (jobs)		8,260	8,019	10,146	13,426	19,996	27,067
By economic sector - Trade (jobs)		6,584	6,027	7,242	9,254	13,767	18,313
By economic sector - Utilities (jobs)		22,475	21,362	22,127	24,335	31,583	41,185
By resource sector - Biomass (jobs)		1,304	1,213	773	531	340	2,743
By resource sector - CO2 (jobs)		0	2,736	1,748	234	423	2,479
By resource sector - Coal (jobs)		5,359	2,206	1,758	1,535	1,369	1,186
By resource sector - Grid (jobs)		16,280	17,415	24,121	31,833	48,733	69,408
By resource sector - Natural Gas (jobs)		33,811	26,348	19,299	15,554	12,128	8,530
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,584
By resource sector - Oil (jobs)		11,245	9,837	8,619	7,352	6,084	4,223
By resource sector - Solar (jobs)		4,929	6,954	15,269	25,489	45,295	58,542
By resource sector - Wind (jobs)		5,678	8,818	10,898	12,972	16,390	22,989
By education level - All sectors - High school diploma or less (jobs)		34,612	33,303	36,402	41,839	56,722	73,346
By education level - All sectors - Associates degree or some college (jobs)		25,914	25,017	27,379	31,696	43,285	56,033
By education level - All sectors - Bachelors degree (jobs)		17,701	16,561	17,626	20,034	26,723	34,343
By education level - All sectors - Masters or professional degree (jobs)		4,241	3,939	4,247	4,919	6,681	8,670
By education level - All sectors - Doctoral degree (jobs)		567	525	588	709	991	1,292
Related work experience - All sectors - None (jobs)		11,871	11,422	12,435	14,337	19,528	25,341
Related work experience - All sectors - Up to 1 year (jobs)		15,943	15,373	17,036	19,815	27,103	35,232
Related work experience - All sectors - 1 to 4 years (jobs)		30,344	28,800	31,139	35,719	48,269	62,280
Related work experience - All sectors - 4 to 10 years (jobs)		19,564	18,691	20,215	23,187	31,322	40,341
Related work experience - All sectors - Over 10 years (jobs)		5,312	5,058	5,416	6,139	8,178	10,489
On-the-Job Training - All sectors - None (jobs)		4,400	4,186	4,606	5,368	7,360	9,522
On-the-Job Training - All sectors - Up to 1 year (jobs)		54,788	52,170	56,525	64,804	87,420	113,095
On-the-Job Training - All sectors - 1 to 4 years (jobs)		17,630	16,945	18,424	21,203	28,804	37,112
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,426	5,269	5,839	6,850	9,512	12,297
On-the-Job Training - All sectors - Over 10 years (jobs)		790	775	848	972	1,305	1,657
On-Site or In-Plant Training - All sectors - None (jobs)		13,173	12,655	13,839	16,029	21,829	28,253
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		49,888	47,460	51,424	58,949	79,552	102,862
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,635	13,102	14,260	16,411	22,288	28,730
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,649	5,450	5,972	6,940	9,543	12,294
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		691	679	747	867	1,189	1,545
Wage income - All (million \$2019)		4,779	4,590	5,005	5,799	7,921	10,355

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Commercial (PJ)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.07	5.09	7.06	7.31	10.1	10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	48.5	306	563	1,755	2,948	5,587	8,226
Vehicle stocks - LDV – All others (1000 units)	10,752	10,752	10,752	10,199	9,646	7,433	5,220
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	333	699	2,363	7,431	10,827
Public EV charging plugs - DC Fast (1000 units)	0.267		1.09		5.72		16
Public EV charging plugs - L2 (1000 units)	1.32		26.2		137		383

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 (%)	8.42	13.6	18	31.2	54.5	74.9	84.5
Sales of space heating units - Electric Resistance (%)	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of water heating units - Electric Heat Pump (%)	0	0.823	3.14	10.1	22.7	34.2	39.8
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Sales of water heating units - Gas Furnace (%)	58.8	42.8	40.8	34.6	22.4	10	3.56
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247
Sales of cooking units - Electric Resistance (%)	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.8	13				

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 (%)	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Sales of space heating units - Electric Resistance (%)	5.59	3.46	4.4	7.36	12.7	16.8	19
Sales of space heating units - Gas Furnace (%)	72.4	71.6	67.9	58.1	38.6	18.3	7.04
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of water heating units - Electric Heat Pump (%)	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Sales of water heating units - Electric Resistance (%)	3.49	2.59	4.34	9.88	21.2	33.5	40.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	94.2	94.7	90.2	76.4	49.4	22.1	7.82
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,150	64,632				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	22,806	22,038	21,553	17,222	12,762	12,729
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	7,685

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		61.8	43.8	26.3	18.8	6.67	1.29
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		6.31	3.3	3.23	3.14	3.14	2.91
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		423	374	287	198	104	6.12
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		548	388	233	167	59.1	11.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million \$2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		754	692	546	371	230	126
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		226	181	129	80.9	54.3	40
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		55.7	29.1	28.5	27.7	27.7	25.7
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,754	3,318	2,552	1,755	920	54.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		376	579	326	190	89.1	652
By economic sector - Construction (jobs)		17,934	19,857	37,826	57,985	63,143	58,422
By economic sector - Manufacturing (jobs)		12,429	14,901	20,181	22,411	26,387	28,743
By economic sector - Mining (jobs)		13,268	9,064	6,129	3,836	2,148	684
By economic sector - Other (jobs)		1,145	1,727	5,983	11,238	12,900	11,506
By economic sector - Pipeline (jobs)		2,520	2,150	1,559	1,053	567	116
By economic sector - Professional (jobs)		8,764	9,425	16,896	26,623	30,762	31,568

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		6,913	6,751	11,498	17,910	20,562	20,144
By economic sector - Utilities (jobs)		22,928	21,987	28,872	40,117	47,027	49,633
By resource sector - Biomass (jobs)		1,172	1,530	792	529	339	2,900
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		5,710	2,203	1,746	1,517	1,366	1,155
By resource sector - Grid (jobs)		17,762	20,578	39,819	65,769	85,665	96,683
By resource sector - Natural Gas (jobs)		32,838	27,453	19,833	15,472	9,104	3,956
By resource sector - Nuclear (jobs)		4,428	3,817	3,179	2,314	1,564	313
By resource sector - Oil (jobs)		11,171	9,376	7,362	5,055	3,111	228
By resource sector - Solar (jobs)		7,119	11,832	40,708	70,840	76,469	59,648
By resource sector - Wind (jobs)		6,077	9,651	15,833	19,867	25,967	36,585
By education level - All sectors - High school diploma or less (jobs)		36,094	36,337	55,057	77,238	86,388	85,105
By education level - All sectors - Associates degree or some college (jobs)		26,965	27,224	41,382	58,640	66,078	65,391
By education level - All sectors - Bachelors degree (jobs)		18,254	17,990	25,683	35,374	39,720	39,573
By education level - All sectors - Masters or professional degree (jobs)		4,376	4,302	6,250	8,804	9,938	9,951
By education level - All sectors - Doctoral degree (jobs)		589	586	899	1,307	1,462	1,448
Related work experience - All sectors - None (jobs)		12,332	12,419	18,693	26,403	29,659	29,328
Related work experience - All sectors - Up to 1 year (jobs)		16,672	16,928	26,157	36,980	41,468	40,955
Related work experience - All sectors - 1 to 4 years (jobs)		31,487	31,312	46,342	64,855	72,828	72,106
Related work experience - All sectors - 4 to 10 years (jobs)		20,287	20,283	30,092	42,148	47,295	46,809
Related work experience - All sectors - Over 10 years (jobs)		5,500	5,497	7,988	10,977	12,335	12,270
On-the-Job Training - All sectors - None (jobs)		4,579	4,594	7,008	9,932	11,100	10,862
On-the-Job Training - All sectors - Up to 1 year (jobs)		56,896	56,943	84,425	117,702	132,329	131,505
On-the-Job Training - All sectors - 1 to 4 years (jobs)		18,321	18,364	27,631	38,980	43,722	43,105
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,657	5,690	8,911	12,957	14,457	14,085
On-the-Job Training - All sectors - Over 10 years (jobs)		825	849	1,298	1,792	1,977	1,911
On-Site or In-Plant Training - All sectors - None (jobs)		13,696	13,860	20,956	29,511	33,094	32,689
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		51,816	51,754	76,778	107,127	120,410	119,541
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		14,176	14,217	21,405	30,166	33,845	33,373
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,872	5,873	9,004	12,943	14,413	14,053
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		718	735	1,129	1,615	1,823	1,812
Wage income - All (million \$2019)		4,951	4,974	7,399	10,480	11,917	11,983

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.8	12.5				

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 (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas Furnace (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas Furnace (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	22,762	23,238	23,160	24,310	19,850	22,186
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	4,809	4,809	1,138	0
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	2,489	6,985	34,263	80,226	118,350	140,419
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	27,886	76,561
Installed renewables - Solar - Constrained land use assumptions (MW)	86.8	3,346	10,981	51,933	93,527	111,556	142,851
Installed renewables - Wind - Constrained land use assumptions (MW)	1,818	1,818	1,818	39,748	61,513	61,513	61,513
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		3.22	5.38	30.1	47.8	37.4	20.4
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	53	92.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	4,440	12,355	59,174	137,449	201,306	240,508
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	99,062	239,521
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	338	12,023	38,750	179,024	319,962	379,989	490,835
Wind - Constrained land use assumptions (GWh)	13,823	13,823	13,823	269,647	386,096	386,096	386,096
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		70.1	54.5	64.6	49.2	18.8	5.84
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.5	3.3	3.23	3.14	3.14	2.91
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		443	411	391	341	283	211
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		621	483	573	436	166	51.7
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million \$2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		754	692	546	371	230	126
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		226	181	129	80.9	54.3	40

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		48.5	29.1	28.5	27.7	27.7	25.7
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,937	3,648	3,469	3,027	2,510	1,870

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		402	494	284	183	92.8	661
By economic sector - Construction (jobs)		15,517	16,316	17,831	18,952	19,004	20,450
By economic sector - Manufacturing (jobs)		10,485	9,121	8,597	9,468	8,508	7,756
By economic sector - Mining (jobs)		13,413	9,710	7,599	5,568	3,985	2,696
By economic sector - Other (jobs)		658	761	986	1,273	1,425	1,758
By economic sector - Pipeline (jobs)		2,677	2,785	2,486	2,013	1,689	1,615
By economic sector - Professional (jobs)		7,665	6,966	8,264	10,491	10,580	11,523
By economic sector - Trade (jobs)		6,238	5,448	5,711	6,285	6,197	6,492
By economic sector - Utilities (jobs)		21,875	21,230	28,390	38,841	39,360	39,296
By resource sector - Biomass (jobs)		1,189	1,213	754	545	368	2,777
By resource sector - CO2 (jobs)		0	3,092	1,975	264	477	2,801
By resource sector - Coal (jobs)		5,207	2,201	1,747	1,518	1,367	1,155
By resource sector - Grid (jobs)		15,131	14,688	21,560	26,225	28,976	31,622
By resource sector - Natural Gas (jobs)		34,264	30,271	27,967	26,308	22,026	18,873
By resource sector - Nuclear (jobs)		4,428	3,817	10,488	22,379	22,780	20,394
By resource sector - Oil (jobs)		11,167	9,436	7,556	5,500	4,151	3,141
By resource sector - Solar (jobs)		3,042	3,581	3,795	4,445	4,601	5,665
By resource sector - Wind (jobs)		4,502	4,533	4,302	5,890	6,093	5,818
By education level - All sectors - High school diploma or less (jobs)		32,812	30,437	33,043	37,532	36,596	37,535
By education level - All sectors - Associates degree or some college (jobs)		24,603	22,985	25,267	29,052	28,441	28,963
By education level - All sectors - Bachelors degree (jobs)		16,915	15,269	17,093	20,622	20,059	19,981
By education level - All sectors - Masters or professional degree (jobs)		4,060	3,658	4,180	5,151	5,042	5,055
By education level - All sectors - Doctoral degree (jobs)		541	483	563	717	704	712
Related work experience - All sectors - None (jobs)		11,289	10,537	11,521	13,194	12,883	13,203
Related work experience - All sectors - Up to 1 year (jobs)		15,044	13,848	15,195	17,635	17,231	17,702
Related work experience - All sectors - 1 to 4 years (jobs)		28,902	26,548	29,222	33,977	33,146	33,539
Related work experience - All sectors - 4 to 10 years (jobs)		18,640	17,271	19,067	22,187	21,661	21,893
Related work experience - All sectors - Over 10 years (jobs)		5,056	4,628	5,141	6,080	5,921	5,908
On-the-Job Training - All sectors - None (jobs)		4,177	3,817	4,260	5,091	4,971	5,022
On-the-Job Training - All sectors - Up to 1 year (jobs)		52,026	47,602	52,316	61,017	59,453	60,314
On-the-Job Training - All sectors - 1 to 4 years (jobs)		16,794	15,717	17,308	19,902	19,474	19,764
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,188	5,002	5,503	6,176	6,082	6,286

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		745	694	759	888	861	859
On-Site or In-Plant Training - All sectors - None (jobs)		12,489	11,522	12,749	15,045	14,687	14,902
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		47,397	43,388	47,705	55,561	54,157	54,920
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		12,978	12,115	13,316	15,290	14,953	15,184
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,409	5,176	5,688	6,412	6,292	6,461
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		657	631	688	766	752	779
Wage income - All (million \$2019)		4,563	4,266	4,792	5,681	5,637	5,789

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.8	12.5				

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 (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas Furnace (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas Furnace (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	19,310	18,308	20,406	21,739	21,604	20,797
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	10,513	17,904	24,102	28,132
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	86.8	750	1,374	2,556	3,690	3,690
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Solar - Constrained land use assumptions (MW)	86.8	645	2,606	3,895	5,558	10,250	10,962
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0.794	0.689	1.23	1.11	0
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.746	2.35	1.42	1.73	4.6	0.659
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	169	1,359	2,465	4,576	6,564	6,564
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
Offshore Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Constrained land use assumptions (GWh)	169	1,166	4,672	6,963	9,894	18,163	19,405
Wind - Constrained land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		67.6	40.3	23.3	18.1	10.4	2.85
Premature deaths from air pollution - Mobile - On-Road (deaths)		477	480	466	418	332	228
Premature deaths from air pollution - Gas Stations (deaths)		27.4	27.5	26.3	23.4	18.5	12.7
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		104	93.8	82.3	67.9	50.8	33.4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		73.2	68.9	64.6	55.7	41.2	25.7
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		13	12.9	12.6	11.6	9.44	6.95
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.5	85.6	84	77.5	65.8	51.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.7	22.8	20.2	16.8	13.9	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	6.31	5.59	4.88	4.2	3.56
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.88	3.31	3.25	3.18	3.18	3.09

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		433	359	272	209	167	121
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		599	357	206	160	92.3	25.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,245	4,272	4,139	3,715	2,952	2,023
Monetary damages from air pollution - Gas Stations (million \$2019)		243	243	233	207	164	112
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		921	831	729	602	450	296
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		649	611	573	493	365	228
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		116	114	112	103	83.6	61.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		757	758	743	686	583	455
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		228	202	179	149	123	98.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		62.5	55.9	49.5	43.2	37.2	31.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		51.9	29.2	28.7	28.1	28.1	27.3
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,845	3,187	2,412	1,853	1,479	1,071

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		396	480	290	179	81.9	1,080
By economic sector - Construction (jobs)		16,662	17,912	21,396	23,748	31,642	46,114
By economic sector - Manufacturing (jobs)		12,067	13,255	12,501	10,264	11,584	16,295
By economic sector - Mining (jobs)		13,264	8,986	6,433	4,675	3,326	2,139
By economic sector - Other (jobs)		881	1,169	2,279	3,331	5,574	9,820
By economic sector - Pipeline (jobs)		2,570	2,440	1,853	1,336	1,054	1,035
By economic sector - Professional (jobs)		8,325	8,108	9,788	11,425	15,429	24,363
By economic sector - Trade (jobs)		6,621	6,066	7,007	7,968	10,620	16,248
By economic sector - Utilities (jobs)		22,659	21,636	22,187	22,760	27,931	36,325
By resource sector - Biomass (jobs)		1,269	1,214	773	568	373	5,124
By resource sector - CO2 (jobs)		0	2,808	1,794	240	434	2,544
By resource sector - Coal (jobs)		5,445	2,206	1,758	1,536	1,382	1,219
By resource sector - Grid (jobs)		16,688	17,869	23,886	28,360	40,902	59,710
By resource sector - Natural Gas (jobs)		33,630	26,334	19,817	16,183	12,809	8,627
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,297
By resource sector - Oil (jobs)		11,246	9,837	8,619	7,510	6,113	4,084

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Solar (jobs)		4,877	6,878	13,350	18,643	30,374	52,965
By resource sector - Wind (jobs)		5,862	9,090	9,980	8,949	11,216	15,849
By education level - All sectors - High school diploma or less (jobs)		34,787	33,600	35,294	36,034	45,165	64,913
By education level - All sectors - Associates degree or some college (jobs)		26,053	25,253	26,585	27,332	34,503	49,269
By education level - All sectors - Bachelors degree (jobs)		17,777	16,699	17,145	17,413	21,437	30,379
By education level - All sectors - Masters or professional degree (jobs)		4,259	3,972	4,140	4,294	5,357	7,699
By education level - All sectors - Doctoral degree (jobs)		569	529	571	615	780	1,159
Related work experience - All sectors - None (jobs)		11,928	11,525	12,085	12,405	15,594	22,430
Related work experience - All sectors - Up to 1 year (jobs)		16,028	15,511	16,464	16,929	21,393	31,227
Related work experience - All sectors - 1 to 4 years (jobs)		30,493	29,053	30,270	30,955	38,627	54,997
Related work experience - All sectors - 4 to 10 years (jobs)		19,658	18,859	19,660	20,101	25,081	35,550
Related work experience - All sectors - Over 10 years (jobs)		5,338	5,103	5,257	5,298	6,546	9,215
On-the-Job Training - All sectors - None (jobs)		4,420	4,221	4,461	4,613	5,817	8,441
On-the-Job Training - All sectors - Up to 1 year (jobs)		55,063	52,631	54,824	55,867	69,689	100,040
On-the-Job Training - All sectors - 1 to 4 years (jobs)		17,717	17,100	17,927	18,388	23,074	32,637
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,451	5,318	5,707	5,996	7,638	10,849
On-the-Job Training - All sectors - Over 10 years (jobs)		794	781	817	823	1,023	1,453
On-Site or In-Plant Training - All sectors - None (jobs)		13,235	12,767	13,404	13,760	17,294	24,962
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		50,140	47,879	49,899	50,873	63,475	90,960
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,703	13,221	13,866	14,216	17,837	25,282
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,673	5,499	5,839	6,086	7,682	10,856
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		694	685	727	752	953	1,361
Wage income - All (million \$2019)		4,802	4,630	4,877	5,054	6,374	9,153

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Commercial (PJ)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.07	5.09	7.06	7.31	10.1	10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	48.5	306	563	1,755	2,948	5,587	8,226
Vehicle stocks - LDV – All others (1000 units)	10,752	10,752	10,752	10,199	9,646	7,433	5,220
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	333	699	2,363	7,431	10,827
Public EV charging plugs - DC Fast (1000 units)	0.267		1.09		5.72		16
Public EV charging plugs - L2 (1000 units)	1.32		26.2		137		383

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 (%)	8.42	13.6	18	31.2	54.5	74.9	84.5
Sales of space heating units - Electric Resistance (%)	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of water heating units - Electric Heat Pump (%)	0	0.823	3.14	10.1	22.7	34.2	39.8
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Sales of water heating units - Gas Furnace (%)	58.8	42.8	40.8	34.6	22.4	10	3.56
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247
Sales of cooking units - Electric Resistance (%)	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.8	13				

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 (%)	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Sales of space heating units - Electric Resistance (%)	5.59	3.46	4.4	7.36	12.7	16.8	19
Sales of space heating units - Gas Furnace (%)	72.4	71.6	67.9	58.1	38.6	18.3	7.04
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of water heating units - Electric Heat Pump (%)	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Sales of water heating units - Electric Resistance (%)	3.49	2.59	4.34	9.88	21.2	33.5	40.1
Sales of water heating units - Gas Furnace (%)	94.2	94.7	90.2	76.4	49.4	22.1	7.82
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		59,150	64,632				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	23,686	22,962	22,478	18,448	17,482	17,148
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	6,186

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	15
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	0	14,912
Biomass purchases (million \$2018/y)		0	0	0	0	0	1,316

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	6.84	7.07
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	20.6
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	515	669	669	669	669
Spur (km)		0	107	157	157	416	241
All (km)		0	622	826	826	1,084	909
Cumulative investment - Trunk (million \$2018)		0	1,614	2,529	2,529	2,938	2,938
Cumulative investment - Spur (million \$2018)		0	54.5	97.9	97.7	272	183
Cumulative investment - All (million \$2018)		0	1,668	2,627	2,627	3,210	3,121

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-627
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-1,009
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-44.1
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-1,680
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-627
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-1,912

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-88.1
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,627
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							253
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							768
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							80.2
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							14.8
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							58.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,174
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							253
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,594
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							160
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							14.8
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							58.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,080

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)		702	443	413	400	392	356
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		51.1	56.6	72.5	74	73	66.4
Premature deaths from air pollution - Mobile - On-Road (deaths)		476	486	495	507	520	533
Premature deaths from air pollution - Gas Stations (deaths)		27.3	27.7	28	28.5	29	29.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	95.8	91.8	90.7	90.6	89.7
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		71.1	59.9	43.4	28.4	17	10.4
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.7	12.6	12.7	12.9	13	13
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		7.21	7.14	7.09	7.02	6.96	6.86
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		86.2	87.6	85.2	82.2	83.1	87.8
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.9	22.9	19.3	15	12.4	11
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.38	7.49	7.6	7.69	7.77	7.85
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		10.6	7.74	6.5	6.16	5.96	5.61
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		437	466	476	446	444	426
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		6,223	3,926	3,660	3,543	3,470	3,154
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		453	501	643	656	647	588
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		4,236	4,322	4,405	4,511	4,620	4,736
Monetary damages from air pollution - Gas Stations (million \$2019)		242	245	248	252	256	260
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		914	849	813	803	803	795
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		630	530	385	252	150	92.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		113	112	113	114	115	115
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		63.8	63.3	62.8	62.1	61.6	60.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		764	776	755	728	735	778
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		229	202	171	133	109	97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		65.3	66.3	67.2	68	68.8	69.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		93.6	68.3	57.4	54.3	52.6	49.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		3,880	4,135	4,229	3,964	3,942	3,786

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		386	365	363	330	330	342
By economic sector - Construction (jobs)		14,549	15,789	16,881	17,646	18,526	19,317
By economic sector - Manufacturing (jobs)		7,296	7,916	8,261	8,951	8,400	8,098
By economic sector - Mining (jobs)		15,415	12,331	10,150	8,138	6,842	5,571
By economic sector - Other (jobs)		457	634	732	879	974	1,320
By economic sector - Pipeline (jobs)		2,661	2,837	2,909	2,733	2,754	2,709
By economic sector - Professional (jobs)		7,649	7,219	7,181	7,464	7,661	7,805
By economic sector - Trade (jobs)		6,643	6,048	5,836	5,845	5,892	5,993
By economic sector - Utilities (jobs)		22,497	21,719	22,415	22,966	23,804	23,026
By resource sector - Biomass (jobs)		1,203	1,142	1,080	1,000	1,005	1,007
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		8,770	5,163	3,825	3,292	2,911	2,270
By resource sector - Grid (jobs)		16,047	15,115	16,892	18,906	20,429	21,055
By resource sector - Natural Gas (jobs)		34,463	35,595	35,901	34,675	34,389	31,807
By resource sector - Nuclear (jobs)		4,428	3,817	3,179	2,314	2,278	2,243
By resource sector - Oil (jobs)		11,327	10,030	9,039	8,351	7,863	7,308
By resource sector - Solar (jobs)			1,943	2,444	2,551	2,713	4,929
By resource sector - Wind (jobs)		1,315	2,055	2,367	3,862	3,596	3,564
By education level - All sectors - High school diploma or less (jobs)		32,507	31,362	31,386	31,555	31,703	31,414
By education level - All sectors - Associates degree or some college (jobs)		24,034	23,469	23,677	23,967	24,165	23,892
By education level - All sectors - Bachelors degree (jobs)		16,486	15,737	15,467	15,291	15,192	14,835
By education level - All sectors - Masters or professional degree (jobs)		3,994	3,789	3,711	3,661	3,648	3,571
By education level - All sectors - Doctoral degree (jobs)		532	502	486	477	475	470
Related work experience - All sectors - None (jobs)		11,065	10,775	10,837	10,925	11,006	10,891
Related work experience - All sectors - Up to 1 year (jobs)		14,801	14,213	14,148	14,209	14,233	14,134
Related work experience - All sectors - 1 to 4 years (jobs)		28,574	27,442	27,312	27,322	27,376	26,951
Related work experience - All sectors - 4 to 10 years (jobs)		18,219	17,693	17,717	17,788	17,870	17,597
Related work experience - All sectors - Over 10 years (jobs)		4,893	4,735	4,713	4,707	4,698	4,608
On-the-Job Training - All sectors - None (jobs)		4,064	3,909	3,862	3,839	3,831	3,792
On-the-Job Training - All sectors - Up to 1 year (jobs)		51,165	49,061	48,737	48,759	48,742	48,016
On-the-Job Training - All sectors - 1 to 4 years (jobs)		16,482	16,088	16,210	16,344	16,485	16,278
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,145	5,108	5,224	5,313	5,430	5,407
On-the-Job Training - All sectors - Over 10 years (jobs)		697	692	694	697	695	689
On-Site or In-Plant Training - All sectors - None (jobs)		12,072	11,714	11,682	11,710	11,723	11,584
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		46,740	44,792	44,502	44,516	44,522	43,861

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		12,750	12,418	12,495	12,593	12,690	12,535
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,354	5,297	5,393	5,460	5,562	5,520
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		637	637	656	673	686	682
Wage income - All (million \$2019)		4,510	4,404	4,452	4,512	4,592	4,578

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	774	716	682	684	705	733
Final energy use - Residential (PJ)	467	430	411	398	391	386	383
Final energy use - Commercial (PJ)	388	385	387	386	389	402	426
Final energy use - Industry (PJ)	792	798	821	830	852	875	887

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		5.28	5.32	8.01	8.36	9.84	10.3

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 (%)	6.94	20.6	21.2	22	22.5	23	23.7
Sales of space heating units - Electric Resistance (%)	9.71	11.3	11.1	10.9	10.7	10.1	9.42
Sales of space heating units - Gas (%)	58.8	38.5	50	56.9	57	57	57.1
Sales of space heating units - Fossil (%)	24.6	29.7	17.7	10.2	9.79	9.79	9.79
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.5	52.4	52.4	52.3
Sales of water heating units - Gas Furnace (%)	58.8	43.5	43.6	43.7	43.7	43.8	43.9
Sales of water heating units - Other (%)	5.73	3.84	3.85	3.85	3.86	3.86	3.87
Sales of cooking units - Electric Resistance (%)	54.8	54.8	54.8	54.8	54.8	54.8	54.8
Sales of cooking units - Gas (%)	45.2	45.2	45.2	45.2	45.2	45.2	45.2
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		10.4	10.9				

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 (%)	2.56	12.8	39.8	61.7	65	65.6	65.5
Sales of space heating units - Electric Resistance (%)	5.59	4.04	8.87	21.3	31.9	33.3	33.6
Sales of space heating units - Gas Furnace (%)	72.4	66.4	38.4	11.1	2.19	0.955	0.868
Sales of space heating units - Fossil (%)	19.4	16.7	13	5.8	0.885	0.071	0
Sales of water heating units - Electric Heat Pump (%)	0.624	0.33	0.331	0.332	0.331	0.334	0.334
Sales of water heating units - Electric Resistance (%)	3.49	1.96	1.94	1.95	1.94	1.94	1.94
Sales of water heating units - Gas Furnace (%)	94.2	96.3	96.3	96.3	96.3	96.2	96.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	1.74	1.38	1.45	1.44	1.45	1.49	1.49
Sales of cooking units - Electric Resistance (%)	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		58,459	60,226				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	3,013	1,428	1,428	1,428	1,428	0
Installed thermal - Natural gas (MW)	18,464	21,955	21,187	23,058	25,826	27,916	29,146
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	4,809	4,809	4,809	4,809
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	86.8	86.8	86.8	86.8	86.8	86.8
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	169	169	169	169	169	169
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-32.9		-14.7				-13.1
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.61		-2.91				-3.02
Business-as-usual carbon sink - Total (Mt CO2e/y)	-34.5		-17.6				-16.2

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285

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 - Total impacted (over 30 years) (1000 hectares)							6,626