



Net-Zero America - Kentucky data

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

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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)		85.9	0.275	0.273	0.256	0.195	0.019
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		18.7	14.5	8.05	6.39	2.78	0.997
Premature deaths from air pollution - Mobile - On-Road (deaths)		138	128	96.5	55.5	25.3	10.1
Premature deaths from air pollution - Gas Stations (deaths)		12.1	10.9	8.12	4.76	2.31	1.11
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.54	5.27	2.49	1.02
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.74	1.39	0.932	0.523	0.212	0.063
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.11	2.77	2.09	1.34	0.676	0.283
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.36	5.87	5.42	4.99	4.52	4.04
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		13.8	12.1	8.98	5.7	3.45	2.19
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.47	1.19	0.887	0.616	0.408	0.255
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.833	0.687	0.552	0.424	0.306	0.198
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.91	1.36	1.29	1.21	1.16	1.1
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		64.1	58.5	51.6	39.2	28.2	17
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		762	2.43	2.42	2.27	1.73	0.168
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		166	129	71.3	56.6	24.6	8.83
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,223	1,135	858	493	225	90.1
Monetary damages from air pollution - Gas Stations (million \$2019)		107	96.7	71.9	42.2	20.5	9.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	84.5	46.7	22	9.02
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.4	12.3	8.26	4.64	1.88	0.561
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		27.6	24.5	18.5	11.8	5.99	2.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		56.3	51.9	48	44.2	40	35.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		122	107	79.5	50.5	30.6	19.4

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)		13	10.5	7.85	5.45	3.61	2.26
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.37	6.08	4.88	3.75	2.71	1.76
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		25.7	12	11.3	10.6	10.3	9.71
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		569	520	458	348	251	151

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		96.7	484	1,257	991	1,105	890
By economic sector - Construction (jobs)		3,515	4,044	4,539	3,999	3,579	4,061
By economic sector - Manufacturing (jobs)		3,386	3,853	4,798	4,404	3,703	4,164
By economic sector - Mining (jobs)		3,343	2,045	1,485	1,026	741	535
By economic sector - Other (jobs)		192	201	253	254	237	309
By economic sector - Pipeline (jobs)		384	485	428	317	312	353
By economic sector - Professional (jobs)		2,162	2,134	2,954	2,574	2,698	2,688
By economic sector - Trade (jobs)		2,011	1,608	1,587	1,369	1,252	1,242
By economic sector - Utilities (jobs)		5,251	5,513	6,118	5,553	4,508	4,961
By resource sector - Biomass (jobs)		295	1,304	3,542	2,961	4,033	3,812
By resource sector - CO2 (jobs)		24.2	1,338	1,452	1,106	1,664	2,392
By resource sector - Coal (jobs)		3,153	589	505	432	384	339
By resource sector - Grid (jobs)		5,655	6,702	8,551	7,326	5,968	6,504
By resource sector - Natural Gas (jobs)		4,926	4,400	3,428	3,561	2,066	1,686
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		4,580	3,754	2,855	2,011	1,414	933
By resource sector - Solar (jobs)		748	912	1,295	1,407	1,368	1,864
By resource sector - Wind (jobs)		959	1,368	1,791	1,683	1,236	1,673
By education level - All sectors - High school diploma or less (jobs)		8,618	8,748	10,291	8,973	7,988	8,415
By education level - All sectors - Associates degree or some college (jobs)		6,292	6,321	7,134	6,308	5,479	5,924
By education level - All sectors - Bachelors degree (jobs)		4,287	4,186	4,709	4,092	3,645	3,812
By education level - All sectors - Masters or professional degree (jobs)		1,012	986	1,133	981	892	923
By education level - All sectors - Doctoral degree (jobs)		131	126	153	132	129	130
Related work experience - All sectors - None (jobs)		2,907	2,965	3,440	3,013	2,674	2,828
Related work experience - All sectors - Up to 1 year (jobs)		3,973	4,029	4,817	4,205	3,809	4,017
Related work experience - All sectors - 1 to 4 years (jobs)		7,467	7,395	8,445	7,369	6,491	6,842
Related work experience - All sectors - 4 to 10 years (jobs)		4,720	4,709	5,296	4,649	4,071	4,350
Related work experience - All sectors - Over 10 years (jobs)		1,274	1,267	1,422	1,250	1,088	1,167
On-the-Job Training - All sectors - None (jobs)		1,063	1,053	1,203	1,049	946	1,001
On-the-Job Training - All sectors - Up to 1 year (jobs)		13,606	13,595	15,827	13,806	12,312	12,933

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)		4,224	4,242	4,751	4,183	3,618	3,901
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,264	1,289	1,428	1,262	1,095	1,191
On-the-Job Training - All sectors - Over 10 years (jobs)		183	187	210	186	162	177
On-Site or In-Plant Training - All sectors - None (jobs)		3,174	3,221	3,752	3,282	2,930	3,095
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		12,387	12,330	14,276	12,460	11,082	11,670
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,295	3,307	3,722	3,272	2,839	3,050
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,318	1,336	1,474	1,299	1,130	1,222
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		166	173	195	174	152	165
Wage income - All (million \$2019)		1,061	1,065	1,223	1,080	963	1,028

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		88.2	77.2	61.2	46.1	34.1	24.3
Oil consumption - Cumulative (million bbls)							1,887
Oil production - Annual (million bbls)		2.93	2.94	2.94	2.33	1.89	1.26
Natural gas consumption - Annual (tcf)		263	222	178	134	84.2	58.4
Natural gas consumption - Cumulative (tcf)							5,358
Natural gas production - Annual (tcf)		96.2	91	79.2	67	53.1	41.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	426	391	344	288	236	205	193
Final energy use - Residential (PJ)	184	171	156	137	121	111	106
Final energy use - Commercial (PJ)	119	118	113	105	99.3	96.6	97
Final energy use - Industry (PJ)	382	396	409	403	409	414	415

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)		3.26	3.36	4.91	5.18	4.05	4.16

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	10.4	368	726	1,977	3,229	4,229	5,229
Vehicle stocks - LDV – All others (1000 units)	4,361	4,152	3,944	2,874	1,804	1,021	237
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		840	2,147	3,490	5,282	5,754	5,483
Public EV charging plugs - DC Fast (1000 units)	0.06		1.72		7.66		12.4
Public EV charging plugs - L2 (1000 units)	0.251		41.4		184		298

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 (%)	26.6	42.5	77.8	85.8	86.2	86.1	86.1
Sales of space heating units - Electric Resistance (%)	26.5	25.4	10.6	7.34	7.19	7.29	7.32
Sales of space heating units - Gas (%)	37.2	20.8	6.32	3.1	2.98	2.95	2.94
Sales of space heating units - Fossil (%)	9.65	11.3	5.2	3.78	3.67	3.61	3.61
Sales of water heating units - Electric Heat Pump (%)	0	8.47	44.9	53	53.3	53.4	53.4
Sales of water heating units - Electric Resistance (%)	62.5	70	49.2	44.5	44.3	44.3	44.3
Sales of water heating units - Gas Furnace (%)	34.2	19.2	3.59	0.151	0	0	0
Sales of water heating units - Other (%)	3.3	2.39	2.36	2.36	2.36	2.37	2.38
Sales of cooking units - Electric Resistance (%)	76.9	81.8	96.9	99.8	100	100	100
Sales of cooking units - Gas (%)	23.1	18.2	3.11	0.157	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.38	3.59				

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 (%)	5.4	31	77.5	91	92.2	92.3	92.3
Sales of space heating units - Electric Resistance (%)	3.11	4.17	4.51	5.9	6.19	6.19	6.21
Sales of space heating units - Gas Furnace (%)	76.4	60.5	17.1	3.03	1.58	1.53	1.52
Sales of space heating units - Fossil (%)	15.1	4.35	0.819	0.034	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.117	10.6	55.7	65.7	66.2	66.2	66.2
Sales of water heating units - Electric Resistance (%)	4.29	9.87	28	32.1	32.3	32.2	32.3
Sales of water heating units - Gas Furnace (%)	94.4	77.9	14.7	0.621	0	0	0
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,650	14,338				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,857	10,932	12,861	12,400	9,318	7,755	8,472
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	45.2	72.8	103	147	208	288	390
Installed renewables - Solar - Base land use assumptions (MW)	68.3	68.3	68.3	68.3	68.3	68.3	145
Installed renewables - Solar - Constrained land use assumptions (MW)	68.3	68.3	68.3	68.3	68.3	68.3	68.3
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	73.6	421	465	465	465
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0.071
Capital invested - Solar PV - Constrained (billion \$2018)		0.091	0	0	0	0.132	0.08

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Constrained (billion \$2018)		0	0.098	0.431	0.052	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
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	5.14	0	0	5.51	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	145	145	145	145	145	145	283
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	145	145	145	145	145	145	145
Wind - Constrained land use assumptions (GWh)	0	0	217	1,055	1,146	1,146	1,146
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	5,771	5,771	5,771	11,950	11,950
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	4	4	4	9	9
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	6	6	8	8
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	1	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	4,717	5,838	0	6,983	0
Biomass purchases (million \$2018/y)		0	227	552	552	902	902

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	5.71	20.1	22.8	35.3	34.1
Annual - BECCS (MMT)		0	5.71	13.2	13	21.4	21.4
Annual - NGCC (MMT)		0	0	6.95	6.44	10.4	9.12
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Cumulative - All (MMT)		0	5.71	25.9	48.6	83.9	118
Cumulative - BECCS (MMT)		0	5.71	18.9	31.9	53.4	74.8
Cumulative - NGCC (MMT)		0	0	6.95	13.4	23.8	33
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	275	359	359	359	359
Spur (km)		0	230	1,031	1,097	2,176	2,477
All (km)		0	505	1,390	1,455	2,534	2,836
Cumulative investment - Trunk (million \$2018)		0	1,440	1,954	1,954	1,954	1,954
Cumulative investment - Spur (million \$2018)		0	284	929	966	1,808	2,046
Cumulative investment - All (million \$2018)		0	1,724	2,883	2,920	3,762	4,000

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	1.1	1.76	3.61	5.16	6.52
Injection wells (wells)		0	1	4	7	12	15
Resource characterization, appraisal, permitting costs (million \$2020)		45.8	128	165	165	165	165
Wells and facilities construction costs (million \$2020)		0	30.5	119	212	354	439

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)							-48.5
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,490

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,665
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,200
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999

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 - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668

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)							-432
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,618
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-67.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,118

Table 16: 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)							-432
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,963
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-136
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-5,532
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,187
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							124
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,498
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,250
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							247
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,685

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)		85.9	0.275	0.273	0.256	0.195	0.019
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		16.1	9.67	3.71	1.59	0.547	0.312
Premature deaths from air pollution - Mobile - On-Road (deaths)		140	141	136	122	96.8	66.2
Premature deaths from air pollution - Gas Stations (deaths)		12.3	12.2	11.6	10.3	8.05	5.51
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	15.5	13.4	10.9	8.07	5.29
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.77	1.66	1.55	1.33	0.968	0.608
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.15	3.1	3	2.69	2.09	1.44
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.36	5.87	5.42	4.99	4.52	4.04
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		13.9	13.6	12.8	11.3	9.01	6.62

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.48	1.31	1.15	0.967	0.779	0.606
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.833	0.737	0.647	0.561	0.479	0.404
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.81	1.36	1.3	1.23	1.17	1.06
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		64	56.3	47.3	40.2	34.6	23.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		762	2.43	2.42	2.27	1.73	0.168
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		142	85.7	32.8	14.1	4.84	2.76
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,243	1,249	1,211	1,086	860	589
Monetary damages from air pollution - Gas Stations (million \$2019)		109	108	103	90.9	71.3	48.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		154	137	119	96.5	71.5	46.9
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.7	14.7	13.7	11.8	8.58	5.38
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		27.9	27.4	26.6	23.8	18.5	12.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		56.3	51.9	48	44.2	40	35.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		123	120	114	99.8	79.8	58.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		13.1	11.6	10.2	8.56	6.9	5.37
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.37	6.52	5.73	4.96	4.24	3.58
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		24.8	12	11.5	10.8	10.3	9.38
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		568	500	420	357	307	210

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		104	1,572	2,258	1,748	1,542	890
By economic sector - Construction (jobs)		3,105	3,743	4,732	4,473	4,787	4,758
By economic sector - Manufacturing (jobs)		3,371	4,140	4,892	4,943	5,162	5,333
By economic sector - Mining (jobs)		3,395	2,086	1,629	1,268	1,021	741
By economic sector - Other (jobs)		160	158	247	268	281	301
By economic sector - Pipeline (jobs)		385	591	552	434	495	587
By economic sector - Professional (jobs)		1,981	2,974	4,262	4,323	4,045	2,708

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		1,996	1,642	2,030	2,059	1,851	1,335
By economic sector - Utilities (jobs)		4,426	4,528	5,656	5,353	5,738	5,575
By resource sector - Biomass (jobs)		307	4,202	7,433	7,292	6,568	3,682
By resource sector - CO2 (jobs)		24.5	2,274	2,494	1,912	2,854	4,080
By resource sector - Coal (jobs)		3,473	789	513	443	385	321
By resource sector - Grid (jobs)		4,519	4,411	6,787	6,599	7,328	6,374
By resource sector - Natural Gas (jobs)		4,185	3,410	2,949	2,907	2,182	1,709
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		4,621	3,964	3,411	2,833	2,264	1,510
By resource sector - Solar (jobs)		782	950	1,083	1,245	1,518	1,907
By resource sector - Wind (jobs)		1,012	1,433	1,588	1,638	1,823	2,648
By education level - All sectors - High school diploma or less (jobs)		8,050	9,447	11,688	10,890	10,920	9,760
By education level - All sectors - Associates degree or some college (jobs)		5,794	6,305	7,640	7,291	7,434	6,909
By education level - All sectors - Bachelors degree (jobs)		4,017	4,448	5,391	5,197	5,118	4,386
By education level - All sectors - Masters or professional degree (jobs)		940	1,078	1,336	1,290	1,260	1,035
By education level - All sectors - Doctoral degree (jobs)		123	155	203	200	190	140
Related work experience - All sectors - None (jobs)		2,690	3,143	3,886	3,659	3,668	3,272
Related work experience - All sectors - Up to 1 year (jobs)		3,723	4,449	5,599	5,287	5,273	4,616
Related work experience - All sectors - 1 to 4 years (jobs)		6,956	7,766	9,434	8,905	8,900	7,917
Related work experience - All sectors - 4 to 10 years (jobs)		4,369	4,794	5,801	5,540	5,586	5,058
Related work experience - All sectors - Over 10 years (jobs)		1,185	1,281	1,538	1,479	1,496	1,367
On-the-Job Training - All sectors - None (jobs)		997	1,122	1,390	1,338	1,326	1,151
On-the-Job Training - All sectors - Up to 1 year (jobs)		12,735	14,665	18,074	17,101	17,016	14,925
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,882	4,211	5,058	4,787	4,888	4,559
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,139	1,243	1,509	1,424	1,469	1,381
On-the-Job Training - All sectors - Over 10 years (jobs)		171	190	227	218	223	213
On-Site or In-Plant Training - All sectors - None (jobs)		2,955	3,478	4,288	4,064	4,049	3,575
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		11,584	13,170	16,193	15,337	15,294	13,480
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,038	3,315	3,993	3,776	3,844	3,562
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,195	1,301	1,575	1,491	1,528	1,420
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		150	168	208	200	206	192
Wage income - All (million \$2019)		985	1,109	1,363	1,307	1,324	1,189

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	427	394	360	333	312	287	259
Final energy use - Residential (PJ)	184	172	163	153	142	129	118
Final energy use - Commercial (PJ)	119	119	117	114	110	106	103
Final energy use - Industry (PJ)	382	396	410	408	416	420	420

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)		2.71	2.75	3.26	3.36	4.25	4.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	8.06	113	218	706	1,193	2,271	3,349
Vehicle stocks - LDV – All others (1000 units)	4,378	4,378	4,378	4,153	3,928	3,027	2,126
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	135	286	962	3,037	4,422
Public EV charging plugs - DC Fast (1000 units)	0.06		0.518		2.83		7.94
Public EV charging plugs - L2 (1000 units)	0.251		12.5		68		191

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 (%)	26.6	35.6	39.7	51.4	69.2	80.7	84.7
Sales of space heating units - Electric Resistance (%)	26.5	28.2	26.4	21.5	14.1	9.46	7.83
Sales of space heating units - Gas (%)	37.2	23.6	22	17.4	10.1	5.25	3.56
Sales of space heating units - Fossil (%)	9.65	12.5	11.9	9.77	6.6	4.55	3.88
Sales of water heating units - Electric Heat Pump (%)	0	1.46	5.6	17.5	35.8	47.8	51.9
Sales of water heating units - Electric Resistance (%)	62.5	74	71.8	64.8	54.3	47.5	45.1
Sales of water heating units - Gas Furnace (%)	34.2	22.2	20.3	15.3	7.52	2.39	0.624
Sales of water heating units - Other (%)	3.3	2.39	2.37	2.38	2.39	2.38	2.38
Sales of cooking units - Electric Resistance (%)	76.8	77.4	79.5	85.1	92.9	97.7	99.4
Sales of cooking units - Gas (%)	23.2	22.6	20.5	14.9	7.09	2.29	0.616
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.35	3.47				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.4	22.1	27.3	42.8	66.9	83.6	89.9
Sales of space heating units - Electric Resistance (%)	3.11	4.17	4.24	4.4	4.84	5.52	5.99
Sales of space heating units - Gas Furnace (%)	76.4	68.7	63.8	49.5	26.6	10.3	3.94
Sales of space heating units - Fossil (%)	15.1	5.03	4.61	3.36	1.65	0.539	0.139
Sales of water heating units - Electric Heat Pump (%)	0.117	1.95	7.08	21.8	44.5	59.3	64.4
Sales of water heating units - Electric Resistance (%)	4.29	6.36	8.3	14.3	23.5	29.4	31.5
Sales of water heating units - Gas Furnace (%)	94.4	90.1	83.1	62.2	30.5	9.74	2.54
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,642	14,325				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,857	7,886	7,313	7,569	5,648	6,366	6,846
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0

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)							-48.5
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,490
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,665

Table 25: E- 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)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,200
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363

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 - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668

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)							-432
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,618
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-67.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,118
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-432
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,963
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-136
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-5,532

Table 26: E- 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)							188
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,187
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							124
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,498
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,250
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							247
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,685

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)		85.9	0.275	0.273	0.256	0.195	0.019
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		15.6	11.1	6.16	3.78	1.16	0.366
Premature deaths from air pollution - Mobile - On-Road (deaths)		138	128	96.5	55.5	25.3	10.1
Premature deaths from air pollution - Gas Stations (deaths)		12.1	10.9	8.12	4.76	2.31	1.11
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.54	5.27	2.49	1.02
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.74	1.39	0.932	0.523	0.212	0.063
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.11	2.77	2.09	1.34	0.676	0.283
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.36	5.87	5.42	4.99	4.52	4.04
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		13.8	12.1	8.98	5.7	3.45	2.19
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.47	1.19	0.887	0.616	0.408	0.255
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.833	0.687	0.552	0.424	0.306	0.198
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		3.15	1.36	1.28	1.2	1.16	1.02

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		63	57.6	48.2	33.8	20.1	2.86
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		762	2.43	2.42	2.27	1.73	0.168
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		138	98.7	54.6	33.5	10.3	3.25
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,223	1,135	858	493	225	90.1
Monetary damages from air pollution - Gas Stations (million \$2019)		107	96.7	71.9	42.2	20.5	9.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	84.5	46.7	22	9.02
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.4	12.3	8.26	4.64	1.88	0.561
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		27.6	24.5	18.5	11.8	5.99	2.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		56.3	51.9	48	44.2	40	35.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		122	107	79.5	50.5	30.6	19.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		13	10.5	7.85	5.45	3.61	2.26
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.37	6.08	4.88	3.75	2.71	1.76
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		27.8	12	11.3	10.6	10.3	8.97
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		559	512	428	300	178	25.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		96.9	135	1,157	913	943	893
By economic sector - Construction (jobs)		3,162	2,841	3,398	2,965	2,949	6,619
By economic sector - Manufacturing (jobs)		3,524	4,110	5,839	5,954	6,874	7,836
By economic sector - Mining (jobs)		3,413	1,976	1,349	847	499	169
By economic sector - Other (jobs)		167	151	218	220	320	1,243
By economic sector - Pipeline (jobs)		375	317	229	153	89.7	27.1
By economic sector - Professional (jobs)		1,982	1,393	2,509	2,311	2,503	4,231
By economic sector - Trade (jobs)		1,945	1,381	1,366	1,196	1,171	2,258
By economic sector - Utilities (jobs)		4,527	3,613	4,490	4,003	3,514	6,510
By resource sector - Biomass (jobs)		282	348	3,087	2,952	3,505	3,938
By resource sector - CO2 (jobs)		0	0	0	0.001	0.001	0
By resource sector - Coal (jobs)		3,336	589	504	431	383	298
By resource sector - Grid (jobs)		4,807	4,774	7,022	5,819	5,644	11,318
By resource sector - Natural Gas (jobs)		4,260	3,640	2,799	2,672	1,645	1,960
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		4,581	3,719	2,766	1,809	1,039	48.8

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Solar (jobs)		830	1,251	1,868	2,231	3,695	8,205
By resource sector - Wind (jobs)		1,096	1,596	2,510	2,649	2,950	4,019
By education level - All sectors - High school diploma or less (jobs)		8,189	6,827	9,086	8,165	8,325	12,952
By education level - All sectors - Associates degree or some college (jobs)		5,889	4,914	6,184	5,642	5,722	9,362
By education level - All sectors - Bachelors degree (jobs)		4,045	3,327	4,172	3,762	3,809	5,861
By education level - All sectors - Masters or professional degree (jobs)		946	755	981	876	884	1,412
By education level - All sectors - Doctoral degree (jobs)		123	93.1	131	118	122	199
Related work experience - All sectors - None (jobs)		2,728	2,282	2,985	2,691	2,724	4,343
Related work experience - All sectors - Up to 1 year (jobs)		3,787	3,163	4,310	3,912	4,066	6,316
Related work experience - All sectors - 1 to 4 years (jobs)		7,048	5,780	7,398	6,643	6,699	10,565
Related work experience - All sectors - 4 to 10 years (jobs)		4,425	3,671	4,591	4,155	4,187	6,727
Related work experience - All sectors - Over 10 years (jobs)		1,203	1,020	1,271	1,160	1,185	1,835
On-the-Job Training - All sectors - None (jobs)		1,006	834	1,060	961	990	1,592
On-the-Job Training - All sectors - Up to 1 year (jobs)		12,910	10,722	14,102	12,747	13,039	20,050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,946	3,272	4,066	3,669	3,671	6,057
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,156	934	1,135	1,007	974	1,796
On-the-Job Training - All sectors - Over 10 years (jobs)		174	154	192	178	187	290
On-Site or In-Plant Training - All sectors - None (jobs)		2,992	2,516	3,325	3,018	3,101	4,876
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		11,748	9,724	12,674	11,450	11,687	18,087
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,088	2,565	3,208	2,893	2,905	4,744
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,211	982	1,184	1,052	1,019	1,826
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		153	130	164	150	150	253
Wage income - All (million \$2019)		997	828	1,060	961	972	1,556

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	426	391	344	288	236	205	193
Final energy use - Residential (PJ)	184	171	156	137	121	111	106
Final energy use - Commercial (PJ)	119	118	113	105	99.3	96.6	97
Final energy use - Industry (PJ)	382	396	409	403	409	414	415

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)		3.26	3.36	4.91	5.18	4.05	4.16

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	10.4	368	726	1,977	3,229	4,229	5,229
Vehicle stocks - LDV – All others (1000 units)	4,361	4,152	3,944	2,874	1,804	1,021	237
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		840	2,147	3,490	5,282	5,754	5,483
Public EV charging plugs - DC Fast (1000 units)	0.06		1.72		7.66		12.4
Public EV charging plugs - L2 (1000 units)	0.251		41.4		184		298

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 (%)	26.6	42.5	77.8	85.8	86.2	86.1	86.1
Sales of space heating units - Electric Resistance (%)	26.5	25.4	10.6	7.34	7.19	7.29	7.32
Sales of space heating units - Gas (%)	37.2	20.8	6.32	3.1	2.98	2.95	2.94
Sales of space heating units - Fossil (%)	9.65	11.3	5.2	3.78	3.67	3.61	3.61
Sales of water heating units - Electric Heat Pump (%)	0	8.47	44.9	53	53.3	53.4	53.4
Sales of water heating units - Electric Resistance (%)	62.5	70	49.2	44.5	44.3	44.3	44.3
Sales of water heating units - Gas Furnace (%)	34.2	19.2	3.59	0.151	0	0	0
Sales of water heating units - Other (%)	3.3	2.39	2.36	2.36	2.36	2.37	2.38
Sales of cooking units - Electric Resistance (%)	76.9	81.8	96.9	99.8	100	100	100
Sales of cooking units - Gas (%)	23.1	18.2	3.11	0.157	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.38	3.59				

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 (%)	5.4	31	77.5	91	92.2	92.3	92.3
Sales of space heating units - Electric Resistance (%)	3.11	4.17	4.51	5.9	6.19	6.19	6.21
Sales of space heating units - Gas Furnace (%)	76.4	60.5	17.1	3.03	1.58	1.53	1.52
Sales of space heating units - Fossil (%)	15.1	4.35	0.819	0.034	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.117	10.6	55.7	65.7	66.2	66.2	66.2
Sales of water heating units - Electric Resistance (%)	4.29	9.87	28	32.1	32.3	32.2	32.3
Sales of water heating units - Gas Furnace (%)	94.4	77.9	14.7	0.621	0	0	0
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,650	14,338				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,898	8,899	8,582	8,821	5,442	6,089	11,096
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Rooftop PV (MW)	45.2	72.8	103	147	208	288	390
Installed renewables - Solar - Base land use assumptions (MW)	68.3	68.3	68.3	68.3	68.3	597	6,284
Installed renewables - Wind - Base land use assumptions (MW)	0	0	0	0	256	359	524
Installed renewables - Solar - Constrained land use assumptions (MW)	68.4	68.4	68.4	68.4	68.4	799	6,559
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	73.6	465	465	465	465
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0.519	5.27
Capital invested - Wind - Base (billion \$2018)		0	0	0	0.302	0.116	0.175

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	145	145	145	145	145	1,075	11,440
Wind - Base land use assumptions (GWh)	0	0	0	0	623	860	1,310
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	289	289	289	289	289	2,876	23,756
Wind - Constrained land use assumptions (GWh)	0	0	433	2,292	2,292	2,292	2,292
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)							-48.5
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,490
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,665
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,200
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-432
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,618
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-67.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,118
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-432
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,963
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-136
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-5,532
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,187
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							124
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,498
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,250
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							247
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,685

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)		85.9	0.275	0.273	0.256	0.195	0.019
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		15.7	10.3	13.2	9.81	3.29	1.01
Premature deaths from air pollution - Mobile - On-Road (deaths)		138	128	96.5	55.5	25.3	10.1
Premature deaths from air pollution - Gas Stations (deaths)		12.1	10.9	8.12	4.76	2.31	1.11

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.54	5.27	2.49	1.02
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.74	1.39	0.932	0.523	0.212	0.063
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.11	2.77	2.09	1.34	0.676	0.283
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.36	5.87	5.42	4.99	4.52	4.04
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		13.8	12.1	8.98	5.7	3.45	2.19
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.47	1.19	0.887	0.616	0.408	0.255
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.833	0.687	0.552	0.424	0.306	0.198
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.67	1.36	1.28	1.21	1.16	1.02
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		64.9	61.1	58.2	48	39	28.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		762	2.43	2.42	2.27	1.73	0.168
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		140	91.6	117	86.9	29.1	8.96
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,223	1,135	858	493	225	90.1
Monetary damages from air pollution - Gas Stations (million \$2019)		107	96.7	71.9	42.2	20.5	9.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	84.5	46.7	22	9.02
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.4	12.3	8.26	4.64	1.88	0.561
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		27.6	24.5	18.5	11.8	5.99	2.51
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		56.3	51.9	48	44.2	40	35.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		122	107	79.5	50.5	30.6	19.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		13	10.5	7.85	5.45	3.61	2.26
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.37	6.08	4.88	3.75	2.71	1.76
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		23.5	12	11.3	10.6	10.3	8.97

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		577	542	516	426	346	250

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		102	1,689	2,290	1,413	1,242	888
By economic sector - Construction (jobs)		2,998	4,094	5,638	5,064	6,446	8,052
By economic sector - Manufacturing (jobs)		2,900	3,003	3,408	3,171	3,306	3,315
By economic sector - Mining (jobs)		3,260	2,120	1,649	1,214	962	740
By economic sector - Other (jobs)		150	171	292	290	366	459
By economic sector - Pipeline (jobs)		393	648	628	493	554	673
By economic sector - Professional (jobs)		1,855	3,054	4,648	3,726	4,977	6,078
By economic sector - Trade (jobs)		1,840	1,636	2,142	1,817	2,189	2,592
By economic sector - Utilities (jobs)		4,177	5,138	7,133	6,822	15,045	25,315
By resource sector - Biomass (jobs)		285	4,312	7,778	5,236	4,866	3,702
By resource sector - CO2 (jobs)		24.7	2,581	2,829	2,151	3,211	4,604
By resource sector - Coal (jobs)		2,973	587	504	431	384	298
By resource sector - Grid (jobs)		4,109	4,765	9,052	8,592	11,051	13,183
By resource sector - Natural Gas (jobs)		4,322	4,377	3,782	4,239	4,209	3,598
By resource sector - Nuclear (jobs)		0	0	0	0	8,633	20,291
By resource sector - Oil (jobs)		4,579	3,754	2,855	2,011	1,458	1,080
By resource sector - Solar (jobs)		642	616	624	698	744	982
By resource sector - Wind (jobs)		738	562	403	653	530	377
By education level - All sectors - High school diploma or less (jobs)		7,492	9,506	12,309	10,463	12,101	13,536
By education level - All sectors - Associates degree or some college (jobs)		5,409	6,369	8,205	7,290	8,851	10,339
By education level - All sectors - Bachelors degree (jobs)		3,769	4,427	5,662	4,863	5,863	6,773
By education level - All sectors - Masters or professional degree (jobs)		887	1,093	1,435	1,217	1,498	1,751
By education level - All sectors - Doctoral degree (jobs)		117	158	218	178	225	268
Related work experience - All sectors - None (jobs)		2,518	3,188	4,147	3,566	4,199	4,761
Related work experience - All sectors - Up to 1 year (jobs)		3,454	4,432	5,840	4,934	5,745	6,447
Related work experience - All sectors - 1 to 4 years (jobs)		6,501	7,827	10,019	8,638	10,280	11,784
Related work experience - All sectors - 4 to 10 years (jobs)		4,093	4,840	6,212	5,451	6,602	7,691
Related work experience - All sectors - Over 10 years (jobs)		1,107	1,266	1,611	1,422	1,712	1,986
On-the-Job Training - All sectors - None (jobs)		933	1,119	1,463	1,253	1,488	1,704
On-the-Job Training - All sectors - Up to 1 year (jobs)		11,860	14,629	18,916	16,136	18,966	21,454
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,641	4,294	5,487	4,868	5,913	6,924
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,081	1,326	1,732	1,551	1,926	2,301
On-the-Job Training - All sectors - Over 10 years (jobs)		160	185	231	204	245	286
On-Site or In-Plant Training - All sectors - None (jobs)		2,761	3,479	4,503	3,849	4,592	5,271
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		10,793	13,157	17,003	14,563	17,145	19,433

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		2,845	3,367	4,306	3,800	4,583	5,333
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,134	1,376	1,787	1,593	1,965	2,334
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		141	174	229	206	253	298
Wage income - All (million \$2019)		924	1,124	1,460	1,280	1,548	1,800

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	426	391	344	288	236	205	193
Final energy use - Residential (PJ)	184	171	156	137	121	111	106
Final energy use - Commercial (PJ)	119	118	113	105	99.3	96.6	97
Final energy use - Industry (PJ)	382	396	409	403	409	414	415

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)		3.26	3.36	4.91	5.18	4.05	4.16

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	10.4	368	726	1,977	3,229	4,229	5,229
Vehicle stocks - LDV – All others (1000 units)	4,361	4,152	3,944	2,874	1,804	1,021	237
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		840	2,147	3,490	5,282	5,754	5,483
Public EV charging plugs - DC Fast (1000 units)	0.06		1.72		7.66		12.4
Public EV charging plugs - L2 (1000 units)	0.251		41.4		184		298

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 (%)	26.6	42.5	77.8	85.8	86.2	86.1	86.1
Sales of space heating units - Electric Resistance (%)	26.5	25.4	10.6	7.34	7.19	7.29	7.32
Sales of space heating units - Gas (%)	37.2	20.8	6.32	3.1	2.98	2.95	2.94
Sales of space heating units - Fossil (%)	9.65	11.3	5.2	3.78	3.67	3.61	3.61
Sales of water heating units - Electric Heat Pump (%)	0	8.47	44.9	53	53.3	53.4	53.4
Sales of water heating units - Electric Resistance (%)	62.5	70	49.2	44.5	44.3	44.3	44.3
Sales of water heating units - Gas Furnace (%)	34.2	19.2	3.59	0.151	0	0	0
Sales of water heating units - Other (%)	3.3	2.39	2.36	2.36	2.36	2.37	2.38
Sales of cooking units - Electric Resistance (%)	76.9	81.8	96.9	99.8	100	100	100
Sales of cooking units - Gas (%)	23.1	18.2	3.11	0.157	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.38	3.59				

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 (%)	5.4	31	77.5	91	92.2	92.3	92.3
Sales of space heating units - Electric Resistance (%)	3.11	4.17	4.51	5.9	6.19	6.19	6.21
Sales of space heating units - Gas Furnace (%)	76.4	60.5	17.1	3.03	1.58	1.53	1.52
Sales of space heating units - Fossil (%)	15.1	4.35	0.819	0.034	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.117	10.6	55.7	65.7	66.2	66.2	66.2
Sales of water heating units - Electric Resistance (%)	4.29	9.87	28	32.1	32.3	32.2	32.3
Sales of water heating units - Gas Furnace (%)	94.4	77.9	14.7	0.621	0	0	0
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,650	14,338				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,857	7,420	7,288	9,318	10,224	15,250	13,296
Installed thermal - Nuclear (MW)	0	0	0	0	0	3,742	11,906
Installed renewables - Rooftop PV (MW)	45.2	72.8	103	147	208	288	390
Installed renewables - Solar - Base land use assumptions (MW)	68.3	68.3	68.3	68.3	68.3	68.3	68.3
Installed renewables - Solar - Constrained land use assumptions (MW)	68.4	68.4	68.4	68.4	68.4	68.4	68.4
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - 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)	145	145	145	145	145	145	145
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	145	145	145	145	145	145	145
Wind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
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)							-48.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,490
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,665
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,200
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668

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)							-432
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,618
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-67.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,118
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-432
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,963
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-136
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-5,532
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							188
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,187
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							124
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,498
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							188

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,250
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							247
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,685

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)		85.9	0.275	0.273	0.256	0.195	0.019
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		16.3	9.35	5.14	3.22	1.62	0.626
Premature deaths from air pollution - Mobile - On-Road (deaths)		140	141	136	122	96.8	66.2
Premature deaths from air pollution - Gas Stations (deaths)		12.3	12.2	11.6	10.3	8.05	5.51
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	15.5	13.4	10.9	8.07	5.29
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.77	1.66	1.55	1.33	0.968	0.608
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.15	3.1	3	2.69	2.09	1.44
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.36	5.87	5.42	4.99	4.52	4.04
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		13.9	13.6	12.8	11.3	9.01	6.62
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.48	1.31	1.15	0.967	0.779	0.606
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.833	0.737	0.647	0.561	0.479	0.404
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.9	1.36	1.3	1.23	1.18	1.11
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		64	56.3	47.3	40.2	34.6	23.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		762	2.43	2.42	2.27	1.73	0.168
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		144	82.8	45.5	28.5	14.3	5.55
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,243	1,249	1,211	1,086	860	589
Monetary damages from air pollution - Gas Stations (million \$2019)		109	108	103	90.9	71.3	48.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		154	137	119	96.5	71.5	46.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.7	14.7	13.7	11.8	8.58	5.38
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		27.9	27.4	26.6	23.8	18.5	12.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		56.3	51.9	48	44.2	40	35.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		123	120	114	99.8	79.8	58.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		13.1	11.6	10.2	8.56	6.9	5.37
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.37	6.52	5.73	4.96	4.24	3.58
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		25.6	12	11.5	10.8	10.4	9.81
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		568	500	420	357	307	210

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		101	3,497	1,665	1,532	1,762	1,634
By economic sector - Construction (jobs)		3,021	4,194	4,528	4,164	4,721	5,241
By economic sector - Manufacturing (jobs)		3,375	4,882	4,289	3,726	4,228	5,028
By economic sector - Mining (jobs)		3,341	2,082	1,638	1,311	1,040	720
By economic sector - Other (jobs)		155	194	227	243	279	340
By economic sector - Pipeline (jobs)		382	597	563	446	500	592
By economic sector - Professional (jobs)		1,908	5,170	3,496	3,915	4,695	4,457
By economic sector - Trade (jobs)		1,894	1,992	1,861	1,964	2,067	1,844
By economic sector - Utilities (jobs)		4,249	5,062	5,434	4,964	5,442	5,909
By resource sector - Biomass (jobs)		300	9,385	5,565	6,370	8,152	7,717
By resource sector - CO2 (jobs)		24.4	2,328	2,559	1,980	2,943	4,155
By resource sector - Coal (jobs)		3,144	591	513	444	395	344
By resource sector - Grid (jobs)		4,216	5,380	6,452	5,810	6,944	7,143
By resource sector - Natural Gas (jobs)		4,293	3,601	2,869	2,933	1,842	1,365
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		4,622	3,964	3,411	2,926	2,277	1,445
By resource sector - Solar (jobs)		773	940	956	950	1,111	1,856
By resource sector - Wind (jobs)		1,053	1,481	1,375	852	1,073	1,739
By education level - All sectors - High school diploma or less (jobs)		7,837	12,453	10,485	9,722	10,798	11,288
By education level - All sectors - Associates degree or some college (jobs)		5,641	7,725	7,010	6,522	7,227	7,699
By education level - All sectors - Bachelors degree (jobs)		3,914	5,780	4,846	4,671	5,187	5,264
By education level - All sectors - Masters or professional degree (jobs)		915	1,475	1,185	1,168	1,312	1,311
By education level - All sectors - Doctoral degree (jobs)		120	236	174	182	211	203
Related work experience - All sectors - None (jobs)		2,620	4,096	3,501	3,285	3,649	3,803

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - Up to 1 year (jobs)		3,625	6,011	4,972	4,697	5,290	5,509
Related work experience - All sectors - 1 to 4 years (jobs)		6,770	10,009	8,527	7,992	8,826	9,145
Related work experience - All sectors - 4 to 10 years (jobs)		4,254	5,981	5,295	4,978	5,513	5,772
Related work experience - All sectors - Over 10 years (jobs)		1,157	1,573	1,405	1,315	1,458	1,536
On-the-Job Training - All sectors - None (jobs)		970	1,457	1,249	1,202	1,345	1,382
On-the-Job Training - All sectors - Up to 1 year (jobs)		12,399	19,368	16,172	15,256	16,983	17,556
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,782	5,127	4,661	4,306	4,746	5,049
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,107	1,489	1,409	1,310	1,448	1,546
On-the-Job Training - All sectors - Over 10 years (jobs)		168	228	208	192	213	231
On-Site or In-Plant Training - All sectors - None (jobs)		2,880	4,601	3,835	3,623	4,039	4,197
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		11,277	17,227	14,539	13,700	15,239	15,782
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		2,959	4,074	3,668	3,392	3,740	3,966
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,162	1,563	1,466	1,371	1,514	1,603
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		146	204	192	180	202	217
Wage income - All (million \$2019)		959	1,419	1,235	1,178	1,320	1,382

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	427	394	360	333	312	287	259
Final energy use - Residential (PJ)	184	172	163	153	142	129	118
Final energy use - Commercial (PJ)	119	119	117	114	110	106	103
Final energy use - Industry (PJ)	382	396	410	408	416	420	420

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)		2.71	2.75	3.26	3.36	4.25	4.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	8.06	113	218	706	1,193	2,271	3,349
Vehicle stocks - LDV – All others (1000 units)	4,378	4,378	4,378	4,153	3,928	3,027	2,126
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	135	286	962	3,037	4,422
Public EV charging plugs - DC Fast (1000 units)	0.06		0.518		2.83		7.94
Public EV charging plugs - L2 (1000 units)	0.251		12.5		68		191

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 (%)	26.6	35.6	39.7	51.4	69.2	80.7	84.7
Sales of space heating units - Electric Resistance (%)	26.5	28.2	26.4	21.5	14.1	9.46	7.83
Sales of space heating units - Gas (%)	37.2	23.6	22	17.4	10.1	5.25	3.56
Sales of space heating units - Fossil (%)	9.65	12.5	11.9	9.77	6.6	4.55	3.88
Sales of water heating units - Electric Heat Pump (%)	0	1.46	5.6	17.5	35.8	47.8	51.9
Sales of water heating units - Electric Resistance (%)	62.5	74	71.8	64.8	54.3	47.5	45.1
Sales of water heating units - Gas Furnace (%)	34.2	22.2	20.3	15.3	7.52	2.39	0.624
Sales of water heating units - Other (%)	3.3	2.39	2.37	2.38	2.39	2.38	2.38
Sales of cooking units - Electric Resistance (%)	76.8	77.4	79.5	85.1	92.9	97.7	99.4
Sales of cooking units - Gas (%)	23.2	22.6	20.5	14.9	7.09	2.29	0.616
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.35	3.47				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.4	22.1	27.3	42.8	66.9	83.6	89.9
Sales of space heating units - Electric Resistance (%)	3.11	4.17	4.24	4.4	4.84	5.52	5.99
Sales of space heating units - Gas Furnace (%)	76.4	68.7	63.8	49.5	26.6	10.3	3.94
Sales of space heating units - Fossil (%)	15.1	5.03	4.61	3.36	1.65	0.539	0.139
Sales of water heating units - Electric Heat Pump (%)	0.117	1.95	7.08	21.8	44.5	59.3	64.4
Sales of water heating units - Electric Resistance (%)	4.29	6.36	8.3	14.3	23.5	29.4	31.5
Sales of water heating units - Gas Furnace (%)	94.4	90.1	83.1	62.2	30.5	9.74	2.54
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,642	14,325				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	1,493	0	0	0	0	0
Installed thermal - Natural gas (MW)	7,895	8,691	7,445	8,410	5,666	4,674	4,549
Installed thermal - Nuclear (MW)	0	0	0	0	0	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	0.018	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	31.9	0	7.92	5.72	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	35,757	35,757	44,647	51,069	51,069

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	18	18

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	29	29	36	40	40
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	5	6
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	29,223	0	7,265	9,733	1,101
Biomass purchases (million \$2018/y)		0	2,298	2,298	2,870	3,689	3,789

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	35.4	35.4	47.5	59.7	61.2
Annual - BECCS (MMT)		0	35.4	35.4	44.2	56.3	57.5
Annual - NGCC (MMT)		0	0	0	0	0	0.14
Annual - Cement and lime (MMT)		0	0	0	3.32	3.42	3.53
Cumulative - All (MMT)		0	35.4	70.8	118	178	239
Cumulative - BECCS (MMT)		0	35.4	70.8	115	171	229
Cumulative - NGCC (MMT)		0	0	0	0	0	0.14
Cumulative - Cement and lime (MMT)		0	0	0	3.32	6.74	10.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	275	359	442	442	442
Spur (km)		0	1,225	1,225	1,195	2,322	2,931
All (km)		0	1,500	1,584	1,637	2,764	3,373
Cumulative investment - Trunk (million \$2018)		0	1,525	2,123	2,827	2,827	2,827
Cumulative investment - Spur (million \$2018)		0	1,678	1,677	1,686	2,774	3,438
Cumulative investment - All (million \$2018)		0	3,203	3,800	4,513	5,600	6,265

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	1.85	6.42	13.1	17.7	18.4
Injection wells (wells)		0	3	12	21	35	44
Resource characterization, appraisal, permitting costs (million \$2020)		45.8	201	311	311	311	311
Wells and facilities construction costs (million \$2020)		0	91.4	356	635	1,062	1,318

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)							-48.5
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,490
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,665
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,200

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-971
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,418
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-62.1
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,451
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-971
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,584
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-124
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)							-5,680

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							395
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,086
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							113
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							92.2
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							432
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,118
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							395
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							5,086
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							226
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							92.2
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							432
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							6,231

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)		222	159	134	121	116	113
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		15.2	19.9	21.8	28.2	22.5	19.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		140	142	145	149	152	155
Premature deaths from air pollution - Gas Stations (deaths)		12.3	12.3	12.4	12.5	12.5	12.5
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.1	15.3	13.7	12.6	12	11.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.71	1.41	0.987	0.608	0.324	0.174
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		2.97	2.84	2.76	2.71	2.64	2.54
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.64	6.42	6.22	6.03	5.76	5.45

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		14	13.5	12.2	10.7	9.79	9.65
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.52	1.45	1.34	1.22	1.13	1.07
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.87	0.874	0.88	0.883	0.886	0.892
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.69	3.92	3.12	2.86	2.66	2.41
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		64.3	66.1	65.9	61.4	59.4	54.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,971	1,411	1,189	1,069	1,026	1,006
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		134	177	193	250	199	173
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,243	1,267	1,291	1,321	1,351	1,382
Monetary damages from air pollution - Gas Stations (million \$2019)		109	109	109	110	111	111
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		152	136	121	112	106	102
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		15.1	12.5	8.75	5.39	2.87	1.54
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		26.3	25.2	24.4	24	23.4	22.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		58.8	56.8	55.1	53.3	51	48.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		124	120	108	94.7	86.6	85.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		13.5	12.9	11.9	10.8	9.97	9.47
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		7.7	7.74	7.79	7.82	7.85	7.89
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		50.2	34.6	27.6	25.2	23.5	21.3
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		571	587	585	546	528	481

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		98.7	94.9	94.5	88.3	88.3	90.5
By economic sector - Construction (jobs)		3,584	4,374	4,614	4,936	4,324	4,702
By economic sector - Manufacturing (jobs)		2,321	2,564	2,596	2,809	2,424	2,417
By economic sector - Mining (jobs)		4,857	3,444	2,650	2,007	1,672	1,365

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		176	244	262	302	260	324
By economic sector - Pipeline (jobs)		393	407	412	393	398	398
By economic sector - Professional (jobs)		2,502	2,467	2,370	2,378	1,859	1,930
By economic sector - Trade (jobs)		2,665	2,361	2,130	1,905	1,612	1,619
By economic sector - Utilities (jobs)		5,629	6,609	6,791	7,391	5,688	6,026
By resource sector - Biomass (jobs)		288	275	261	245	244	244
By resource sector - CO2 (jobs)		0	0.036	0.046	0.049	0.054	0.058
By resource sector - Coal (jobs)		6,345	3,901	3,134	1,903	1,165	974
By resource sector - Grid (jobs)		6,492	8,342	9,069	9,045	7,706	8,376
By resource sector - Natural Gas (jobs)		4,396	5,424	5,082	6,597	5,074	5,042
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		4,670	4,078	3,650	3,388	3,220	3,058
By resource sector - Solar (jobs)			339	470	516	595	957
By resource sector - Wind (jobs)		34.6	205	252	513	322	221
By education level - All sectors - High school diploma or less (jobs)		9,678	9,694	9,391	9,453	7,911	8,158
By education level - All sectors - Associates degree or some college (jobs)		6,769	7,036	6,901	7,098	5,807	6,017
By education level - All sectors - Bachelors degree (jobs)		4,550	4,596	4,434	4,456	3,638	3,706
By education level - All sectors - Masters or professional degree (jobs)		1,085	1,097	1,059	1,066	862	881
By education level - All sectors - Doctoral degree (jobs)		143	141	135	134	108	110
Related work experience - All sectors - None (jobs)		3,140	3,243	3,175	3,245	2,679	2,772
Related work experience - All sectors - Up to 1 year (jobs)		4,444	4,422	4,267	4,277	3,571	3,678
Related work experience - All sectors - 1 to 4 years (jobs)		8,243	8,299	8,030	8,102	6,677	6,859
Related work experience - All sectors - 4 to 10 years (jobs)		5,058	5,222	5,102	5,213	4,272	4,405
Related work experience - All sectors - Over 10 years (jobs)		1,340	1,378	1,344	1,370	1,127	1,157
On-the-Job Training - All sectors - None (jobs)		1,146	1,159	1,120	1,125	931	957
On-the-Job Training - All sectors - Up to 1 year (jobs)		14,961	14,989	14,479	14,555	12,041	12,353
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,557	4,743	4,655	4,791	3,930	4,071
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,378	1,482	1,476	1,541	1,261	1,323
On-the-Job Training - All sectors - Over 10 years (jobs)		182	192	189	195	163	168
On-Site or In-Plant Training - All sectors - None (jobs)		3,363	3,456	3,367	3,428	2,816	2,902
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		13,684	13,696	13,227	13,295	11,002	11,290
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,575	3,696	3,620	3,710	3,053	3,159
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,429	1,526	1,515	1,575	1,291	1,349
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		173	189	190	199	163	171
Wage income - All (million \$2019)		1,159	1,192	1,172	1,203	1,002	1,044

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	426	395	363	345	346	357	372

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	184	172	165	159	157	156	157
Final energy use - Commercial (PJ)	119	120	121	120	120	122	127
Final energy use - Industry (PJ)	382	406	427	438	455	470	488

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)		3.28	3.39	4.37	4.58	4.26	4.41

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 (%)	24.6	48.5	49.4	50.7	51.9	53.4	55.7
Sales of space heating units - Electric Resistance (%)	27.3	23.3	22.9	22.2	21.3	19.9	17.6
Sales of space heating units - Gas (%)	38.3	19	19.9	20	19.9	19.9	19.8
Sales of space heating units - Fossil (%)	9.89	9.17	7.81	7.09	6.94	6.85	6.89
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	62.5	74.8	75	74.8	74.6	74.6	74.6
Sales of water heating units - Gas Furnace (%)	34.2	22.8	22.6	22.8	23	23	23
Sales of water heating units - Other (%)	3.3	2.39	2.37	2.39	2.4	2.4	2.41
Sales of cooking units - Electric Resistance (%)	76.6	76.6	76.6	76.6	76.6	76.6	76.6
Sales of cooking units - Gas (%)	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.33	3.22				

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 (%)	5.4	26.5	53.4	75.5	79.2	79.6	79.6
Sales of space heating units - Electric Resistance (%)	3.11	5.03	9.13	15	18.3	18.8	18.9
Sales of space heating units - Gas Furnace (%)	76.4	63.9	35.2	9.15	2.46	1.58	1.52
Sales of space heating units - Fossil (%)	15.1	4.63	2.27	0.341	0.034	0	0
Sales of water heating units - Electric Heat Pump (%)	0.117	0.149	0.144	0.146	0.145	0.143	0.145
Sales of water heating units - Electric Resistance (%)	4.29	5.63	5.49	5.57	5.54	5.49	5.54
Sales of water heating units - Gas Furnace (%)	94.4	92.6	92.8	92.7	92.7	92.8	92.8
Sales of water heating units - Other (%)	1.17	1.57	1.57	1.57	1.57	1.56	1.55
Sales of cooking units - Electric Resistance (%)	43.5	45.6	45.9	45.7	46	45.9	45.7
Sales of cooking units - Gas (%)	56.5	54.4	54.1	54.3	54	54.1	54.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		12,419	12,935				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	10,116	4,225	4,225	4,225	0	0	0
Installed thermal - Natural gas (MW)	7,883	8,576	12,921	13,159	17,399	15,481	17,162

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	45.2	72.8	103	147	208	288	390
Installed renewables - Solar - Base land use assumptions (MW)	68.3	68.3	68.3	68.3	68.3	68.3	68.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	145	145	145	145	145	145	145
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
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)	-13.6		-9.57				-7.76
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.27		-2.12				-2.23
Business-as-usual carbon sink - Total (Mt CO2e/y)	-14.9		-11.7				-9.99

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)							-48.5
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-256
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,177
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-24.5
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,555
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-338
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-704
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-773
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,079
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-6,956
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-72.6
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-897
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-3,923
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-35.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,110
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-651
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,057

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-5,490
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-2,139
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-17,376
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-96.7
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-1,537
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-5,669
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-48.1
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-4,665
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-965
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-1,409
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-10,207
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-27,796
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-3,200
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							7.91
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							195
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,107
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							8.86
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)							48.3
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							46.6
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							50.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							642
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,107
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							11.9
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							202

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,999
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							13.3
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)							70
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							69.9
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,293
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,022
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							15.8
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							208
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,891
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							17.7
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							91.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							93.2
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							290
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,061
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,668