



Net-Zero America - Delaware data

October 29, 2021 (updated November 17, 2023)

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)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.93	4.36	2.9	2.63	1.77	0.736
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.1	24.5	18.7	10.8	4.91	1.87
Premature deaths from air pollution - Gas Stations (deaths)		1.65	1.51	1.14	0.665	0.312	0.134
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.31	3.59	2.44	1.36	0.65	0.262
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.71	2.2	1.49	0.85	0.366	0.109
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.821	0.736	0.567	0.383	0.22	0.121
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.322	0.31	0.297	0.283	0.269	0.253
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.34	3.82	2.84	1.81	1.09	0.634
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.33	1.07	0.766	0.495	0.328	0.223
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.304	0.258	0.212	0.167	0.123	0.082
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.179	0.101	0.101	0.1	0.102	0.102
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		8.88	8.14	7.1	5.54	3.93	2.35
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		52.5	38.6	25.7	23.3	15.7	6.52
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		232	218	166	96.2	43.7	16.6
Monetary damages from air pollution - Gas Stations (million \$2019)		14.6	13.4	10.1	5.89	2.76	1.18
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38.2	31.8	21.6	12.1	5.76	2.33
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		24	19.5	13.2	7.53	3.24	0.967
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.27	6.52	5.03	3.39	1.95	1.07
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.85	2.74	2.63	2.5	2.38	2.24
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		38.4	33.9	25.1	16	9.67	5.61

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)		11.8	9.47	6.78	4.38	2.9	1.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.69	2.28	1.88	1.48	1.09	0.722
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.58	0.89	0.891	0.886	0.904	0.902
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		78.9	72.3	63	49.2	34.9	20.9

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		3.8	7.71	2.95	2.29	1.68	1.25
By economic sector - Construction (jobs)		1,157	1,093	1,405	1,414	2,997	4,672
By economic sector - Manufacturing (jobs)		880	1,577	1,618	1,384	1,975	2,205
By economic sector - Mining (jobs)		287	197	119	64.2	27.8	8.9
By economic sector - Other (jobs)		116	123	180	173	288	464
By economic sector - Pipeline (jobs)		81.8	67.9	52	36.7	21.4	39.3
By economic sector - Professional (jobs)		475	427	554	576	1,150	1,701
By economic sector - Trade (jobs)		359	317	374	366	684	1,042
By economic sector - Utilities (jobs)		1,295	1,149	1,543	1,835	4,358	6,673
By resource sector - Biomass (jobs)		16.3	21.3	8.39	6.88	6.13	5.33
By resource sector - CO2 (jobs)		0	0	0	0	0	224
By resource sector - Coal (jobs)		60.3	0	0	0	0	0
By resource sector - Grid (jobs)		1,533	1,562	2,384	2,802	8,501	13,175
By resource sector - Natural Gas (jobs)		1,224	934	898	1,048	701	713
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		583	435	275	147	58.8	0
By resource sector - Solar (jobs)		1,228	1,906	2,203	1,624	1,610	2,187
By resource sector - Wind (jobs)		9.84	100	81.4	224	626	504
By education level - All sectors - High school diploma or less (jobs)		1,968	2,134	2,517	2,502	4,955	7,261
By education level - All sectors - Associates degree or some college (jobs)		1,501	1,598	1,905	1,925	3,794	5,558
By education level - All sectors - Bachelors degree (jobs)		938	982	1,136	1,129	2,174	3,140
By education level - All sectors - Masters or professional degree (jobs)		220	219	260	263	521	763
By education level - All sectors - Doctoral degree (jobs)		28	26.3	31.4	31.3	59.3	86.6
Related work experience - All sectors - None (jobs)		679	716	850	856	1,694	2,488
Related work experience - All sectors - Up to 1 year (jobs)		911	1,004	1,182	1,164	2,276	3,316
Related work experience - All sectors - 1 to 4 years (jobs)		1,676	1,769	2,086	2,092	4,123	6,030
Related work experience - All sectors - 4 to 10 years (jobs)		1,096	1,149	1,359	1,368	2,692	3,937
Related work experience - All sectors - Over 10 years (jobs)		293	320	373	370	719	1,038
On-the-Job Training - All sectors - None (jobs)		244	258	303	298	575	839
On-the-Job Training - All sectors - Up to 1 year (jobs)		3,045	3,298	3,858	3,831	7,478	10,858

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)		1,003	1,047	1,252	1,271	2,532	3,731
On-the-Job Training - All sectors - 4 to 10 years (jobs)		316	303	377	394	815	1,233
On-the-Job Training - All sectors - Over 10 years (jobs)		45.8	52.2	59.8	57.3	104	148
On-Site or In-Plant Training - All sectors - None (jobs)		745	801	940	931	1,790	2,597
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		2,770	2,987	3,503	3,486	6,833	9,943
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		776	816	972	983	1,958	2,881
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		322	311	382	397	815	1,227
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		41.5	42.9	52.1	53.7	109	161
Wage income - All (million \$2019)		273	287	342	350	705	1,048

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		13.1	10.7	7.3	4.21	1.8	0
Oil consumption - Cumulative (million bbls)							229
Oil production - Annual (million bbls)		0	0	0	0	0	0
Natural gas consumption - Annual (tcf)		73.9	62.3	50	37.6	23.7	16.4
Natural gas consumption - Cumulative (tcf)							1,505
Natural gas production - Annual (tcf)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Commercial (PJ)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18

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)		0.526	0.536	0.919	0.973	0.907	0.947

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	5.71	88	170	459	747	977	1,207
Vehicle stocks - LDV – All others (1000 units)	1,007	959	910	663	417	236	54.8
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		193	496	803	1,217	1,325	1,263
Public EV charging plugs - DC Fast (1000 units)	0.065		0.324		1.42		2.3
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3

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 (%)	14.3	32.1	79.9	90.6	91	91	91
Sales of space heating units - Electric Resistance (%)	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49
Sales of water heating units - Electric Heat Pump (%)	0	9.43	49.9	59	59.4	59.4	59.4
Sales of water heating units - Electric Resistance (%)	30.2	45.9	40.3	39	38.9	38.9	38.9
Sales of water heating units - Gas Furnace (%)	65.2	41.3	7.81	0.329	0	0	0
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7
Sales of cooking units - Electric Resistance (%)	50.1	60.7	93.3	99.7	100	100	100
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.774	0.771				

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 (%)	1.53	28.2	70.6	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Gas (%)	84.3	59.2	18.1	3.53	1.88	1.85	1.84
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Sales of water heating units - Gas (%)	93.3	74.5	14.1	0.593	0	0	0
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,472	3,883				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,625	2,963	2,679	2,967	4,449	4,449	4,007
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	110	165	219	290	375	472	584
Installed renewables - Solar - Base land use assumptions (MW)	39.5	164	309	597	597	597	597
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	0	4,059	8,319
Installed renewables - Solar - Constrained land use assumptions (MW)	38	38	134	317	317	317	317
Installed renewables - Wind - Constrained land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	2,240	8,324

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		0.167	0.173	0.318	0	0	0
Capital invested - Offshore Wind - Base (billion \$2018)		0	0	0	0	5.99	5.64
Capital invested - Solar PV - Constrained (billion \$2018)		0.144	0.276	0.328	0	0	0
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	0	0	0	3.3	8.06
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	75.2	309	579	1,122	1,122	1,122	1,122
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	17,643	37,615
Solar - Constrained land use assumptions (GWh)	0	0	180	522	522	522	522
Wind - Constrained land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	17,643	37,615
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	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	0	0	0	0	0
Biomass purchases (million \$2018/y)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	0
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative - All (MMT)		0	0	0	0	0	0
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	166
All (km)		0	0	0	0	0	166
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	122
Cumulative investment - All (million \$2018)		0	0	0	0	0	122

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-69.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-29.2
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-20.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-56.4
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-581
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-206
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03
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)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2

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 - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
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)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
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)							7.93
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178

Table 16: *E+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-126
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-3.22
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-129
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-244
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-6.43
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-250
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							88.6
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							5.85
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							94.5
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							171
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							11.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							183

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)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.37	3.48	1.51	0.651	0.213	0.146
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.6	27	26.4	23.8	19	13.1
Premature deaths from air pollution - Gas Stations (deaths)		1.68	1.7	1.65	1.48	1.17	0.806

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.34	4	3.57	2.95	2.2	1.45
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.75	2.65	2.53	2.21	1.64	1.03
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.832	0.84	0.836	0.767	0.616	0.445
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.322	0.31	0.297	0.283	0.269	0.253
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.37	4.32	4.16	3.72	3.04	2.28
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.34	1.18	1.02	0.838	0.684	0.548
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.304	0.277	0.249	0.221	0.193	0.166
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.174	0.101	0.102	0.102	0.103	0.1
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		8.85	7.69	6.2	5.07	4.27	3.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		47.6	30.8	13.4	5.77	1.89	1.29
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		237	240	234	212	169	116
Monetary damages from air pollution - Gas Stations (million \$2019)		14.9	15.1	14.6	13.1	10.4	7.13
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38.5	35.5	31.6	26.1	19.5	12.9
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		24.4	23.4	22.4	19.6	14.6	9.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.37	7.44	7.41	6.8	5.46	3.94
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.85	2.74	2.63	2.5	2.38	2.24
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		38.7	38.2	36.8	32.9	26.9	20.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		11.9	10.4	9.01	7.42	6.06	4.85
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.69	2.45	2.2	1.96	1.71	1.47
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.53	0.892	0.898	0.896	0.905	0.88

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		78.6	68.3	55	45	37.9	27.6

Table 18: *E- scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		4.63	5.93	2.26	1.46	1.32	1.27
By economic sector - Construction (jobs)		1,100	995	1,095	888	3,182	5,552
By economic sector - Manufacturing (jobs)		904	1,628	1,287	1,135	2,409	2,642
By economic sector - Mining (jobs)		314	205	144	97.6	61.7	28.2
By economic sector - Other (jobs)		113	117	152	133	296	513
By economic sector - Pipeline (jobs)		82.1	66	52.4	42.8	33.8	68.4
By economic sector - Professional (jobs)		455	396	426	351	1,204	1,975
By economic sector - Trade (jobs)		373	307	322	267	735	1,211
By economic sector - Utilities (jobs)		1,166	968	1,005	819	4,502	7,927
By resource sector - Biomass (jobs)		17.6	15.9	7.51	6.12	5.61	5.22
By resource sector - CO2 (jobs)		0	0	0	0	0	384
By resource sector - Coal (jobs)		177	59.1	0	0	0	0
By resource sector - Grid (jobs)		1,378	1,204	1,497	1,191	9,161	15,941
By resource sector - Natural Gas (jobs)		1,061	837	657	557	395	494
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		591	479	389	292	200	83
By resource sector - Solar (jobs)		1,277	1,987	1,863	1,470	1,745	2,219
By resource sector - Wind (jobs)		10.3	105	72.9	218	918	792
By education level - All sectors - High school diploma or less (jobs)		1,917	2,017	1,936	1,612	5,373	8,624
By education level - All sectors - Associates degree or some college (jobs)		1,446	1,503	1,445	1,206	4,077	6,578
By education level - All sectors - Bachelors degree (jobs)		911	935	880	731	2,353	3,715
By education level - All sectors - Masters or professional degree (jobs)		211	206	199	165	559	901
By education level - All sectors - Doctoral degree (jobs)		27.1	24.9	24.8	20.4	63.1	101
Related work experience - All sectors - None (jobs)		655	674	649	541	1,823	2,947
Related work experience - All sectors - Up to 1 year (jobs)		891	954	913	762	2,475	3,932
Related work experience - All sectors - 1 to 4 years (jobs)		1,626	1,670	1,600	1,330	4,450	7,145
Related work experience - All sectors - 4 to 10 years (jobs)		1,057	1,083	1,037	862	2,896	4,663
Related work experience - All sectors - Over 10 years (jobs)		284	305	286	239	781	1,231
On-the-Job Training - All sectors - None (jobs)		238	246	236	196	623	992
On-the-Job Training - All sectors - Up to 1 year (jobs)		2,966	3,133	2,972	2,478	8,113	12,873
On-the-Job Training - All sectors - 1 to 4 years (jobs)		963	981	949	788	2,716	4,420
On-the-Job Training - All sectors - 4 to 10 years (jobs)		300	277	282	232	860	1,459
On-the-Job Training - All sectors - Over 10 years (jobs)		44.6	50.4	46.9	39.3	114	175
On-Site or In-Plant Training - All sectors - None (jobs)		723	762	725	604	1,936	3,071
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		2,696	2,833	2,695	2,246	7,407	11,791

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		747	766	739	615	2,104	3,414
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		306	286	288	237	862	1,452
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		39.5	39.9	39	32.4	116	191
Wage income - All (million \$2019)		263	270	262	220	759	1,242

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.5	76.4	70.2	64.9	60.8	55.9	50.1
Final energy use - Residential (PJ)	41.7	39.5	38.4	37	34.6	31.5	28.6
Final energy use - Commercial (PJ)	29.9	29.9	29.5	28.9	28	27	26.5
Final energy use - Industry (PJ)	16	16.3	16.7	17.1	17.5	17.9	18.4

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)		0.457	0.458	0.597	0.614	0.89	0.939

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	4.42	28.6	52.8	165	277	525	773
Vehicle stocks - LDV – All others (1000 units)	1,011	1,011	1,011	959	907	699	491
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	31.3	65.7	222	699	1,018
Public EV charging plugs - DC Fast (1000 units)	0.065		0.1		0.527		1.47
Public EV charging plugs - L2 (1000 units)	0.118		2.42		12.7		35.4

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 (%)	14.3	22.9	28.3	44	68	83.7	89.1
Sales of space heating units - Electric Resistance (%)	9.9	12	11.2	9.09	5.93	3.95	3.26
Sales of space heating units - Gas (%)	55.3	35.2	32.6	25.4	14.2	6.89	4.33
Sales of space heating units - Fossil (%)	20.5	29.9	27.8	21.5	11.8	5.49	3.29
Sales of water heating units - Electric Heat Pump (%)	0	1.62	6.23	19.5	39.9	53.2	57.8
Sales of water heating units - Electric Resistance (%)	30.2	47	46.3	44.4	41.6	39.8	39.1
Sales of water heating units - Gas Furnace (%)	65.2	47.8	44	33.1	16.2	5.18	1.35
Sales of water heating units - Other (%)	4.6	3.59	3.44	3	2.33	1.9	1.75
Sales of cooking units - Electric Resistance (%)	49.9	51.2	55.8	67.9	84.7	95.1	98.7
Sales of cooking units - Gas (%)	50.1	48.8	44.2	32.1	15.3	4.94	1.33
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.769	0.798				

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 (%)	1.53	20.1	24.9	38.9	61.1	76.8	82.8
Sales of space heating units - Electric Resistance (%)	1.94	8.06	8.33	9.15	10.6	12	12.8
Sales of space heating units - Gas (%)	84.3	66.9	62.2	48.4	26.6	10.7	4.3
Sales of space heating units - Fossil (%)	12.2	4.9	4.55	3.47	1.71	0.536	0.14
Sales of water heating units - Electric Heat Pump (%)	0.078	2.03	7.05	21.5	43.6	58.1	63.1
Sales of water heating units - Electric Resistance (%)	1.96	7.38	9.33	15.1	24	29.7	31.7
Sales of water heating units - Gas (%)	93.3	86.1	79.2	59.5	29.1	9.29	2.42
Sales of water heating units - Other (%)	4.67	4.49	4.43	3.93	3.32	2.91	2.76
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,468	3,852				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	446	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,629	2,286	1,958	1,670	1,330	1,330	2,061
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 tCO ₂ e/y)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)							-69.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)							-29.2
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-20.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-56.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-581
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-206
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03
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)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
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)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
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)							7.93
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178

Table 26: E- scenario - PILLAR 6: Land sinks - Agriculture

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-126
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-3.22
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-129
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-244
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-6.43
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-250
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							88.6
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							5.85
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							94.5
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							171
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							11.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							183

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)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		4.93	3.65	2.23	1.52	0.539	0.107
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.1	24.5	18.7	10.8	4.91	1.87
Premature deaths from air pollution - Gas Stations (deaths)		1.65	1.51	1.14	0.665	0.312	0.134
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.31	3.59	2.44	1.36	0.65	0.262
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.71	2.2	1.49	0.85	0.366	0.109

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.821	0.736	0.567	0.383	0.22	0.121
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.322	0.31	0.297	0.283	0.269	0.253
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.34	3.82	2.84	1.81	1.09	0.634
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.33	1.07	0.766	0.495	0.328	0.223
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.304	0.258	0.212	0.167	0.123	0.082
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.191	0.101	0.101	0.1	0.102	0.097
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		8.67	7.96	6.47	4.6	2.59	0.24
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		43.7	32.3	19.8	13.5	4.78	0.946
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		232	218	166	96.2	43.7	16.6
Monetary damages from air pollution - Gas Stations (million \$2019)		14.6	13.4	10.1	5.89	2.76	1.18
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38.2	31.8	21.6	12.1	5.76	2.33
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		24	19.5	13.2	7.53	3.24	0.967
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.27	6.52	5.03	3.39	1.95	1.07
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.85	2.74	2.63	2.5	2.38	2.24
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		38.4	33.9	25.1	16	9.67	5.61
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		11.8	9.47	6.78	4.38	2.9	1.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.69	2.28	1.88	1.48	1.09	0.722
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.69	0.89	0.89	0.884	0.903	0.853
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		77	70.7	57.5	40.9	23	2.13

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		3.82	793	293	1.87	1.51	1.1
By economic sector - Construction (jobs)		990	1,054	1,012	2,075	5,408	3,860
By economic sector - Manufacturing (jobs)		1,135	1,616	2,514	2,180	2,924	3,615
By economic sector - Mining (jobs)		307	191	105	45.4	9.67	5.25
By economic sector - Other (jobs)		90	125	120	207	432	791
By economic sector - Pipeline (jobs)		79.5	64.8	43.2	25.3	11.5	7.42
By economic sector - Professional (jobs)		421	426	402	831	1,999	1,651
By economic sector - Trade (jobs)		348	312	276	492	1,145	1,150
By economic sector - Utilities (jobs)		1,169	1,069	1,170	2,970	8,363	3,648
By resource sector - Biomass (jobs)		14.9	22.4	7.89	6.1	5.6	4.86
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		177	59.1	0	0	0	0
By resource sector - Grid (jobs)		1,391	1,352	1,767	5,475	17,219	6,924
By resource sector - Natural Gas (jobs)		1,053	898	726	777	497	668
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		583	427	257	107	0.002	0
By resource sector - Solar (jobs)		1,316	1,972	2,554	1,739	1,420	6,600
By resource sector - Wind (jobs)		9.59	134	333	723	1,151	531
By education level - All sectors - High school diploma or less (jobs)		1,930	2,091	2,449	3,797	8,765	6,350
By education level - All sectors - Associates degree or some college (jobs)		1,456	1,566	1,826	2,901	6,702	4,816
By education level - All sectors - Bachelors degree (jobs)		921	967	1,108	1,691	3,804	2,813
By education level - All sectors - Masters or professional degree (jobs)		210	215	236	394	921	663
By education level - All sectors - Doctoral degree (jobs)		25.9	26.1	25.9	44.6	102	84.4
Related work experience - All sectors - None (jobs)		657	701	807	1,289	2,997	2,148
Related work experience - All sectors - Up to 1 year (jobs)		898	988	1,168	1,764	3,994	3,029
Related work experience - All sectors - 1 to 4 years (jobs)		1,635	1,734	1,999	3,155	7,285	5,238
Related work experience - All sectors - 4 to 10 years (jobs)		1,062	1,127	1,295	2,058	4,755	3,392
Related work experience - All sectors - Over 10 years (jobs)		290	315	376	562	1,262	921
On-the-Job Training - All sectors - None (jobs)		238	254	290	444	1,002	779
On-the-Job Training - All sectors - Up to 1 year (jobs)		3,008	3,242	3,812	5,797	13,145	9,693
On-the-Job Training - All sectors - 1 to 4 years (jobs)		964	1,024	1,173	1,915	4,499	3,142
On-the-Job Training - All sectors - 4 to 10 years (jobs)		289	293	308	587	1,470	965
On-the-Job Training - All sectors - Over 10 years (jobs)		45.6	51.8	62.6	84.6	177	148
On-Site or In-Plant Training - All sectors - None (jobs)		728	790	920	1,393	3,122	2,380
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		2,730	2,934	3,440	5,277	12,036	8,805
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		749	798	918	1,485	3,476	2,444
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		297	302	319	592	1,465	967
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		39.4	41.8	47.8	81.2	194	131
Wage income - All (million \$2019)		265	281	324	529	1,252	884

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Commercial (PJ)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18

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)		0.526	0.536	0.919	0.973	0.907	0.947

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	5.71	88	170	459	747	977	1,207
Vehicle stocks - LDV – All others (1000 units)	1,007	959	910	663	417	236	54.8
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		193	496	803	1,217	1,325	1,263
Public EV charging plugs - DC Fast (1000 units)	0.065		0.324		1.42		2.3
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3

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 (%)	14.3	32.1	79.9	90.6	91	91	91
Sales of space heating units - Electric Resistance (%)	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49
Sales of water heating units - Electric Heat Pump (%)	0	9.43	49.9	59	59.4	59.4	59.4
Sales of water heating units - Electric Resistance (%)	30.2	45.9	40.3	39	38.9	38.9	38.9
Sales of water heating units - Gas Furnace (%)	65.2	41.3	7.81	0.329	0	0	0
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7
Sales of cooking units - Electric Resistance (%)	50.1	60.7	93.3	99.7	100	100	100
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.774	0.771				

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 (%)	1.53	28.2	70.6	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Gas (%)	84.3	59.2	18.1	3.53	1.88	1.85	1.84
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Sales of water heating units - Gas (%)	93.3	74.5	14.1	0.593	0	0	0
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,472	3,883				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	446	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,629	2,194	2,387	2,391	3,293	3,293	4,368
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	110	165	219	290	375	472	584
Installed renewables - Solar - Base land use assumptions (MW)	39.5	39.5	241	241	241	241	3,383
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	131
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	2,235	7,552	8,319
Installed renewables - Solar - Constrained land use assumptions (MW)	39.5	145	741	741	741	741	3,713
Installed renewables - Wind - Constrained land use assumptions (MW)	2.29	2.29	2.29	2.29	2.29	2.29	2.29
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	2,240	2,240	8,324
Capital invested - Solar PV - Base (billion \$2018)		0	0.242	0	0	0	2.91
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0.246
Capital invested - Offshore Wind - Base (billion \$2018)		0	0	0	3.88	7.84	1.02

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	75.2	75.2	454	454	454	454	6,352
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	403
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	9,506	33,967	37,615
Solar - Constrained land use assumptions (GWh)	150	548	2,786	2,786	2,786	2,786	13,929
Wind - Constrained land use assumptions (GWh)	16.1	16.1	16.1	16.1	16.1	16.1	16.1
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	19,052	19,052	75,270

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)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-69.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-29.2
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-20.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-56.4
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-581
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-206
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03
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)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
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)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							7.93
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-126
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-3.22
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-129
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-244
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-6.43
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-250
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							88.6
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							5.85
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							94.5
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							171
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							11.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							183

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)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.79	4.72	5.44	4.16	1.66	0.482
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.1	24.5	18.7	10.8	4.91	1.87
Premature deaths from air pollution - Gas Stations (deaths)		1.65	1.51	1.14	0.665	0.312	0.134
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.31	3.59	2.44	1.36	0.65	0.262
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.71	2.2	1.49	0.85	0.366	0.109
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.821	0.736	0.567	0.383	0.22	0.121
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.322	0.31	0.297	0.283	0.269	0.253
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.34	3.82	2.84	1.81	1.09	0.634
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.33	1.07	0.766	0.495	0.328	0.223
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.304	0.258	0.212	0.167	0.123	0.082
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.166	0.101	0.101	0.1	0.102	0.097
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		9.04	8.65	8.46	7.46	6.3	4.77
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		51.3	41.8	48.2	36.9	14.7	4.27
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		232	218	166	96.2	43.7	16.6
Monetary damages from air pollution - Gas Stations (million \$2019)		14.6	13.4	10.1	5.89	2.76	1.18
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38.2	31.8	21.6	12.1	5.76	2.33
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		24	19.5	13.2	7.53	3.24	0.967
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.27	6.52	5.03	3.39	1.95	1.07

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.85	2.74	2.63	2.5	2.38	2.24
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		38.4	33.9	25.1	16	9.67	5.61
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		11.8	9.47	6.78	4.38	2.9	1.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.69	2.28	1.88	1.48	1.09	0.722
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.47	0.889	0.891	0.885	0.904	0.853
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		80.3	76.8	75.1	66.2	56	42.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		4.34	6.22	2.08	1.72	1.58	1.37
By economic sector - Construction (jobs)		856	776	934	1,088	1,142	1,806
By economic sector - Manufacturing (jobs)		672	681	612	548	575	509
By economic sector - Mining (jobs)		291	203	133	80.9	45.6	25.6
By economic sector - Other (jobs)		78.6	78.4	103	127	145	251
By economic sector - Pipeline (jobs)		84.2	72.3	63.9	53.4	41	83.5
By economic sector - Professional (jobs)		337	295	345	509	460	1,084
By economic sector - Trade (jobs)		286	244	251	302	293	564
By economic sector - Utilities (jobs)		894	804	1,033	1,870	1,543	4,804
By resource sector - Biomass (jobs)		15.2	15.9	7.13	6.41	6.19	5.7
By resource sector - CO2 (jobs)		0	0	0	0	0	434
By resource sector - Coal (jobs)		60.3	0	0	0	0	0
By resource sector - Grid (jobs)		923	814	1,434	1,822	2,152	2,675
By resource sector - Natural Gas (jobs)		1,023	971	830	905	871	803
By resource sector - Nuclear (jobs)		0	0	0	797	161	3,880
By resource sector - Oil (jobs)		582	435	275	147	67.5	21.1
By resource sector - Solar (jobs)		866	882	922	886	954	1,289
By resource sector - Wind (jobs)		32.1	40.7	7.88	16.1	34.7	18.7
By education level - All sectors - High school diploma or less (jobs)		1,481	1,345	1,488	1,671	1,755	2,525
By education level - All sectors - Associates degree or some college (jobs)		1,119	1,016	1,133	1,306	1,365	2,031
By education level - All sectors - Bachelors degree (jobs)		715	634	677	783	789	1,248
By education level - All sectors - Masters or professional degree (jobs)		166	146	159	192	191	322
By education level - All sectors - Doctoral degree (jobs)		21.2	18.4	19.8	25.5	23.8	48.3
Related work experience - All sectors - None (jobs)		509	461	511	583	610	899
Related work experience - All sectors - Up to 1 year (jobs)		684	622	685	776	808	1,199
Related work experience - All sectors - 1 to 4 years (jobs)		1,264	1,136	1,248	1,431	1,480	2,226
Related work experience - All sectors - 4 to 10 years (jobs)		824	741	817	942	972	1,473

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - Over 10 years (jobs)		221	200	217	246	254	377
On-the-Job Training - All sectors - None (jobs)		185	166	180	206	211	326
On-the-Job Training - All sectors - Up to 1 year (jobs)		2,298	2,073	2,261	2,573	2,661	3,971
On-the-Job Training - All sectors - 1 to 4 years (jobs)		750	678	758	873	912	1,357
On-the-Job Training - All sectors - 4 to 10 years (jobs)		234	210	244	289	302	464
On-the-Job Training - All sectors - Over 10 years (jobs)		34.8	31.8	33.8	37.3	38.3	56.5
On-Site or In-Plant Training - All sectors - None (jobs)		561	506	551	633	651	999
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		2,089	1,884	2,061	2,345	2,430	3,615
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		581	525	586	672	702	1,039
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		240	216	247	290	302	463
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		30.7	27.9	31.9	37.2	39.1	58.1
Wage income - All (million \$2019)		206	186	208	242	253	387

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.4	75.7	67	56.1	46.1	40	37.3
Final energy use - Residential (PJ)	41.7	39.3	35.9	31.4	27.7	25.3	24.4
Final energy use - Commercial (PJ)	29.9	29.8	28.5	26.5	24.9	24.3	24.6
Final energy use - Industry (PJ)	16	16.3	16.6	16.9	17.1	17.5	18

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)		0.526	0.536	0.919	0.973	0.907	0.947

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	5.71	88	170	459	747	977	1,207
Vehicle stocks - LDV – All others (1000 units)	1,007	959	910	663	417	236	54.8
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		193	496	803	1,217	1,325	1,263
Public EV charging plugs - DC Fast (1000 units)	0.065		0.324		1.42		2.3
Public EV charging plugs - L2 (1000 units)	0.118		7.8		34.2		55.3

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 (%)	14.3	32.1	79.9	90.6	91	91	91
Sales of space heating units - Electric Resistance (%)	9.9	10.8	4.53	3.11	3.02	3.06	3.07
Sales of space heating units - Gas (%)	55.3	30.9	8.61	3.64	3.44	3.45	3.44
Sales of space heating units - Fossil (%)	20.5	26.2	6.99	2.7	2.51	2.5	2.49

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	0	9.43	49.9	59	59.4	59.4	59.4
Sales of water heating units - Electric Resistance (%)	30.2	45.9	40.3	39	38.9	38.9	38.9
Sales of water heating units - Gas Furnace (%)	65.2	41.3	7.81	0.329	0	0	0
Sales of water heating units - Other (%)	4.6	3.33	1.97	1.68	1.67	1.69	1.7
Sales of cooking units - Electric Resistance (%)	50.1	60.7	93.3	99.7	100	100	100
Sales of cooking units - Gas (%)	49.9	39.3	6.72	0.338	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.774	0.771				

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 (%)	1.53	28.2	70.6	83.7	85	85.1	85.1
Sales of space heating units - Electric Resistance (%)	1.94	8.4	10.6	12.7	13.1	13.1	13.1
Sales of space heating units - Gas (%)	84.3	59.2	18.1	3.53	1.88	1.85	1.84
Sales of space heating units - Fossil (%)	12.2	4.23	0.808	0.035	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.078	10.5	54.6	64.4	64.9	64.9	64.9
Sales of water heating units - Electric Resistance (%)	1.96	10.8	28.3	32.2	32.4	32.4	32.4
Sales of water heating units - Gas (%)	93.3	74.5	14.1	0.593	0	0	0
Sales of water heating units - Other (%)	4.67	4.25	3.03	2.72	2.72	2.72	2.71
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,472	3,883				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,598	1,746	1,414	2,038	2,558	3,610	3,168
Installed thermal - Nuclear (MW)	0	0	0	0	340	340	1,978
Installed renewables - Rooftop PV (MW)	110	165	219	290	375	472	584
Installed renewables - Solar - Base land use assumptions (MW)	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Solar - Constrained land use assumptions (MW)	39.5	39.5	145	395	395	616	616
Installed renewables - Wind - Constrained land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	241	321
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0.127	0.275	0	0.217	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Offshore Wind - Constrained (billion \$2018)		0	0	0	0	0.356	0.106

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	75.2	75.2	75.2	75.2	75.2	75.2	75.2
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	75.2	75.2	274	743	743	1,157	1,157
Wind - Constrained land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	1,008	1,348

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)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-69.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-29.2
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-20.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-56.4
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-581

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-206
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03
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)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
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)							7.93
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-126
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-3.22
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-129

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-244
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-6.43
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-250
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							88.6
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							5.85
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							94.5
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							171
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							11.7
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							183

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)		14.6	0.01	0.01	0.009	0.006	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.26	3.19	1.79	1.29	0.751	0.223
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.6	27	26.4	23.8	19	13.1
Premature deaths from air pollution - Gas Stations (deaths)		1.68	1.7	1.65	1.48	1.17	0.806
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.34	4	3.57	2.95	2.2	1.45
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.75	2.65	2.53	2.21	1.64	1.03
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.832	0.84	0.836	0.767	0.616	0.445
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.322	0.31	0.297	0.283	0.269	0.253
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.37	4.32	4.16	3.72	3.04	2.28

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.34	1.18	1.02	0.838	0.684	0.548
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.304	0.277	0.249	0.221	0.193	0.166
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.178	0.101	0.102	0.102	0.104	0.103
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		8.85	7.69	6.2	5.07	4.27	3.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		129	0.09	0.089	0.082	0.057	0.005
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		46.6	28.3	15.9	11.4	6.65	1.97
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		237	240	234	212	169	116
Monetary damages from air pollution - Gas Stations (million \$2019)		14.9	15.1	14.6	13.1	10.4	7.13
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38.5	35.5	31.6	26.1	19.5	12.9
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		24.4	23.4	22.4	19.6	14.6	9.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.37	7.44	7.41	6.8	5.46	3.94
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.85	2.74	2.63	2.5	2.38	2.24
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		38.7	38.2	36.8	32.9	26.9	20.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		11.9	10.4	9.01	7.42	6.06	4.85
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.69	2.45	2.2	1.96	1.71	1.47
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.57	0.892	0.898	0.897	0.916	0.908
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		78.6	68.3	55	45	37.9	27.6

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		4.24	5.93	2.22	1.64	1.36	55.9
By economic sector - Construction (jobs)		1,096	992	1,057	982	2,321	4,585
By economic sector - Manufacturing (jobs)		894	1,613	1,112	816	1,542	2,228
By economic sector - Mining (jobs)		312	204	145	103	61.3	25.1
By economic sector - Other (jobs)		112	117	144	136	236	448
By economic sector - Pipeline (jobs)		81.3	65.9	53.2	44.4	32.9	67.9
By economic sector - Professional (jobs)		454	395	410	395	887	1,726

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		373	306	313	292	557	1,033
By economic sector - Utilities (jobs)		1,162	967	978	1,018	3,170	6,389
By resource sector - Biomass (jobs)		16.8	16	7.5	6.88	6.3	264
By resource sector - CO2 (jobs)		0	0	0	0	0	394
By resource sector - Coal (jobs)		177	59.1	0	0	0	0
By resource sector - Grid (jobs)		1,378	1,204	1,433	1,446	6,243	12,719
By resource sector - Natural Gas (jobs)		1,051	835	666	711	477	432
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		591	479	389	314	202	70.1
By resource sector - Solar (jobs)		1,264	1,965	1,655	1,194	1,336	2,157
By resource sector - Wind (jobs)		10.6	108	63.9	117	543	521
By education level - All sectors - High school diploma or less (jobs)		1,907	2,008	1,816	1,623	3,800	7,173
By education level - All sectors - Associates degree or some college (jobs)		1,438	1,497	1,358	1,230	2,891	5,442
By education level - All sectors - Bachelors degree (jobs)		906	931	827	740	1,672	3,101
By education level - All sectors - Masters or professional degree (jobs)		210	206	189	173	399	754
By education level - All sectors - Doctoral degree (jobs)		27	24.8	23.8	21.9	46.2	87.3
Related work experience - All sectors - None (jobs)		652	671	612	554	1,295	2,450
Related work experience - All sectors - Up to 1 year (jobs)		886	950	854	757	1,749	3,288
Related work experience - All sectors - 1 to 4 years (jobs)		1,617	1,663	1,505	1,357	3,157	5,934
Related work experience - All sectors - 4 to 10 years (jobs)		1,052	1,079	977	883	2,057	3,866
Related work experience - All sectors - Over 10 years (jobs)		282	303	267	237	550	1,020
On-the-Job Training - All sectors - None (jobs)		237	245	222	198	444	830
On-the-Job Training - All sectors - Up to 1 year (jobs)		2,951	3,118	2,783	2,482	5,736	10,729
On-the-Job Training - All sectors - 1 to 4 years (jobs)		958	977	895	815	1,929	3,650
On-the-Job Training - All sectors - 4 to 10 years (jobs)		298	276	270	255	619	1,202
On-the-Job Training - All sectors - Over 10 years (jobs)		44.4	50.2	43.5	37.6	80.5	146
On-Site or In-Plant Training - All sectors - None (jobs)		719	759	679	606	1,374	2,564
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		2,682	2,821	2,526	2,258	5,239	9,816
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		743	762	696	632	1,493	2,822
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		305	285	275	258	620	1,198
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		39.3	39.7	36.9	34	82.3	157
Wage income - All (million \$2019)		262	269	247	226	539	1,031

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.5	76.4	70.2	64.9	60.8	55.9	50.1
Final energy use - Residential (PJ)	41.7	39.5	38.4	37	34.6	31.5	28.6
Final energy use - Commercial (PJ)	29.9	29.9	29.5	28.9	28	27	26.5
Final energy use - Industry (PJ)	16	16.3	16.7	17.1	17.5	17.9	18.4

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)		0.457	0.458	0.597	0.614	0.89	0.939

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	4.42	28.6	52.8	165	277	525	773
Vehicle stocks - LDV – All others (1000 units)	1,011	1,011	1,011	959	907	699	491
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	31.3	65.7	222	699	1,018
Public EV charging plugs - DC Fast (1000 units)	0.065		0.1		0.527		1.47
Public EV charging plugs - L2 (1000 units)	0.118		2.42		12.7		35.4

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 (%)	14.3	22.9	28.3	44	68	83.7	89.1
Sales of space heating units - Electric Resistance (%)	9.9	12	11.2	9.09	5.93	3.95	3.26
Sales of space heating units - Gas (%)	55.3	35.2	32.6	25.4	14.2	6.89	4.33
Sales of space heating units - Fossil (%)	20.5	29.9	27.8	21.5	11.8	5.49	3.29
Sales of water heating units - Electric Heat Pump (%)	0	1.62	6.23	19.5	39.9	53.2	57.8
Sales of water heating units - Electric Resistance (%)	30.2	47	46.3	44.4	41.6	39.8	39.1
Sales of water heating units - Gas Furnace (%)	65.2	47.8	44	33.1	16.2	5.18	1.35
Sales of water heating units - Other (%)	4.6	3.59	3.44	3	2.33	1.9	1.75
Sales of cooking units - Electric Resistance (%)	49.9	51.2	55.8	67.9	84.7	95.1	98.7
Sales of cooking units - Gas (%)	50.1	48.8	44.2	32.1	15.3	4.94	1.33
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.769	0.798				

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 (%)	1.53	20.1	24.9	38.9	61.1	76.8	82.8
Sales of space heating units - Electric Resistance (%)	1.94	8.06	8.33	9.15	10.6	12	12.8
Sales of space heating units - Gas (%)	84.3	66.9	62.2	48.4	26.6	10.7	4.3
Sales of space heating units - Fossil (%)	12.2	4.9	4.55	3.47	1.71	0.536	0.14
Sales of water heating units - Electric Heat Pump (%)	0.078	2.03	7.05	21.5	43.6	58.1	63.1
Sales of water heating units - Electric Resistance (%)	1.96	7.38	9.33	15.1	24	29.7	31.7
Sales of water heating units - Gas (%)	93.3	86.1	79.2	59.5	29.1	9.29	2.42
Sales of water heating units - Other (%)	4.67	4.49	4.43	3.93	3.32	2.91	2.76
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,468	3,852				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	446	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,627	2,286	1,958	1,670	2,142	2,142	2,061
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	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	0	772
Biomass purchases (million \$2018/y)		0	0	0	0	0	69.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	0
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	0	0
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	0
All (km)		0	0	0	0	0	0
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative investment - All (million \$2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million \$2020)		0	0	0	0	0	0
Wells and facilities construction costs (million \$2020)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-69.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-29.2
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-20.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-56.4
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-581
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-206

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03
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)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
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)							6.05

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
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)							7.93
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178

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)							-25.9
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-116
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-2.8
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)							-145

Table 63: E-B+ 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)							-25.9
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-225
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-5.61
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)							-257
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							13.8
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							81.5
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							5.1
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							3.07
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							0.14
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							104
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							13.8
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							10.2
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							3.07
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							0.14
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							417

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)		38.9	24.3	22.8	22.2	21.8	19.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		4.15	4.63	6.08	6.31	6.31	5.9
Premature deaths from air pollution - Mobile - On-Road (deaths)		26.6	27.3	28.1	28.9	29.8	30.6
Premature deaths from air pollution - Gas Stations (deaths)		1.68	1.72	1.75	1.8	1.85	1.88
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		4.28	4.02	3.86	3.81	3.82	3.81
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.64	2.22	1.59	1.03	0.628	0.402
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		0.794	0.784	0.785	0.798	0.815	0.829
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.336	0.339	0.341	0.342	0.342	0.341
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		4.4	4.41	4.21	3.97	3.94	4.13
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.36	1.23	1.08	0.909	0.811	0.761
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.318	0.328	0.339	0.348	0.357	0.367
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.324	0.241	0.207	0.2	0.197	0.189
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		8.92	9.67	10.1	9.7	9.81	9.51
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		345	215	202	196	193	177
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		36.8	41	53.9	55.9	55.9	52.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		236	243	249	257	265	272
Monetary damages from air pollution - Gas Stations (million \$2019)		14.8	15.2	15.5	16	16.3	16.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		38	35.6	34.2	33.7	33.9	33.8
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		23.4	19.7	14.1	9.14	5.56	3.56
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		7.03	6.95	6.95	7.08	7.22	7.35
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		2.98	3	3.02	3.02	3.03	3.01
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		39	39	37.3	35.2	34.9	36.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		12	10.9	9.56	8.04	7.18	6.74

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		2.81	2.91	3	3.08	3.16	3.24
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		2.86	2.13	1.82	1.76	1.74	1.67
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		79.2	85.9	89.6	86.1	87.1	84.5

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		4.02	3.6	3.56	2.9	2.89	3.14
By economic sector - Construction (jobs)		726	925	1,112	1,360	1,555	2,287
By economic sector - Manufacturing (jobs)		277	320	362	453	470	895
By economic sector - Mining (jobs)		317	257	209	168	143	110
By economic sector - Other (jobs)		34.2	84.8	110	141	163	288
By economic sector - Pipeline (jobs)		83.8	87.2	88.1	82.5	83.3	82.3
By economic sector - Professional (jobs)		329	372	445	552	610	890
By economic sector - Trade (jobs)		290	307	337	393	430	613
By economic sector - Utilities (jobs)		1,132	1,064	1,343	1,767	2,043	2,796
By resource sector - Biomass (jobs)		15.5	14.5	13.5	12	12.3	12.5
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		177	167	158	150	143	55
By resource sector - Grid (jobs)		1,314	1,183	1,616	2,287	2,901	4,636
By resource sector - Natural Gas (jobs)		1,079	1,062	1,199	1,378	1,351	1,260
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		594	488	418	383	365	352
By resource sector - Solar (jobs)			470	571	675	721	1,353
By resource sector - Wind (jobs)		13.5	36.8	33.7	33	6.68	295
By education level - All sectors - High school diploma or less (jobs)		1,327	1,443	1,694	2,078	2,335	3,408
By education level - All sectors - Associates degree or some college (jobs)		1,024	1,104	1,308	1,617	1,812	2,621
By education level - All sectors - Bachelors degree (jobs)		663	688	792	960	1,061	1,519
By education level - All sectors - Masters or professional degree (jobs)		159	165	192	234	259	371
By education level - All sectors - Doctoral degree (jobs)		19.8	21.5	24.7	29.5	32.2	46
Related work experience - All sectors - None (jobs)		469	503	593	730	818	1,181
Related work experience - All sectors - Up to 1 year (jobs)		595	655	768	942	1,057	1,560
Related work experience - All sectors - 1 to 4 years (jobs)		1,168	1,241	1,451	1,778	1,987	2,865
Related work experience - All sectors - 4 to 10 years (jobs)		762	811	952	1,168	1,304	1,872
Related work experience - All sectors - Over 10 years (jobs)		198	210	245	300	335	487
On-the-Job Training - All sectors - None (jobs)		165	179	207	252	280	408
On-the-Job Training - All sectors - Up to 1 year (jobs)		2,076	2,213	2,582	3,162	3,531	5,135
On-the-Job Training - All sectors - 1 to 4 years (jobs)		696	748	884	1,091	1,224	1,760
On-the-Job Training - All sectors - 4 to 10 years (jobs)		229	250	299	369	417	590

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		279	31.5	36.6	44.3	48.9	72
On-Site or In-Plant Training - All sectors - None (jobs)		498	539	630	770	857	1,246
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		1,896	2,021	2,360	2,892	3,232	4,696
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		536	576	681	839	941	1,357
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		234	253	301	371	417	589
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		29	31.2	37.5	46.7	52.6	75.4
Wage income - All (million \$2019)		193	206	244	303	343	497

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	81.4	76.3	70.4	66.8	66.7	68.4	70.6
Final energy use - Residential (PJ)	41.7	39.3	38.7	38.6	39	40	41.1
Final energy use - Commercial (PJ)	29.9	30.3	30.5	30.5	30.7	31.5	33.2
Final energy use - Industry (PJ)	16	16.8	17.7	18.8	20	21.3	22.7

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)		0.488	0.492	0.647	0.67	0.83	0.869

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 (%)	11.1	37.9	39.1	40.3	41.2	41.9	42.9
Sales of space heating units - Electric Resistance (%)	10.4	9.91	9.75	9.4	9.02	8.38	7.34
Sales of space heating units - Gas (%)	57.3	30.9	39.4	42.7	42.6	42.6	42.6
Sales of space heating units - Fossil (%)	21.2	21.3	11.8	7.55	7.21	7.18	7.25
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	30.2	47.2	47.2	47.1	47	47	46.9
Sales of water heating units - Gas Furnace (%)	65.2	49.1	49.2	49.2	49.3	49.4	49.4
Sales of water heating units - Other (%)	4.6	3.64	3.64	3.65	3.66	3.66	3.67
Sales of cooking units - Electric Resistance (%)	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Sales of cooking units - Gas (%)	50.6	50.6	50.6	50.6	50.6	50.6	50.6
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		0.756	0.716				

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 (%)	1.53	24.1	48.5	68.4	71.7	72.1	72.1
Sales of space heating units - Electric Resistance (%)	1.94	8.79	12.8	20.1	25.2	25.9	26
Sales of space heating units - Gas (%)	84.3	62.4	35.2	9.91	2.84	1.91	1.84
Sales of space heating units - Fossil (%)	12.2	4.76	3.52	1.51	0.221	0.018	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	0.078	0.268	0.265	0.267	0.268	0.267	0.268
Sales of water heating units - Electric Resistance (%)	1.96	6.67	6.62	6.62	6.65	6.63	6.65
Sales of water heating units - Gas (%)	93.3	88.5	88.5	88.6	88.5	88.5	88.5
Sales of water heating units - Other (%)	4.67	4.54	4.63	4.53	4.56	4.58	4.53
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		3,421	3,558				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	446	446	446	446	446	446	0
Installed thermal - Natural gas (MW)	1,620	2,286	1,958	2,627	4,157	5,313	5,232
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	110	165	219	290	375	472	584
Installed renewables - Solar - Base land use assumptions (MW)	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Installed renewables - Wind - Base land use assumptions (MW)	2	2	2	2	2	2	2
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	0	0	1,497

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	75.2	75.2	75.2	75.2	75.2	75.2	75.2
Wind - Base land use assumptions (GWh)	8.07	8.07	8.07	8.07	8.07	8.07	8.07
Offshore Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO ₂ e/y)	-0.69		-0.314				-0.281
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO ₂ e/y)	-0.057		-0.102				-0.106
Business-as-usual carbon sink - Total (Mt CO ₂ e/y)	-0.747		-0.416				-0.387

Table 73: REF scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO ₂ e/y)							-3.48
Carbon sink potential - Low - Avoid deforestation (1000 tCO ₂ e/y)							-34.3
Carbon sink potential - Low - Extend rotation length (1000 tCO ₂ e/y)							-77.3
Carbon sink potential - Low - Improve plantations (1000 tCO ₂ e/y)							-13.9
Carbon sink potential - Low - Increase retention of HWP (1000 tCO ₂ e/y)							-69.4
Carbon sink potential - Low - Increase trees outside forests (1000 tCO ₂ e/y)							-29.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Reforest cropland (1000 tCO ₂ e/y)							-2.7
Carbon sink potential - Low - Reforest pasture (1000 tCO ₂ e/y)							-6.51
Carbon sink potential - Low - Restore productivity (1000 tCO ₂ e/y)							-25.8
Carbon sink potential - Low - All (not counting overlap) (1000 tCO ₂ e/y)							-263
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)							-5.21
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)							-120
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)							-139
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-20.4
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-139
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-56.4
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-4.05
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-46.2
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-51.2
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-581
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-6.94
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-206
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-201
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-27.3
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-208
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-83.5
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-5.4
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-85.9
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-901
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-76.6
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							0.567
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							26.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							39.3
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							5.03

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							4.17
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0.179
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							0.423
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							15.4
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							91.2
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							0.851
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							27
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							71
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							7.57
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)							6.05
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0.268
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							3.06
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							30.9
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							147
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							1.13
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							27.8
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							103
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							10.1
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)							7.93

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0.357
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							2.44
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							25.4
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							178