



## **Net-Zero America - Washington data**

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

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Table 1: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		7.18	0.008	0.008	0.006	0.004	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.69	3.97	3.51	3.4	2.84	2.28
Premature deaths from air pollution - Mobile - On-Road (deaths)		125	121	95.3	57	26.7	10.7
Premature deaths from air pollution - Gas Stations (deaths)		7.1	6.76	5.26	3.18	1.55	0.706
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	14	9.21	4.86	2.13	0.726
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.18	2.53	1.75	1.07	0.567	0.245
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.74	1.51	1.17	0.828	0.546	0.373
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.114	0.113	0.111	0.108	0.105	0.101
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.2	15.4	12	8	4.83	2.55
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.36	0.297	0.241	0.189	0.139	0.093
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.24	1.07	0.905	0.731	0.552	0.372
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.16	0.02	0.019	0.017	0.016	0.016
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.7	15.3	14.5	11.6	8.95	5.75
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		63.6	0.071	0.07	0.053	0.033	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		59.3	35.2	31.1	30.1	25.2	20.2
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,113	1,077	847	507	238	95
Monetary damages from air pollution - Gas Stations (million \$2019)		62.9	59.8	46.5	28.2	13.8	6.25
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		155	124	81.6	43.1	18.8	6.43
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.2	22.4	15.5	9.51	5.03	2.17
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.4	13.4	10.4	7.33	4.83	3.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.01	1	0.982	0.958	0.929	0.895
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		144	137	106	70.8	42.8	22.6

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)		3.19	2.63	2.14	1.67	1.23	0.822
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		10.9	9.48	8.01	6.47	4.88	3.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.41	0.176	0.166	0.149	0.14	0.137
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		140	136	129	103	79.5	51

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		125	284	128	99.8	154	650
By economic sector - Construction (jobs)		10,004	13,174	16,688	18,593	20,263	27,400
By economic sector - Manufacturing (jobs)		2,853	4,122	4,551	4,452	4,191	5,144
By economic sector - Mining (jobs)		2,249	1,645	1,105	712	448	269
By economic sector - Other (jobs)		1,263	1,591	2,065	2,576	3,057	5,022
By economic sector - Pipeline (jobs)		418	361	502	229	169	210
By economic sector - Professional (jobs)		4,930	7,144	9,136	11,380	13,451	19,002
By economic sector - Trade (jobs)		3,601	4,466	5,448	6,633	7,821	11,248
By economic sector - Utilities (jobs)		5,361	9,672	12,915	14,191	15,466	19,773
By resource sector - Biomass (jobs)		537	784	364	301	562	2,777
By resource sector - CO2 (jobs)		0	0	1,741	53.5	90	814
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		7,219	16,364	21,247	25,819	28,448	36,083
By resource sector - Natural Gas (jobs)		2,549	2,064	2,014	1,796	1,380	1,366
By resource sector - Nuclear (jobs)		606	596	346	0.015	0.019	0.038
By resource sector - Oil (jobs)		6,006	4,868	3,624	2,612	1,888	1,284
By resource sector - Solar (jobs)		8,316	7,934	9,168	10,070	10,937	19,893
By resource sector - Wind (jobs)		5,473	9,850	14,034	18,214	21,716	26,503
By education level - All sectors - High school diploma or less (jobs)		12,952	17,786	21,848	24,200	26,473	36,168
By education level - All sectors - Associates degree or some college (jobs)		9,543	13,395	16,877	18,961	20,966	28,518
By education level - All sectors - Bachelors degree (jobs)		6,455	8,733	10,670	12,063	13,451	18,339
By education level - All sectors - Masters or professional degree (jobs)		1,601	2,205	2,722	3,141	3,553	4,886
By education level - All sectors - Doctoral degree (jobs)		254	342	421	500	577	808
Related work experience - All sectors - None (jobs)		4,410	6,112	7,590	8,483	9,362	12,830
Related work experience - All sectors - Up to 1 year (jobs)		6,214	8,509	10,434	11,670	12,855	17,713
Related work experience - All sectors - 1 to 4 years (jobs)		11,109	15,300	18,909	21,210	23,456	31,961
Related work experience - All sectors - 4 to 10 years (jobs)		7,201	9,956	12,413	13,935	15,418	20,911
Related work experience - All sectors - Over 10 years (jobs)		1,870	2,582	3,192	3,567	3,929	5,303
On-the-Job Training - All sectors - None (jobs)		1,746	2,329	2,846	3,200	3,550	4,901
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,156	27,704	34,000	38,091	42,075	57,568

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)		6,458	9,018	11,344	12,693	13,998	18,936
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,137	3,002	3,848	4,331	4,799	6,504
On-the-Job Training - All sectors - Over 10 years (jobs)		308	407	500	549	598	809
On-Site or In-Plant Training - All sectors - None (jobs)		5,062	6,920	8,543	9,609	10,656	14,623
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,295	25,160	30,921	34,619	38,216	52,230
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,011	6,975	8,736	9,766	10,758	14,572
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,178	3,034	3,862	4,335	4,798	6,493
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		258	371	475	535	592	802
Wage income - All (million \$2019)		1,949	2,740	3,444	3,914	4,387	6,040

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		135	119	96.2	74.7	57.8	41.8
Oil consumption - Cumulative (million bbls)							2,955
Oil production - Annual (million bbls)		0	0	0	0	0	0
Natural gas consumption - Annual (tcf)		238	201	161	121	76.3	52.9
Natural gas consumption - Cumulative (tcf)							4,854
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)	656	650	592	519	454	412	391
Final energy use - Residential (PJ)	246	227	199	170	144	128	117
Final energy use - Commercial (PJ)	160	162	160	153	146	145	146
Final energy use - Industry (PJ)	342	354	359	361	368	377	387

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		3.77	3.88	6.5	6.9	5.9	6.14

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	284	851	1,418	3,404	5,389	6,976	8,562
Vehicle stocks - LDV – All others (1000 units)	7,140	6,798	6,457	4,705	2,954	1,671	388
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,331	3,547	5,529	8,462	9,115	8,742
Public EV charging plugs - DC Fast (1000 units)	0.551		2.62		9.97		15.8
Public EV charging plugs - L2 (1000 units)	2.37		63.1		240		381

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	25.2	47.6	59.1	60.7	60.7	60.6
Sales of space heating units - Electric Resistance (%)	35.6	41	35.5	30.7	30	30.2	30.3
Sales of space heating units - Gas (%)	41.5	20.6	6.9	1.33	0.7	0.659	0.662
Sales of space heating units - Fossil (%)	8.89	13.2	9.93	8.85	8.62	8.41	8.39
Sales of water heating units - Electric Heat Pump (%)	0	6.87	37.5	47.6	48.6	48.6	48.6
Sales of water heating units - Electric Resistance (%)	45.5	59.1	48.2	46.1	46.1	46.1	46.1
Sales of water heating units - Gas Furnace (%)	47.5	28.5	9.06	0.967	0.047	0	0
Sales of water heating units - Other (%)	6.95	5.52	5.27	5.27	5.28	5.27	5.28
Sales of cooking units - Electric Resistance (%)	70.6	76.8	96	99.8	100	100	100
Sales of cooking units - Gas (%)	29.4	23.2	3.96	0.2	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.12	4.1				

Table 8: *E+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	15.7	39.9	56.5	59	59.1	59.1
Sales of space heating units - Electric Resistance (%)	18.3	17.1	34.2	39.6	40.2	40.2	40.2
Sales of space heating units - Gas (%)	79	67.2	25.9	3.88	0.83	0.698	0.698
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	9.5	48.6	62.9	64.3	64.4	64.4
Sales of water heating units - Electric Resistance (%)	3.42	6.18	24.2	33.6	34.9	34.9	34.9
Sales of water heating units - Gas (%)	94.6	83.7	26.6	2.84	0.138	0	0
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,776	24,705				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,741	2,659	2,659	4,235	4,299	4,391	5,265
Installed thermal - Nuclear (MW)	1,200	1,200	1,200	0	0.006	0.013	0.027
Installed renewables - Rooftop PV (MW)	1,788	2,755	3,680	4,796	6,121	7,666	9,495
Installed renewables - Solar - Base land use assumptions (MW)	695	695	695	695	695	695	695
Installed renewables - Wind - Base land use assumptions (MW)	3,388	3,388	3,866	4,313	4,773	5,279	5,320
Installed renewables - Solar - Constrained land use assumptions (MW)	674	674	674	674	674	674	674
Installed renewables - Wind - Constrained land use assumptions (MW)	3,421	3,421	4,686	6,666	14,261	20,324	21,419
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	0
Capital invested - Wind - Base (billion \$2018)		0	0.826	0.787	0.706	0.738	0.057

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion \$2018)		0.2	0	0	0	0	0
Capital invested - Wind - Constrained (billion \$2018)		0	2.11	3.35	11.6	9.51	1.16
Capital invested - Biomass power plant (billion \$2018)	0	0.003	0.249	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0.008	0.044
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0.02	0.172

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,419	1,419	1,419	1,419	1,419	1,419	1,419
Wind - Base land use assumptions (GWh)	11,561	11,561	13,217	14,787	16,215	17,781	17,905
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,371	1,371	1,371	1,371	1,371	1,371	1,371
Wind - Constrained land use assumptions (GWh)	11,682	11,682	15,810	21,726	43,208	59,787	62,739
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	6.64	495	495	495	495	495
Biomass w/ccu power plant (GWh)	0	0	0	0	0	22.3	216
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	7.51	51.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	1	8
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	3
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	1	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		3.83	277	22.3	0	927	8,114
Biomass purchases (million \$2018/y)		49.2	148	149	149	200	644

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	4.6	15
Annual - BECCS (MMT)		0	0	0	0	1.17	11.5
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0	3.35	6.67	11.3	26.3
Cumulative - BECCS (MMT)		0	0	0	0	1.17	12.7
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6



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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	675	675	675	675
Spur (km)		0	0	101	101	344	1,526
All (km)		0	0	776	776	1,019	2,201
Cumulative investment - Trunk (million \$2018)		0	0	1,702	1,702	1,702	1,702
Cumulative investment - Spur (million \$2018)		0	0	99.8	99.3	246	1,036
Cumulative investment - All (million \$2018)		0	0	1,802	1,801	1,948	2,738

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)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-728
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-11,236

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,904
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,545
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250

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 - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959

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 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,027

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-73.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-1,101
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,981
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-147
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,129
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)							1,458
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							117
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,575
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)							2,798
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							235
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,033

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)		7.18	0.008	0.008	0.006	0.004	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		7.04	3.76	2.59	1.98	1.6	1.65
Premature deaths from air pollution - Mobile - On-Road (deaths)		127	134	135	125	103	72.9
Premature deaths from air pollution - Gas Stations (deaths)		7.25	7.58	7.56	6.98	5.71	4.04
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.6	15.6	13.4	10.6	7.74	5.02
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.23	2.98	2.8	2.46	1.88	1.26
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.76	1.72	1.67	1.54	1.27	0.98

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.114	0.113	0.111	0.108	0.105	0.101
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.4	17.7	18.2	17.2	14.6	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.36	0.319	0.284	0.251	0.219	0.189
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.24	1.15	1.06	0.966	0.864	0.758
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.15	0.02	0.02	0.019	0.016	0.01
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.7	14.8	13.4	12.2	11.2	8.05
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		63.6	0.071	0.07	0.053	0.033	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		62.4	33.3	23	17.6	14.2	14.7
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,133	1,189	1,198	1,115	917	648
Monetary damages from air pollution - Gas Stations (million \$2019)		64.2	67.1	66.9	61.8	50.6	35.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		156	138	118	94.3	68.6	44.5
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.6	26.4	24.8	21.8	16.7	11.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.6	15.2	14.8	13.6	11.2	8.68
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.01	1	0.982	0.958	0.929	0.895
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		145	157	161	152	129	99.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		3.19	2.82	2.51	2.22	1.94	1.67
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		10.9	10.2	9.4	8.55	7.65	6.71
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.33	0.18	0.178	0.17	0.142	0.092
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		139	132	119	108	99.4	71.5

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		152	321	131	92.4	182	650
By economic sector - Construction (jobs)		9,925	13,317	16,154	17,774	22,499	31,560

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		2,875	4,260	4,171	4,331	5,216	6,185
By economic sector - Mining (jobs)		2,267	1,713	1,287	945	669	417
By economic sector - Other (jobs)		1,258	1,606	1,984	2,499	3,234	5,422
By economic sector - Pipeline (jobs)		420	361	673	279	244	337
By economic sector - Professional (jobs)		4,927	7,285	8,698	11,008	14,850	21,930
By economic sector - Trade (jobs)		3,603	4,580	5,345	6,584	8,683	12,936
By economic sector - Utilities (jobs)		5,107	9,627	11,687	12,705	17,845	23,665
By resource sector - Biomass (jobs)		578	863	436	389	776	2,684
By resource sector - CO2 (jobs)		0	0	2,985	91.7	154	1,396
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		6,660	16,308	17,762	22,782	32,850	43,096
By resource sector - Natural Gas (jobs)		2,549	1,936	1,673	1,697	1,725	1,451
By resource sector - Nuclear (jobs)		606	596	346	0.017	0.023	0.05
By resource sector - Oil (jobs)		6,063	5,158	4,384	3,611	2,871	2,009
By resource sector - Solar (jobs)		8,343	7,967	8,996	9,935	11,061	19,922
By resource sector - Wind (jobs)		5,638	10,242	13,549	17,712	23,985	32,546
By education level - All sectors - High school diploma or less (jobs)		12,842	18,047	20,861	23,091	29,957	41,963
By education level - All sectors - Associates degree or some college (jobs)		9,440	13,559	16,057	18,017	23,636	33,164
By education level - All sectors - Bachelors degree (jobs)		6,410	8,875	10,211	11,606	15,195	21,362
By education level - All sectors - Masters or professional degree (jobs)		1,590	2,240	2,597	3,017	3,992	5,681
By education level - All sectors - Doctoral degree (jobs)		254	348	406	486	642	933
Related work experience - All sectors - None (jobs)		4,368	6,197	7,244	8,088	10,575	14,894
Related work experience - All sectors - Up to 1 year (jobs)		6,170	8,642	9,958	11,161	14,501	20,492
Related work experience - All sectors - 1 to 4 years (jobs)		11,011	15,521	18,044	20,268	26,496	37,175
Related work experience - All sectors - 4 to 10 years (jobs)		7,133	10,090	11,847	13,296	17,401	24,356
Related work experience - All sectors - Over 10 years (jobs)		1,853	2,619	3,038	3,405	4,449	6,187
On-the-Job Training - All sectors - None (jobs)		1,735	2,366	2,731	3,079	3,994	5,667
On-the-Job Training - All sectors - Up to 1 year (jobs)		19,997	28,133	32,434	36,447	47,582	66,879
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,387	9,126	10,808	12,059	15,789	22,055
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,110	3,031	3,677	4,104	5,385	7,565
On-the-Job Training - All sectors - Over 10 years (jobs)		307	413	481	528	673	938
On-Site or In-Plant Training - All sectors - None (jobs)		5,027	7,025	8,168	9,201	11,999	16,954
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,143	25,541	29,491	33,107	43,221	60,692
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,958	7,062	8,325	9,286	12,142	16,963
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,152	3,066	3,696	4,118	5,392	7,559
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		255	375	451	506	668	935
Wage income - All (million \$2019)		1,929	2,777	3,282	3,730	4,956	7,035

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	657	654	611	573	544	510	470
Final energy use - Residential (PJ)	246	227	207	188	169	150	133
Final energy use - Commercial (PJ)	160	163	165	166	164	162	160
Final energy use - Industry (PJ)	342	355	361	367	376	385	395

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		2.95	2.96	4.08	4.22	5.76	6.07

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	220	385	551	1,319	2,086	3,785	5,484
Vehicle stocks - LDV – All others (1000 units)	7,169	7,169	7,169	6,800	6,431	4,956	3,481
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	239	450	1,569	4,778	7,016
Public EV charging plugs - DC Fast (1000 units)	0.551		1.02		3.86		10.1
Public EV charging plugs - L2 (1000 units)	2.37		24.5		92.8		244

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	21.3	23.9	31.4	44.1	54.1	58.4
Sales of space heating units - Electric Resistance (%)	35.6	41.8	41.1	39.2	35.8	32.7	31
Sales of space heating units - Gas (%)	41.5	23	21.5	17	9.58	4.03	1.76
Sales of space heating units - Fossil (%)	8.89	13.8	13.5	12.4	10.6	9.24	8.81
Sales of water heating units - Electric Heat Pump (%)	0	1.23	4.71	14.8	30.9	42.3	46.7
Sales of water heating units - Electric Resistance (%)	45.5	61.3	60	56.4	51	47.6	46.5
Sales of water heating units - Gas Furnace (%)	47.5	31.9	29.8	23.3	12.8	4.87	1.59
Sales of water heating units - Other (%)	6.95	5.56	5.52	5.49	5.39	5.31	5.28
Sales of cooking units - Electric Resistance (%)	70.4	71.2	73.9	81.1	91	97.1	99.2
Sales of cooking units - Gas (%)	29.6	28.8	26.1	18.9	9.03	2.91	0.784
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.1	4.04				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	11.9	14.6	22.8	37.2	49.8	55.8
Sales of space heating units - Electric Resistance (%)	18.3	13.9	15.8	21.6	30.6	36.8	39.3
Sales of space heating units - Gas (%)	79	74.3	69.5	55.6	32.2	13.3	4.9
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	2.39	6.84	19.8	40.6	55.7	61.7
Sales of water heating units - Electric Resistance (%)	3.42	3.14	5.18	11.2	21.3	29.5	33.1
Sales of water heating units - Gas (%)	94.6	93.8	87.3	68.4	37.5	14.2	4.65
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,723	24,348				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,745	2,659	2,659	3,254	3,569	5,123	4,999
Installed thermal - Nuclear (MW)	1,200	1,200	1,200	0	0.007	0.016	0.035

Table 25: E- scenario - PILLAR 6: Land sinks - Forests

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-728
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-11,236
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,904



Table 25: E- 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)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,545
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2

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 - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959

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
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,027
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-73.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,101
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-1,981

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-147
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,129
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)							1,458
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							117
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,575
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)							2,798
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							235
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,033

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)		7.18	0.008	0.008	0.006	0.004	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.23	2.96	1.9	1.73	1.47	0.472
Premature deaths from air pollution - Mobile - On-Road (deaths)		125	121	95.3	57	26.7	10.7
Premature deaths from air pollution - Gas Stations (deaths)		7.1	6.76	5.26	3.18	1.55	0.706
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	14	9.21	4.86	2.13	0.726
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.18	2.53	1.75	1.07	0.567	0.245
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.74	1.51	1.17	0.828	0.546	0.373
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.114	0.113	0.111	0.108	0.105	0.101
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.2	15.4	12	8	4.83	2.55
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.36	0.297	0.241	0.189	0.139	0.093
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.24	1.07	0.905	0.731	0.552	0.372

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.183	0.02	0.019	0.017	0.016	0.004
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.5	15.1	13.6	10.1	6.44	1.03
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		63.6	0.071	0.07	0.053	0.033	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		55.2	26.2	16.9	15.4	13	4.18
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,113	1,077	847	507	238	95
Monetary damages from air pollution - Gas Stations (million \$2019)		62.9	59.8	46.5	28.2	13.8	6.25
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		155	124	81.6	43.1	18.8	6.43
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.2	22.4	15.5	9.51	5.03	2.17
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.4	13.4	10.4	7.33	4.83	3.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.01	1	0.982	0.958	0.929	0.895
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		144	137	106	70.8	42.8	22.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		3.19	2.63	2.14	1.67	1.23	0.822
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		10.9	9.48	8.01	6.47	4.88	3.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.61	0.177	0.164	0.147	0.137	0.037
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		138	134	121	89.8	57.2	9.15

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		126	261	125	84.1	134	648
By economic sector - Construction (jobs)		10,072	12,256	18,017	23,344	29,139	45,677
By economic sector - Manufacturing (jobs)		3,156	4,083	5,509	6,176	6,476	10,700
By economic sector - Mining (jobs)		2,237	1,618	1,045	623	290	17.4
By economic sector - Other (jobs)		1,273	1,545	2,272	3,056	3,979	7,751
By economic sector - Pipeline (jobs)		410	350	260	180	102	24
By economic sector - Professional (jobs)		5,003	6,929	10,701	14,958	20,089	32,195
By economic sector - Trade (jobs)		3,629	4,343	6,200	8,411	11,220	18,618
By economic sector - Utilities (jobs)		5,223	7,381	13,283	18,474	24,121	35,916
By resource sector - Biomass (jobs)		490	737	335	275	496	2,851
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		6,928	11,713	23,908	34,123	45,335	68,554

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		2,466	2,075	1,837	1,563	1,235	1,101
By resource sector - Nuclear (jobs)		606	351	0	0	0	0
By resource sector - Oil (jobs)		6,007	4,817	3,512	2,362	1,227	234
By resource sector - Solar (jobs)		8,509	8,180	9,306	10,458	11,467	27,404
By resource sector - Wind (jobs)		6,025	10,892	18,513	26,525	35,791	51,634
By education level - All sectors - High school diploma or less (jobs)		13,084	16,173	23,725	30,778	38,667	61,500
By education level - All sectors - Associates degree or some college (jobs)		9,643	12,175	18,406	24,301	30,918	48,958
By education level - All sectors - Bachelors degree (jobs)		6,527	8,054	11,774	15,522	19,851	31,381
By education level - All sectors - Masters or professional degree (jobs)		1,617	2,037	3,027	4,056	5,264	8,346
By education level - All sectors - Doctoral degree (jobs)		257	327	479	649	852	1,360
Related work experience - All sectors - None (jobs)		4,449	5,552	8,249	10,816	13,719	21,831
Related work experience - All sectors - Up to 1 year (jobs)		6,290	7,811	11,433	14,890	18,783	30,086
Related work experience - All sectors - 1 to 4 years (jobs)		11,220	13,958	20,665	27,139	34,490	54,618
Related work experience - All sectors - 4 to 10 years (jobs)		7,274	9,089	13,564	17,873	22,747	35,854
Related work experience - All sectors - Over 10 years (jobs)		1,894	2,357	3,499	4,588	5,812	9,156
On-the-Job Training - All sectors - None (jobs)		1,765	2,154	3,120	4,077	5,170	8,286
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,386	25,339	37,261	48,754	61,796	98,297
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,517	8,179	12,328	16,250	20,649	32,505
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,146	2,715	4,154	5,524	7,065	11,078
On-the-Job Training - All sectors - Over 10 years (jobs)		314	381	546	701	871	1,380
On-Site or In-Plant Training - All sectors - None (jobs)		5,126	6,380	9,382	12,311	15,640	24,918
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,495	22,974	33,843	44,289	56,128	89,206
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,058	6,328	9,498	12,490	15,845	24,986
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,188	2,749	4,171	5,529	7,060	11,057
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		260	335	516	686	877	1,379
Wage income - All (million \$2019)		1,965	2,486	3,756	5,013	6,472	10,340

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	656	650	592	519	454	412	391
Final energy use - Residential (PJ)	246	227	199	170	144	128	117
Final energy use - Commercial (PJ)	160	162	160	153	146	145	146
Final energy use - Industry (PJ)	342	354	359	361	368	377	387

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		3.77	3.88	6.5	6.9	5.9	6.14

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	284	851	1,418	3,404	5,389	6,976	8,562
Vehicle stocks - LDV – All others (1000 units)	7,140	6,798	6,457	4,705	2,954	1,671	388
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,331	3,547	5,529	8,462	9,115	8,742
Public EV charging plugs - DC Fast (1000 units)	0.551		2.62		9.97		15.8
Public EV charging plugs - L2 (1000 units)	2.37		63.1		240		381

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	25.2	47.6	59.1	60.7	60.7	60.6
Sales of space heating units - Electric Resistance (%)	35.6	41	35.5	30.7	30	30.2	30.3
Sales of space heating units - Gas (%)	41.5	20.6	6.9	1.33	0.7	0.659	0.662
Sales of space heating units - Fossil (%)	8.89	13.2	9.93	8.85	8.62	8.41	8.39
Sales of water heating units - Electric Heat Pump (%)	0	6.87	37.5	47.6	48.6	48.6	48.6
Sales of water heating units - Electric Resistance (%)	45.5	59.1	48.2	46.1	46.1	46.1	46.1
Sales of water heating units - Gas Furnace (%)	47.5	28.5	9.06	0.967	0.047	0	0
Sales of water heating units - Other (%)	6.95	5.52	5.27	5.27	5.28	5.27	5.28
Sales of cooking units - Electric Resistance (%)	70.6	76.8	96	99.8	100	100	100
Sales of cooking units - Gas (%)	29.4	23.2	3.96	0.2	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.12	4.1				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	15.7	39.9	56.5	59	59.1	59.1
Sales of space heating units - Electric Resistance (%)	18.3	17.1	34.2	39.6	40.2	40.2	40.2
Sales of space heating units - Gas (%)	79	67.2	25.9	3.88	0.83	0.698	0.698
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	9.5	48.6	62.9	64.3	64.4	64.4
Sales of water heating units - Electric Resistance (%)	3.42	6.18	24.2	33.6	34.9	34.9	34.9
Sales of water heating units - Gas (%)	94.6	83.7	26.6	2.84	0.138	0	0
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,776	24,705				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,745	2,659	3,241	4,967	5,031	5,123	4,999

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	1,200	1,200	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	1,788	2,755	3,680	4,796	6,121	7,666	9,495
Installed renewables - Solar - Base land use assumptions (MW)	695	695	695	695	695	695	7,872
Installed renewables - Wind - Base land use assumptions (MW)	3,388	3,388	3,907	4,687	6,452	9,543	17,222
Installed renewables - Solar - Constrained land use assumptions (MW)	696	696	696	696	696	696	12,340
Installed renewables - Wind - Constrained land use assumptions (MW)	3,865	3,865	5,134	13,313	29,611	58,766	97,172
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0	6.65
Capital invested - Wind - Base (billion \$2018)		0	0.898	1.32	2.71	4.51	10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,419	1,419	1,419	1,419	1,419	1,419	15,515
Wind - Base land use assumptions (GWh)	11,561	11,561	13,355	15,953	21,315	30,373	52,064
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,837	2,837	2,837	2,837	2,837	2,837	48,345
Wind - Constrained land use assumptions (GWh)	23,634	23,634	31,885	78,964	166,657	311,488	472,062
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-728
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-11,236
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,904
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,545
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959

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 <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,027
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-73.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-1,101
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,981
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-147
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,129
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)							1,458
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							117
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,575
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)							2,798
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							235
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,033

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)		7.18	0.008	0.008	0.006	0.004	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.53	3.13	3.7	4.37	2.73	1.29
Premature deaths from air pollution - Mobile - On-Road (deaths)		125	121	95.3	57	26.7	10.7
Premature deaths from air pollution - Gas Stations (deaths)		7.1	6.76	5.26	3.18	1.55	0.706

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	14	9.21	4.86	2.13	0.726
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.18	2.53	1.75	1.07	0.567	0.245
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.74	1.51	1.17	0.828	0.546	0.373
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.114	0.113	0.111	0.108	0.105	0.101
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.2	15.4	12	8	4.83	2.55
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.36	0.297	0.241	0.189	0.139	0.093
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.24	1.07	0.905	0.731	0.552	0.372
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.136	0.02	0.019	0.017	0.016	0.004
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.9	15.9	16.1	14	12	9.14
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		63.6	0.071	0.07	0.053	0.033	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		57.8	27.7	32.8	38.7	24.2	11.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,113	1,077	847	507	238	95
Monetary damages from air pollution - Gas Stations (million \$2019)		62.9	59.8	46.5	28.2	13.8	6.25
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		155	124	81.6	43.1	18.8	6.43
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.2	22.4	15.5	9.51	5.03	2.17
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.4	13.4	10.4	7.33	4.83	3.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.01	1	0.982	0.958	0.929	0.895
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		144	137	106	70.8	42.8	22.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		3.19	2.63	2.14	1.67	1.23	0.822
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		10.9	9.48	8.01	6.47	4.88	3.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.2	0.175	0.165	0.148	0.14	0.036

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		141	141	143	124	106	81.2

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		143	340	126	92.2	163	652
By economic sector - Construction (jobs)		9,994	11,073	13,294	13,802	13,716	17,984
By economic sector - Manufacturing (jobs)		3,094	3,311	3,499	3,533	2,761	3,286
By economic sector - Mining (jobs)		2,261	1,665	1,150	766	510	351
By economic sector - Other (jobs)		1,253	1,407	1,678	2,055	2,365	3,938
By economic sector - Pipeline (jobs)		426	375	739	289	243	371
By economic sector - Professional (jobs)		4,823	5,765	6,207	7,415	8,107	11,221
By economic sector - Trade (jobs)		3,548	3,803	4,018	4,640	5,049	7,074
By economic sector - Utilities (jobs)		5,640	7,679	10,181	10,616	9,640	11,019
By resource sector - Biomass (jobs)		501	873	433	345	639	2,710
By resource sector - CO2 (jobs)		0	0	3,373	104	174	1,577
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		7,851	12,437	14,597	19,231	17,327	17,991
By resource sector - Natural Gas (jobs)		2,600	2,195	2,206	2,087	1,652	2,093
By resource sector - Nuclear (jobs)		606	596	346	0.028	0.043	0.668
By resource sector - Oil (jobs)		6,004	4,868	3,624	2,612	1,940	1,505
By resource sector - Solar (jobs)		8,538	7,842	8,769	9,682	10,732	19,592
By resource sector - Wind (jobs)		4,982	6,607	7,546	9,149	10,090	10,428
By education level - All sectors - High school diploma or less (jobs)		13,147	14,937	17,253	18,068	17,630	23,224
By education level - All sectors - Associates degree or some college (jobs)		9,674	11,096	13,157	13,911	13,688	17,899
By education level - All sectors - Bachelors degree (jobs)		6,504	7,275	8,144	8,672	8,629	11,305
By education level - All sectors - Masters or professional degree (jobs)		1,607	1,827	2,036	2,217	2,249	2,977
By education level - All sectors - Doctoral degree (jobs)		251	283	304	340	360	492
Related work experience - All sectors - None (jobs)		4,470	5,111	5,960	6,275	6,177	8,167
Related work experience - All sectors - Up to 1 year (jobs)		6,289	7,132	8,136	8,623	8,510	11,359
Related work experience - All sectors - 1 to 4 years (jobs)		11,244	12,765	14,694	15,543	15,316	20,059
Related work experience - All sectors - 4 to 10 years (jobs)		7,282	8,268	9,633	10,160	10,007	13,026
Related work experience - All sectors - Over 10 years (jobs)		1,896	2,143	2,471	2,607	2,546	3,286
On-the-Job Training - All sectors - None (jobs)		1,759	1,956	2,210	2,345	2,341	3,136
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,413	23,153	26,394	27,969	27,545	36,308
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,543	7,481	8,872	9,319	9,137	11,849
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,156	2,488	3,023	3,170	3,137	4,082
On-the-Job Training - All sectors - Over 10 years (jobs)		311	341	394	405	396	522
On-Site or In-Plant Training - All sectors - None (jobs)		5,112	5,775	6,610	7,001	6,955	9,238
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,532	21,022	24,039	25,454	25,040	32,941

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,079	5,797	6,838	7,189	7,042	9,148
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,197	2,519	3,035	3,173	3,134	4,070
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		262	306	371	392	385	500
Wage income - All (million \$2019)		1,972	2,280	2,674	2,862	2,852	3,762

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	656	650	592	519	454	412	391
Final energy use - Residential (PJ)	246	227	199	170	144	128	117
Final energy use - Commercial (PJ)	160	162	160	153	146	145	146
Final energy use - Industry (PJ)	342	354	359	361	368	377	387

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		3.77	3.88	6.5	6.9	5.9	6.14

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	284	851	1,418	3,404	5,389	6,976	8,562
Vehicle stocks - LDV – All others (1000 units)	7,140	6,798	6,457	4,705	2,954	1,671	388
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,331	3,547	5,529	8,462	9,115	8,742
Public EV charging plugs - DC Fast (1000 units)	0.551		2.62		9.97		15.8
Public EV charging plugs - L2 (1000 units)	2.37		63.1		240		381

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	25.2	47.6	59.1	60.7	60.7	60.6
Sales of space heating units - Electric Resistance (%)	35.6	41	35.5	30.7	30	30.2	30.3
Sales of space heating units - Gas (%)	41.5	20.6	6.9	1.33	0.7	0.659	0.662
Sales of space heating units - Fossil (%)	8.89	13.2	9.93	8.85	8.62	8.41	8.39
Sales of water heating units - Electric Heat Pump (%)	0	6.87	37.5	47.6	48.6	48.6	48.6
Sales of water heating units - Electric Resistance (%)	45.5	59.1	48.2	46.1	46.1	46.1	46.1
Sales of water heating units - Gas Furnace (%)	47.5	28.5	9.06	0.967	0.047	0	0
Sales of water heating units - Other (%)	6.95	5.52	5.27	5.27	5.28	5.27	5.28
Sales of cooking units - Electric Resistance (%)	70.6	76.8	96	99.8	100	100	100
Sales of cooking units - Gas (%)	29.4	23.2	3.96	0.2	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.12	4.1				

Table 44: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	15.7	39.9	56.5	59	59.1	59.1
Sales of space heating units - Electric Resistance (%)	18.3	17.1	34.2	39.6	40.2	40.2	40.2
Sales of space heating units - Gas (%)	79	67.2	25.9	3.88	0.83	0.698	0.698
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	9.5	48.6	62.9	64.3	64.4	64.4
Sales of water heating units - Electric Resistance (%)	3.42	6.18	24.2	33.6	34.9	34.9	34.9
Sales of water heating units - Gas (%)	94.6	83.7	26.6	2.84	0.138	0	0
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,776	24,705				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,717	2,469	2,469	2,987	2,322	1,631	4,997
Installed thermal - Nuclear (MW)	1,200	1,200	1,200	0	0.012	0.028	0.316
Installed renewables - Rooftop PV (MW)	1,788	2,755	3,680	4,796	6,121	7,666	9,495
Installed renewables - Solar - Base land use assumptions (MW)	695	695	695	695	695	1,080	1,080
Installed renewables - Wind - Base land use assumptions (MW)	3,388	3,459	3,739	3,866	4,313	4,567	4,567
Installed renewables - Solar - Constrained land use assumptions (MW)	1,234	1,561	1,561	1,561	3,042	3,744	3,744
Installed renewables - Wind - Constrained land use assumptions (MW)	3,459	3,508	4,255	4,686	6,919	10,482	10,482
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0	0	0	0.377	0
Capital invested - Wind - Base (billion \$2018)		0.134	0.485	0.205	0.75	0.37	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.437	0	0	1.54	0.688	0
Capital invested - Wind - Constrained (billion \$2018)		0.094	1.29	0.695	3.43	5.19	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,419	1,419	1,419	1,419	1,419	2,177	2,177
Wind - Base land use assumptions (GWh)	11,561	11,817	12,794	13,217	14,787	15,576	15,576
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,487	3,131	3,131	3,131	6,048	7,413	7,413
Wind - Constrained land use assumptions (GWh)	11,817	11,993	14,463	15,810	22,465	32,717	32,717
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-728
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-11,236
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,904
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,545

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959

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 <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,027
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-73.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-1,101
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,981
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-147
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,129
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)							1,458
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							117
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,575

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							2,798
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							235
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,033

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)		7.18	0.008	0.008	0.006	0.004	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.81	3.58	2.73	2.6	2.21	1.96
Premature deaths from air pollution - Mobile - On-Road (deaths)		127	134	135	125	103	72.9
Premature deaths from air pollution - Gas Stations (deaths)		7.25	7.58	7.56	6.98	5.71	4.04
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.6	15.6	13.4	10.6	7.74	5.02
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.23	2.98	2.8	2.46	1.88	1.26
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.76	1.72	1.67	1.54	1.27	0.98
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.114	0.113	0.111	0.108	0.105	0.101
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.4	17.7	18.2	17.2	14.6	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.36	0.319	0.284	0.251	0.219	0.189
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.24	1.15	1.06	0.966	0.864	0.758
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.158	0.02	0.02	0.019	0.018	0.017
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.7	14.8	13.4	12.2	11.2	8.05
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		63.6	0.071	0.07	0.053	0.033	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		60.3	31.8	24.2	23.1	19.6	17.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,133	1,189	1,198	1,115	917	648
Monetary damages from air pollution - Gas Stations (million \$2019)		64.2	67.1	66.9	61.8	50.6	35.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		156	138	118	94.3	68.6	44.5
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.6	26.4	24.8	21.8	16.7	11.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.6	15.2	14.8	13.6	11.2	8.68
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.01	1	0.982	0.958	0.929	0.895
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		145	157	161	152	129	99.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		3.19	2.82	2.51	2.22	1.94	1.67
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		10.9	10.2	9.4	8.55	7.65	6.71
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		1.4	0.179	0.178	0.172	0.162	0.15
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		139	132	119	108	99.4	71.5

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		140	239	96.3	187	554	533
By economic sector - Construction (jobs)		9,974	13,448	15,721	15,433	18,431	26,127
By economic sector - Manufacturing (jobs)		2,892	4,279	3,850	3,424	4,206	5,167
By economic sector - Mining (jobs)		2,263	1,712	1,291	978	671	401
By economic sector - Other (jobs)		1,263	1,618	1,943	2,276	2,821	4,808
By economic sector - Pipeline (jobs)		417	361	685	287	243	334
By economic sector - Professional (jobs)		4,961	7,298	8,379	9,547	12,542	17,453
By economic sector - Trade (jobs)		3,620	4,617	5,198	5,824	7,297	10,537
By economic sector - Utilities (jobs)		5,132	9,717	11,209	10,323	13,770	18,902
By resource sector - Biomass (jobs)		555	642	326	783	2,563	2,513
By resource sector - CO2 (jobs)		0	0	3,064	94.1	158	1,433
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		6,721	16,461	16,700	18,122	25,182	33,896
By resource sector - Natural Gas (jobs)		2,518	1,942	1,716	1,704	1,428	1,564
By resource sector - Nuclear (jobs)		606	596	346	0.016	0.021	0.051
By resource sector - Oil (jobs)		6,063	5,158	4,384	3,743	2,894	1,935
By resource sector - Solar (jobs)		8,336	7,958	8,889	9,695	10,680	19,863
By resource sector - Wind (jobs)		5,763	10,533	12,947	14,138	17,628	23,058
By education level - All sectors - High school diploma or less (jobs)		12,887	18,113	20,125	19,885	24,854	34,500
By education level - All sectors - Associates degree or some college (jobs)		9,483	13,655	15,499	15,390	19,273	27,097
By education level - All sectors - Bachelors degree (jobs)		6,438	8,920	9,851	9,983	12,559	17,328
By education level - All sectors - Masters or professional degree (jobs)		1,598	2,250	2,505	2,597	3,307	4,587
By education level - All sectors - Doctoral degree (jobs)		255	350	392	424	541	750

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		4,385	6,225	6,992	6,956	8,743	12,210
Related work experience - All sectors - Up to 1 year (jobs)		6,194	8,671	9,601	9,628	12,101	16,835
Related work experience - All sectors - 1 to 4 years (jobs)		11,056	15,600	17,413	17,405	21,814	30,341
Related work experience - All sectors - 4 to 10 years (jobs)		7,165	10,156	11,438	11,385	14,242	19,839
Related work experience - All sectors - Over 10 years (jobs)		1,861	2,636	2,929	2,906	3,634	5,036
On-the-Job Training - All sectors - None (jobs)		1,742	2,378	2,639	2,665	3,329	4,653
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,075	28,247	31,267	31,344	39,435	54,663
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,415	9,191	10,439	10,302	12,846	17,999
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,120	3,056	3,561	3,514	4,371	6,175
On-the-Job Training - All sectors - Over 10 years (jobs)		308	416	465	454	553	772
On-Site or In-Plant Training - All sectors - None (jobs)		5,048	7,058	7,882	7,918	9,928	13,852
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,215	25,653	28,436	28,459	35,770	49,621
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,979	7,110	8,039	7,942	9,905	13,859
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,162	3,090	3,579	3,530	4,388	6,167
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		256	378	436	431	543	762
Wage income - All (million \$2019)		1,937	2,792	3,167	3,197	4,069	5,729

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	657	654	611	573	544	510	470
Final energy use - Residential (PJ)	246	227	207	188	169	150	133
Final energy use - Commercial (PJ)	160	163	165	166	164	162	160
Final energy use - Industry (PJ)	342	355	361	367	376	385	395

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		2.95	2.96	4.08	4.22	5.76	6.07

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	220	385	551	1,319	2,086	3,785	5,484
Vehicle stocks - LDV – All others (1000 units)	7,169	7,169	7,169	6,800	6,431	4,956	3,481
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	239	450	1,569	4,778	7,016
Public EV charging plugs - DC Fast (1000 units)	0.551		1.02		3.86		10.1
Public EV charging plugs - L2 (1000 units)	2.37		24.5		92.8		244

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	21.3	23.9	31.4	44.1	54.1	58.4
Sales of space heating units - Electric Resistance (%)	35.6	41.8	41.1	39.2	35.8	32.7	31
Sales of space heating units - Gas (%)	41.5	23	21.5	17	9.58	4.03	1.76
Sales of space heating units - Fossil (%)	8.89	13.8	13.5	12.4	10.6	9.24	8.81
Sales of water heating units - Electric Heat Pump (%)	0	1.23	4.71	14.8	30.9	42.3	46.7
Sales of water heating units - Electric Resistance (%)	45.5	61.3	60	56.4	51	47.6	46.5
Sales of water heating units - Gas Furnace (%)	47.5	31.9	29.8	23.3	12.8	4.87	1.59
Sales of water heating units - Other (%)	6.95	5.56	5.52	5.49	5.39	5.31	5.28
Sales of cooking units - Electric Resistance (%)	70.4	71.2	73.9	81.1	91	97.1	99.2
Sales of cooking units - Gas (%)	29.6	28.8	26.1	18.9	9.03	2.91	0.784
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.1	4.04				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	11.9	14.6	22.8	37.2	49.8	55.8
Sales of space heating units - Electric Resistance (%)	18.3	13.9	15.8	21.6	30.6	36.8	39.3
Sales of space heating units - Gas (%)	79	74.3	69.5	55.6	32.2	13.3	4.9
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	2.39	6.84	19.8	40.6	55.7	61.7
Sales of water heating units - Electric Resistance (%)	3.42	3.14	5.18	11.2	21.3	29.5	33.1
Sales of water heating units - Gas (%)	94.6	93.8	87.3	68.4	37.5	14.2	4.65
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,723	24,348				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,744	2,659	2,600	3,431	3,569	3,661	5,305
Installed thermal - Nuclear (MW)	1,200	1,200	1,200	0	0.007	0.015	0.034
Capital invested - Biomass power plant (billion \$2018)	0	0.004	0.227	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0.008	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0.063	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	7.38	452	452	452	452	452
Biomass w/ccu power plant (GWh)	0	0	0	0	70.4	70.4	70.4
Biomass w/ccu allam power plant (GWh)	0	0	0	0	8.4	8.4	8.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	1	1	1	1	1	1
Number of facilities - Power ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	1	6	7
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	1	1	1
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		4.26	253	26.4	1,350	5,424	624
Biomass purchases (million \$2018/y)		63.7	192	194	290	684	729

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	5.03	12.1	13
Annual - BECCS (MMT)		0	0	0	1.71	8.69	9.49
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	3.42	3.53
Cumulative - All (MMT)		0	0	3.35	8.38	20.5	33.5
Cumulative - BECCS (MMT)		0	0	0	1.71	10.4	19.9
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	10.1	13.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	675	675	675	675
Spur (km)		0	0	101	309	811	1,013
All (km)		0	0	776	984	1,486	1,688
Cumulative investment - Trunk (million \$2018)		0	0	1,702	1,702	1,702	1,702
Cumulative investment - Spur (million \$2018)		0	0	98.6	233	611	741
Cumulative investment - All (million \$2018)		0	0	1,800	1,935	2,313	2,443

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)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-728
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-11,236
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-1,904
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,545

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-0.035
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,027
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-73.6
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-1,101
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-0.035
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-1,981
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-147
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,129

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0.062
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,458
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							117
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							0.016
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							2.81
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0.062
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							6,909
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							235
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							0.016
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							2.81
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							7,146

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)		30.6	22	4.05	3.18	2.91	2.73
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		8.21	8.13	8.52	6.89	6.26	6.49
Premature deaths from air pollution - Mobile - On-Road (deaths)		127	135	143	152	161	171
Premature deaths from air pollution - Gas Stations (deaths)		7.22	7.64	8.03	8.48	8.92	9.35
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	15.8	14.3	13.5	13.2	13.1
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		3.17	2.7	2.13	1.61	1.22	0.974
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.74	1.73	1.77	1.86	1.94	2.03
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		0.119	0.124	0.127	0.131	0.134	0.136

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		16.4	17.8	18.3	19.2	21	23.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		0.376	0.377	0.383	0.392	0.402	0.413
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.29	1.36	1.44	1.52	1.6	1.67
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.428	0.285	0.223	0.213	0.206	0.194
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		15.8	17.1	18	17.8	18.2	17.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		271	195	35.9	28.1	25.7	24.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		72.7	72	75.4	61	55.4	57.5
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,130	1,203	1,275	1,353	1,434	1,517
Monetary damages from air pollution - Gas Stations (million \$2019)		63.9	67.7	71.1	75.1	79	82.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		154	140	127	119	117	116
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		28.1	24	18.9	14.3	10.8	8.63
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		15.4	15.3	15.7	16.4	17.2	18
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		1.06	1.09	1.13	1.16	1.18	1.21
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		146	157	162	170	186	209
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		3.33	3.34	3.39	3.47	3.56	3.66
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		11.4	12.1	12.8	13.5	14.1	14.8
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.78	2.52	1.97	1.88	1.82	1.71
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		140	152	160	158	161	155

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		132	119	117	95.5	95.3	103
By economic sector - Construction (jobs)		4,244	8,397	9,225	11,196	11,188	14,918
By economic sector - Manufacturing (jobs)		1,713	2,262	2,803	3,073	2,466	2,681
By economic sector - Mining (jobs)		2,298	1,855	1,512	1,250	1,065	909

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		218	1,169	1,414	1,777	2,016	3,597
By economic sector - Pipeline (jobs)		428	435	436	421	429	432
By economic sector - Professional (jobs)		2,527	4,032	4,544	5,752	6,108	8,425
By economic sector - Trade (jobs)		2,201	3,080	3,318	3,995	4,277	6,106
By economic sector - Utilities (jobs)		4,196	4,669	5,530	7,655	6,734	7,109
By resource sector - Biomass (jobs)		511	478	444	397	406	413
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		98.8	0	0	0	0	0
By resource sector - Grid (jobs)		5,308	6,129	7,603	12,354	11,137	11,435
By resource sector - Natural Gas (jobs)		2,605	2,660	2,931	2,822	2,566	2,750
By resource sector - Nuclear (jobs)		606	596	587	340	0.02	0.02
By resource sector - Oil (jobs)		6,133	5,324	4,742	4,422	4,228	4,093
By resource sector - Solar (jobs)			7,424	8,539	9,376	10,167	19,124
By resource sector - Wind (jobs)		2,697	3,407	4,055	5,502	5,875	6,464
By education level - All sectors - High school diploma or less (jobs)		7,385	10,976	12,183	14,793	14,368	18,447
By education level - All sectors - Associates degree or some college (jobs)		5,407	8,062	9,059	11,177	10,926	14,147
By education level - All sectors - Bachelors degree (jobs)		4,036	5,424	5,948	7,161	7,009	8,975
By education level - All sectors - Masters or professional degree (jobs)		986	1,343	1,479	1,804	1,790	2,326
By education level - All sectors - Doctoral degree (jobs)		145	211	231	278	285	385
Related work experience - All sectors - None (jobs)		2,563	3,744	4,175	5,110	4,997	6,461
Related work experience - All sectors - Up to 1 year (jobs)		3,454	5,236	5,816	7,045	6,882	8,970
Related work experience - All sectors - 1 to 4 years (jobs)		6,594	9,395	10,420	12,697	12,404	15,939
Related work experience - All sectors - 4 to 10 years (jobs)		4,229	6,069	6,743	8,241	8,045	10,308
Related work experience - All sectors - Over 10 years (jobs)		1,118	1,572	1,747	2,122	2,051	2,602
On-the-Job Training - All sectors - None (jobs)		1,003	1,473	1,620	1,945	1,915	2,527
On-the-Job Training - All sectors - Up to 1 year (jobs)		11,939	17,021	18,874	22,908	22,336	28,728
On-the-Job Training - All sectors - 1 to 4 years (jobs)		3,692	5,456	6,096	7,502	7,312	9,376
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,159	1,810	2,025	2,523	2,489	3,223
On-the-Job Training - All sectors - Over 10 years (jobs)		165	258	285	337	326	425
On-Site or In-Plant Training - All sectors - None (jobs)		2,894	4,257	4,724	5,721	5,609	7,317
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		10,829	15,459	17,145	20,833	20,304	26,094
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		2,875	4,237	4,729	5,807	5,657	7,257
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,216	1,845	2,055	2,544	2,504	3,222
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		145	219	247	310	304	389
Wage income - All (million \$2019)		1,161	1,666	1,872	2,321	2,292	2,962

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	656	659	625	605	608	624	642

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	246	227	210	196	186	179	172
Final energy use - Commercial (PJ)	160	165	169	173	178	188	201
Final energy use - Industry (PJ)	342	367	387	404	428	457	490

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

Item	2020	2025	2030	2035	2040	2045	2050
Electricity distribution capital invested - Cumulative 5-yr (billion \$2018)		3.38	3.44	3.99	4.11	3.95	4.04

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 (%)	12.4	29.8	30.5	31.7	33.2	35.3	38.5
Sales of space heating units - Electric Resistance (%)	36.2	36.9	36.4	35.6	34.5	32.5	29.2
Sales of space heating units - Gas (%)	42.3	20.7	21.6	21.9	21.7	21.7	21.7
Sales of space heating units - Fossil (%)	9.05	12.7	11.5	10.8	10.6	10.5	10.6
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	45.5	61.7	61.7	61.6	61.6	61.6	61.6
Sales of water heating units - Gas Furnace (%)	47.5	32.7	32.8	32.8	32.8	32.8	32.8
Sales of water heating units - Other (%)	6.95	5.57	5.55	5.6	5.61	5.61	5.61
Sales of cooking units - Electric Resistance (%)	70.2	70.2	70.2	70.2	70.2	70.2	70.2
Sales of cooking units - Gas (%)	29.8	29.8	29.8	29.8	29.8	29.8	29.8
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		4.1	3.83				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.72	21.4	53.8	64.1	65.2	65.3	65.3
Sales of space heating units - Electric Resistance (%)	18.3	16.1	25.2	30.3	33.5	33.9	34
Sales of space heating units - Gas (%)	79	62.5	21	5.54	1.3	0.744	0.697
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	1.12	0.821	0.82	0.824	0.831	0.834	0.834
Sales of water heating units - Electric Resistance (%)	3.42	2.42	2.42	2.44	2.44	2.44	2.44
Sales of water heating units - Gas (%)	94.6	96.1	96.1	96.1	96.1	96.1	96.1
Sales of water heating units - Other (%)	0.885	0.628	0.63	0.632	0.632	0.63	0.631
Sales of cooking units - Electric Resistance (%)	27.5	29	29	29	29	28.9	28.9
Sales of cooking units - Gas (%)	72.5	71	71	71	71	71.1	71.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		22,575	23,159				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	730	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	2,737	2,659	2,659	3,670	2,865	2,393	2,986
Installed thermal - Nuclear (MW)	1,200	1,200	1,200	1,200	0	0.009	0.016
Installed renewables - Rooftop PV (MW)	1,788	2,755	3,680	4,796	6,121	7,666	9,495

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Solar - Base land use assumptions (MW)	567	567	567	567	567	567	567
Installed renewables - Wind - Base land use assumptions (MW)	3,388	3,388	3,388	3,388	3,702	3,776	3,776
Installed renewables - Solar - Constrained land use assumptions (MW)	128	128	128	128	128	128	128

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,419	1,419	1,419	1,419	1,419	1,419	1,419
Wind - Base land use assumptions (GWh)	11,561	11,561	11,561	11,561	12,666	12,919	12,919
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-27.2		-5.37				-4.47
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-8.11		-13.6				-14.3
Business-as-usual carbon sink - Total (Mt CO2e/y)	-35.3		-19				-18.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,087
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-317
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,647
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-2,076
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-9,930
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-377
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-7,491
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-188
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,869
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-26,982
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-1,629
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,111
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,570
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-3,042
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-19,860
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-728

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-11,236
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,332
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-3,707
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-49,216
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,170
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,904
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,494
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-4,080
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-29,790
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,078
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-14,981
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,477
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-71,521
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,545
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							178
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							242
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,855
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							752
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							53.9
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							495
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							12.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,112
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							4,699
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							266

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							250
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,348
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,131
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)							78.2
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							743
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							88.2
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,240
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							8,144
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							355
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							258
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,841
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							1,503
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							102
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							990
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							70.4
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,838
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							9,959