



## **Net-Zero America - Wisconsin 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)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		15.1	10.6	5.97	4.84	3.05	1.37
Premature deaths from air pollution - Mobile - On-Road (deaths)		118	110	84.2	49	22.6	9.18
Premature deaths from air pollution - Gas Stations (deaths)		8.05	7.41	5.61	3.33	1.63	0.776
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		26	22.9	16.8	9.96	4.87	1.76
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.55	2.14	1.5	0.877	0.353	0.102
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.63	4.53	3.74	2.57	1.38	0.556
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.53	5.36	5.15	4.91	4.66	4.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		20.7	19	15	9.81	5.48	2.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.5	2.09	1.65	1.2	0.815	0.516
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.48	5.46	4.47	3.5	2.57	1.69
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.566	0.155	0.151	0.144	0.143	0.14
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		53.5	50.4	46	36	26.8	16.7
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		455	0.374	0.364	0.319	0.222	0.013
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		134	93.8	52.9	42.8	27	12.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,048	981	749	435	201	81.6
Monetary damages from air pollution - Gas Stations (million \$2019)		71.3	65.7	49.6	29.5	14.4	6.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		231	203	149	88.2	43.2	15.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		22.6	18.9	13.3	7.77	3.13	0.903
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		41.1	40.1	33.2	22.8	12.2	4.93
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		48.9	47.5	45.6	43.5	41.3	38.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		183	168	133	86.8	48.5	22.3

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)		22.1	18.5	14.6	10.6	7.22	4.56
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		57.4	48.4	39.6	31	22.8	15
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		5	1.37	1.33	1.27	1.26	1.24
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		475	448	409	320	238	148

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,079	1,220	1,016	574	1,015	2,040
By economic sector - Construction (jobs)		5,034	5,170	7,015	7,157	8,104	11,805
By economic sector - Manufacturing (jobs)		3,163	3,340	3,727	3,355	3,288	4,709
By economic sector - Mining (jobs)		2,322	1,587	1,067	687	423	269
By economic sector - Other (jobs)		315	351	671	674	782	1,178
By economic sector - Pipeline (jobs)		528	452	362	275	213	360
By economic sector - Professional (jobs)		2,953	3,008	3,607	3,861	5,631	9,056
By economic sector - Trade (jobs)		2,617	2,283	2,551	2,459	2,903	4,219
By economic sector - Utilities (jobs)		6,299	5,986	7,267	7,810	9,244	13,157
By resource sector - Biomass (jobs)		2,792	2,909	2,325	1,396	3,745	8,865
By resource sector - CO2 (jobs)		0	0	0	0	206	1,869
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		6,720	7,260	11,326	12,787	14,854	22,199
By resource sector - Natural Gas (jobs)		5,020	4,379	3,611	3,308	3,575	2,473
By resource sector - Nuclear (jobs)		649	508	185	0	0	0
By resource sector - Oil (jobs)		4,997	4,076	3,041	2,199	1,592	1,166
By resource sector - Solar (jobs)		1,008	1,012	2,663	2,004	1,733	2,678
By resource sector - Wind (jobs)		1,769	2,883	4,131	5,158	5,898	7,543
By education level - All sectors - High school diploma or less (jobs)		10,549	10,243	11,925	11,472	13,332	19,883
By education level - All sectors - Associates degree or some college (jobs)		7,269	7,023	8,441	8,514	9,935	14,497
By education level - All sectors - Bachelors degree (jobs)		5,089	4,793	5,401	5,347	6,431	9,535
By education level - All sectors - Masters or professional degree (jobs)		1,233	1,172	1,330	1,333	1,655	2,489
By education level - All sectors - Doctoral degree (jobs)		171	164	185	187	250	389
Related work experience - All sectors - None (jobs)		3,584	3,465	4,037	3,946	4,636	6,882
Related work experience - All sectors - Up to 1 year (jobs)		5,046	4,920	5,708	5,437	6,361	9,619
Related work experience - All sectors - 1 to 4 years (jobs)		8,687	8,312	9,673	9,598	11,368	16,761
Related work experience - All sectors - 4 to 10 years (jobs)		5,526	5,294	6,224	6,240	7,343	10,757
Related work experience - All sectors - Over 10 years (jobs)		1,467	1,405	1,640	1,632	1,896	2,774
On-the-Job Training - All sectors - None (jobs)		1,332	1,268	1,458	1,412	1,665	2,491
On-the-Job Training - All sectors - Up to 1 year (jobs)		16,371	15,738	18,107	17,624	20,836	31,084

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,870	4,700	5,640	5,698	6,632	9,635
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,519	1,477	1,825	1,873	2,194	3,182
On-the-Job Training - All sectors - Over 10 years (jobs)		219	213	251	245	276	400
On-Site or In-Plant Training - All sectors - None (jobs)		3,868	3,733	4,336	4,269	5,098	7,586
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,836	14,248	16,444	16,027	18,870	28,090
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,816	3,681	4,397	4,414	5,133	7,479
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,587	1,534	1,863	1,897	2,218	3,221
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		204	200	243	245	284	416
Wage income - All (million \$2019)		1,387	1,344	1,581	1,589	1,900	2,836

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		112	99.9	80.7	62.9	48.7	38
Oil consumption - Cumulative (million bbls)							2,487
Oil production - Annual (million bbls)		0	0	0	0	0	0
Natural gas consumption - Annual (tcf)		420	354	284	214	135	93.3
Natural gas consumption - Cumulative (tcf)							8,559
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)	508	474	413	338	271	230	212
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Commercial (PJ)	194	191	184	171	157	146	140
Final energy use - Industry (PJ)	516	524	516	503	496	492	490

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)		3.38	3.48	6.55	7	5.91	6.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	38.5	502	966	2,588	4,210	5,507	6,803
Vehicle stocks - LDV – All others (1000 units)	5,673	5,402	5,131	3,739	2,347	1,328	309
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,089	2,796	4,523	6,855	7,457	7,112
Public EV charging plugs - DC Fast (1000 units)	0.143		2.06		9		14.5
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350

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 (%)	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Sales of space heating units - Electric Resistance (%)	13.4	18.8	15	6.74	4.9	4.78	4.99
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of water heating units - Electric Heat Pump (%)	0	0.766	10.6	32.6	37.2	37.5	37.6
Sales of water heating units - Electric Resistance (%)	24.6	40.6	46.1	59	62.1	62.3	62.3
Sales of water heating units - Gas Furnace (%)	75.4	58.6	43.2	8.25	0.653	0.021	0
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113
Sales of cooking units - Electric Resistance (%)	51.1	61.5	93.4	99.7	100	100	100
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.31	4.14				

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 (%)	0.938	6.01	29.4	77.8	88.2	89	89.1
Sales of space heating units - Electric Resistance (%)	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Sales of space heating units - Gas (%)	90.4	87.9	64.6	12.4	1.3	0.384	0.356
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Sales of water heating units - Electric Resistance (%)	2.97	4.18	16.6	44.4	50.5	51	51
Sales of water heating units - Gas (%)	96.6	94.3	69.4	13.2	1.05	0.035	0
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,303	21,086				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	2,783	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,760	5,199	8,090	9,270	11,027	11,580	13,738
Installed thermal - Nuclear (MW)	1,286	1,286	643	0	0	0	0
Installed renewables - Rooftop PV (MW)	103	184	235	313	416	536	679
Installed renewables - Solar - Base land use assumptions (MW)	404	404	491	1,728	2,006	2,006	2,391
Installed renewables - Wind - Base land use assumptions (MW)	737	1,535	3,166	5,072	8,544	14,671	27,957
Installed renewables - Solar - Constrained land use assumptions (MW)	384	384	471	855	1,259	1,383	1,585
Installed renewables - Wind - Constrained land use assumptions (MW)	737	1,153	3,144	12,861	24,958	34,220	39,130
Capital invested - Solar PV - Base (billion \$2018)		0	0.104	1.36	0.29	0	0.356
Capital invested - Wind - Base (billion \$2018)		1.17	2.17	2.36	4.1	6.87	14.1

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)		0.719	0.334	1.27	1.13	0.49	0.187
Capital invested - Wind - Constrained (billion \$2018)		1.44	3.18	14.1	13	9.68	4.97
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	830	830	982	3,137	3,610	3,610	4,278
Wind - Base land use assumptions (GWh)	3,031	5,854	11,388	17,739	29,093	49,189	92,875
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	788	788	940	1,604	2,290	2,508	2,859
Wind - Constrained land use assumptions (GWh)	3,031	4,416	10,931	42,907	82,017	110,217	124,429
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	11	14
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	4
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	11
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	9,964	24,682
Biomass purchases (million \$2018/y)		0	0	0	0	653	1,824

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	12.8	25.1
Annual - BECCS (MMT)		0	0	0	0	12.8	25.1
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	12.8	37.9
Cumulative - BECCS (MMT)		0	0	0	0	12.8	37.9
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0



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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	176	1,528
All (km)		0	0	0	0	176	1,528
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	253	1,249
Cumulative investment - All (million \$2018)		0	0	0	0	253	1,249

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)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,624
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,673

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)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-2,104
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276

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)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716

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)							-1,228
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,397

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)							-94.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-3,720
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,228
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,557
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-189
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-5,975
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,716
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							172
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,367
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,259
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							344
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,082

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)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		14.3	7.5	3.08	1.43	0.566	0.448
Premature deaths from air pollution - Mobile - On-Road (deaths)		120	122	119	108	86.2	59.5
Premature deaths from air pollution - Gas Stations (deaths)		8.22	8.3	8.02	7.2	5.74	3.99
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		26.1	24.1	22	19.4	16.2	12.6
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.6	2.58	2.57	2.43	2.07	1.68
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.66	4.82	4.95	4.81	4.17	3.34

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)		5.53	5.36	5.15	4.91	4.66	4.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		20.7	20.3	19.6	18.2	16	13.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.5	2.32	2.13	1.86	1.55	1.24
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.48	5.86	5.25	4.63	4.02	3.45
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.54	0.156	0.154	0.151	0.143	0.127
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		53.3	48.6	42.4	37.2	33	23.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		455	0.374	0.364	0.319	0.222	0.013
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		126	66.5	27.2	12.7	5.01	3.96
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,066	1,081	1,057	957	766	529
Monetary damages from air pollution - Gas Stations (million \$2019)		72.8	73.5	71	63.8	50.9	35.3
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		231	214	195	172	144	112
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		23	22.9	22.8	21.5	18.3	14.9
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		41.3	42.7	43.8	42.6	36.9	29.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		48.9	47.5	45.6	43.5	41.3	38.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		183	180	174	161	142	118
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		22.2	20.5	18.8	16.5	13.7	11
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		57.4	51.9	46.4	41	35.6	30.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.76	1.38	1.36	1.33	1.26	1.12
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		474	431	376	330	293	206

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,109	1,156	991	545	1,359	2,039
By economic sector - Construction (jobs)		4,864	4,573	5,553	5,977	8,827	12,892

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		3,174	3,252	3,292	3,127	4,242	5,384
By economic sector - Mining (jobs)		2,339	1,635	1,218	896	635	401
By economic sector - Other (jobs)		304	311	540	573	824	1,243
By economic sector - Pipeline (jobs)		530	442	366	314	305	583
By economic sector - Professional (jobs)		2,892	2,660	2,996	3,375	6,818	9,626
By economic sector - Trade (jobs)		2,590	2,191	2,342	2,338	3,473	4,621
By economic sector - Utilities (jobs)		5,943	4,723	4,754	5,570	9,502	13,702
By resource sector - Biomass (jobs)		2,836	2,718	2,294	1,369	5,788	8,570
By resource sector - CO2 (jobs)		0	0	0	0	354	3,205
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		6,026	5,374	6,919	8,598	15,402	22,492
By resource sector - Natural Gas (jobs)		4,962	3,585	2,718	2,802	3,384	2,074
By resource sector - Nuclear (jobs)		649	508	185	0	0	0
By resource sector - Oil (jobs)		5,050	4,342	3,736	3,107	2,484	1,759
By resource sector - Solar (jobs)		1,033	1,045	2,274	1,823	1,801	2,706
By resource sector - Wind (jobs)		1,834	3,002	3,927	5,017	6,773	9,687
By education level - All sectors - High school diploma or less (jobs)		10,322	9,221	9,710	9,714	15,201	21,421
By education level - All sectors - Associates degree or some college (jobs)		7,068	6,199	6,655	7,080	11,109	15,679
By education level - All sectors - Bachelors degree (jobs)		4,983	4,325	4,444	4,613	7,454	10,301
By education level - All sectors - Masters or professional degree (jobs)		1,205	1,050	1,087	1,142	1,920	2,673
By education level - All sectors - Doctoral degree (jobs)		168	149	157	166	300	417
Related work experience - All sectors - None (jobs)		3,500	3,096	3,256	3,324	5,265	7,412
Related work experience - All sectors - Up to 1 year (jobs)		4,947	4,459	4,704	4,642	7,342	10,344
Related work experience - All sectors - 1 to 4 years (jobs)		8,482	7,424	7,797	8,117	12,923	18,092
Related work experience - All sectors - 4 to 10 years (jobs)		5,385	4,708	4,977	5,251	8,299	11,638
Related work experience - All sectors - Over 10 years (jobs)		1,431	1,258	1,319	1,380	2,155	3,005
On-the-Job Training - All sectors - None (jobs)		1,305	1,151	1,208	1,219	1,928	2,689
On-the-Job Training - All sectors - Up to 1 year (jobs)		16,023	14,174	14,790	15,019	23,958	33,494
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,733	4,143	4,439	4,731	7,382	10,429
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,469	1,282	1,409	1,533	2,402	3,441
On-the-Job Training - All sectors - Over 10 years (jobs)		215	194	207	212	314	439
On-Site or In-Plant Training - All sectors - None (jobs)		3,785	3,353	3,528	3,636	5,841	8,192
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,513	12,818	13,401	13,632	21,644	30,275
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,712	3,257	3,480	3,679	5,736	8,091
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,538	1,341	1,455	1,566	2,448	3,486
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		197	175	190	202	316	449
Wage income - All (million \$2019)		1,353	1,196	1,268	1,337	2,153	3,057

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	509	478	433	396	369	336	297
Final energy use - Residential (PJ)	247	230	218	208	197	184	171
Final energy use - Commercial (PJ)	194	191	186	183	179	175	171
Final energy use - Industry (PJ)	516	524	517	508	504	500	498

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)		2.66	2.66	3.62	3.74	5.53	5.85

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	29.8	166	302	933	1,564	2,961	4,358
Vehicle stocks - LDV – All others (1000 units)	5,696	5,696	5,696	5,403	5,110	3,938	2,766
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	177	370	1,251	3,933	5,731
Public EV charging plugs - DC Fast (1000 units)	0.143		0.646		3.34		9.32
Public EV charging plugs - L2 (1000 units)	0.459		15.5		80.4		224

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 (%)	3.66	7.03	8.43	13	23.5	36.7	44.5
Sales of space heating units - Electric Resistance (%)	13.4	19	18.7	17.9	16	13.7	12.5
Sales of space heating units - Gas (%)	73.5	57.5	56.6	53.6	46.4	37.4	31.9
Sales of space heating units - Fossil (%)	9.47	16.4	16.3	15.5	14	12.3	11.1
Sales of water heating units - Electric Heat Pump (%)	0	0.205	0.783	2.7	7.35	13.3	17
Sales of water heating units - Electric Resistance (%)	24.6	40.2	40.4	41.4	44.2	47.7	49.9
Sales of water heating units - Gas Furnace (%)	75.4	59.4	58.7	55.8	48.3	38.9	33
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.115	0.115	0.115	0.115
Sales of cooking units - Electric Resistance (%)	50.9	52.2	56.7	68.5	85	95.2	98.7
Sales of cooking units - Gas (%)	49.1	47.8	43.3	31.5	15	4.84	1.3
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.29	4.06				

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 (%)	0.938	4.33	5.66	9.99	20.2	33.1	40.9
Sales of space heating units - Electric Resistance (%)	3.03	3.36	3.47	3.84	4.75	5.92	6.59
Sales of space heating units - Gas (%)	90.4	89.2	87.9	83.5	72.8	59.1	50.7
Sales of space heating units - Fossil (%)	5.62	3.12	3.01	2.66	2.19	1.88	1.77
Sales of water heating units - Electric Heat Pump (%)	0.306	0.605	1.35	3.8	9.77	17.5	22.2
Sales of water heating units - Electric Resistance (%)	2.97	3.47	4.17	6.6	12.5	20.1	24.7
Sales of water heating units - Gas (%)	96.6	95.7	94.3	89.4	77.6	62.3	52.9
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,301	21,085				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	2,783	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,760	4,891	4,934	4,826	6,931	7,395	8,192
Installed thermal - Nuclear (MW)	1,286	1,286	643	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,624
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,673
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,104



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)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120

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)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716

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)							-1,228
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,397
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-94.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,720
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,228
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,557

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)							-189
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-5,975
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,716
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							172
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,367
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,259
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							344
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,082

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)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		13.5	8.12	3.95	2.69	1.08	0.447
Premature deaths from air pollution - Mobile - On-Road (deaths)		118	110	84.2	49	22.6	9.18
Premature deaths from air pollution - Gas Stations (deaths)		8.05	7.41	5.61	3.33	1.63	0.776
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		26	22.9	16.8	9.96	4.87	1.76
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.55	2.14	1.5	0.877	0.353	0.102
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.63	4.53	3.74	2.57	1.38	0.556
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.53	5.36	5.15	4.91	4.66	4.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		20.7	19	15	9.81	5.48	2.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.5	2.09	1.65	1.2	0.815	0.516
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.48	5.46	4.47	3.5	2.57	1.69

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)		0.635	0.155	0.15	0.143	0.142	0.111
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		52.6	49.7	43.1	31.1	19.1	2.86
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		455	0.374	0.364	0.319	0.222	0.013
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		120	71.9	35	23.8	9.59	3.96
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,048	981	749	435	201	81.6
Monetary damages from air pollution - Gas Stations (million \$2019)		71.3	65.7	49.6	29.5	14.4	6.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		231	203	149	88.2	43.2	15.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		22.6	18.9	13.3	7.77	3.13	0.903
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		41.1	40.1	33.2	22.8	12.2	4.93
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		48.9	47.5	45.6	43.5	41.3	38.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		183	168	133	86.8	48.5	22.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		22.1	18.5	14.6	10.6	7.22	4.56
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		57.4	48.4	39.6	31	22.8	15
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		5.6	1.37	1.33	1.27	1.25	0.983
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		467	441	382	276	170	25.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,080	1,228	1,015	559	878	2,043
By economic sector - Construction (jobs)		4,917	4,835	6,328	8,309	10,429	18,249
By economic sector - Manufacturing (jobs)		3,237	3,519	4,306	4,363	5,285	7,083
By economic sector - Mining (jobs)		2,300	1,552	989	584	314	29.8
By economic sector - Other (jobs)		311	345	537	864	1,109	2,743
By economic sector - Pipeline (jobs)		515	434	312	211	130	42.2
By economic sector - Professional (jobs)		2,897	2,919	3,531	4,800	7,302	13,652
By economic sector - Trade (jobs)		2,585	2,222	2,436	2,924	3,800	6,938
By economic sector - Utilities (jobs)		6,036	5,032	6,468	8,501	11,172	17,297
By resource sector - Biomass (jobs)		2,740	2,949	2,307	1,368	3,302	9,143
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		6,325	5,920	10,372	14,405	19,367	32,223

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		4,814	3,868	2,981	2,762	2,862	2,093
By resource sector - Nuclear (jobs)		649	376	0	0	0	0
By resource sector - Oil (jobs)		4,998	4,033	2,949	1,988	1,228	0.018
By resource sector - Solar (jobs)		1,057	1,320	1,869	2,978	3,241	10,046
By resource sector - Wind (jobs)		1,939	3,249	5,445	7,614	10,417	14,573
By education level - All sectors - High school diploma or less (jobs)		10,373	9,702	11,317	13,189	16,881	28,550
By education level - All sectors - Associates degree or some college (jobs)		7,125	6,577	7,988	9,892	12,832	21,401
By education level - All sectors - Bachelors degree (jobs)		5,003	4,541	5,173	6,246	8,266	13,897
By education level - All sectors - Masters or professional degree (jobs)		1,210	1,107	1,268	1,564	2,120	3,649
By education level - All sectors - Doctoral degree (jobs)		168	158	178	225	321	580
Related work experience - All sectors - None (jobs)		3,517	3,264	3,819	4,540	5,870	9,930
Related work experience - All sectors - Up to 1 year (jobs)		4,970	4,695	5,453	6,311	8,118	13,961
Related work experience - All sectors - 1 to 4 years (jobs)		8,529	7,829	9,178	11,118	14,527	24,389
Related work experience - All sectors - 4 to 10 years (jobs)		5,421	4,972	5,902	7,243	9,439	15,734
Related work experience - All sectors - Over 10 years (jobs)		1,442	1,326	1,570	1,903	2,465	4,064
On-the-Job Training - All sectors - None (jobs)		1,311	1,206	1,384	1,647	2,136	3,683
On-the-Job Training - All sectors - Up to 1 year (jobs)		16,101	14,927	17,303	20,441	26,611	44,970
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,770	4,387	5,312	6,590	8,526	14,145
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,480	1,361	1,683	2,149	2,782	4,678
On-the-Job Training - All sectors - Over 10 years (jobs)		216	204	241	289	364	602
On-Site or In-Plant Training - All sectors - None (jobs)		3,804	3,543	4,136	4,991	6,556	11,137
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,586	13,494	15,685	18,565	24,100	40,671
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,740	3,444	4,147	5,103	6,591	10,960
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,549	1,418	1,725	2,174	2,808	4,705
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		199	186	229	282	363	605
Wage income - All (million \$2019)		1,360	1,259	1,493	1,831	2,415	4,095

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	508	474	413	338	271	230	212
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Commercial (PJ)	194	191	184	171	157	146	140
Final energy use - Industry (PJ)	516	524	516	503	496	492	490

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)		3.38	3.48	6.55	7	5.91	6.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	38.5	502	966	2,588	4,210	5,507	6,803
Vehicle stocks - LDV – All others (1000 units)	5,673	5,402	5,131	3,739	2,347	1,328	309
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,089	2,796	4,523	6,855	7,457	7,112
Public EV charging plugs - DC Fast (1000 units)	0.143		2.06		9		14.5
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350

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 (%)	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Sales of space heating units - Electric Resistance (%)	13.4	18.8	15	6.74	4.9	4.78	4.99
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of water heating units - Electric Heat Pump (%)	0	0.766	10.6	32.6	37.2	37.5	37.6
Sales of water heating units - Electric Resistance (%)	24.6	40.6	46.1	59	62.1	62.3	62.3
Sales of water heating units - Gas Furnace (%)	75.4	58.6	43.2	8.25	0.653	0.021	0
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113
Sales of cooking units - Electric Resistance (%)	51.1	61.5	93.4	99.7	100	100	100
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.31	4.14				

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 (%)	0.938	6.01	29.4	77.8	88.2	89	89.1
Sales of space heating units - Electric Resistance (%)	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Sales of space heating units - Gas (%)	90.4	87.9	64.6	12.4	1.3	0.384	0.356
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Sales of water heating units - Electric Resistance (%)	2.97	4.18	16.6	44.4	50.5	51	51
Sales of water heating units - Gas (%)	96.6	94.3	69.4	13.2	1.05	0.035	0
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,303	21,086				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	2,783	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,760	4,891	6,159	7,791	10,556	9,795	12,547

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	1,286	1,286	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	103	184	235	313	416	536	679
Installed renewables - Solar - Base land use assumptions (MW)	404	404	577	832	1,764	2,282	10,189
Installed renewables - Wind - Base land use assumptions (MW)	737	1,576	3,438	5,930	14,266	34,531	59,967
Installed renewables - Solar - Constrained land use assumptions (MW)	405	405	799	1,655	1,972	1,972	12,135
Installed renewables - Wind - Constrained land use assumptions (MW)	845	1,357	4,176	17,564	33,811	39,597	48,599
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	0.207	0.28	0.969	0.509	7.33
Capital invested - Wind - Base (billion \$2018)		1.23	2.48	3.09	9.85	22.7	26.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	830	830	1,132	1,576	3,192	4,095	17,860
Wind - Base land use assumptions (GWh)	3,031	5,991	12,295	20,551	47,859	114,530	195,827
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,659	1,659	3,024	5,982	7,085	7,085	42,496
Wind - Constrained land use assumptions (GWh)	6,062	9,467	27,943	116,150	217,377	250,814	309,441
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)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,624

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)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,673
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-2,104
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846



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)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,228
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,397
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-94.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-3,720
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,228
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,557
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-189
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-5,975
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,716
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							172
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,367
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,259
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							344
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,082

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)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		15.7	11	16.6	12.2	4.36	1.67
Premature deaths from air pollution - Mobile - On-Road (deaths)		118	110	84.2	49	22.6	9.18
Premature deaths from air pollution - Gas Stations (deaths)		8.05	7.41	5.61	3.33	1.63	0.776

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)		26	22.9	16.8	9.96	4.87	1.76
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.55	2.14	1.5	0.877	0.353	0.102
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.63	4.53	3.74	2.57	1.38	0.556
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.53	5.36	5.15	4.91	4.66	4.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		20.7	19	15	9.81	5.48	2.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.5	2.09	1.65	1.2	0.815	0.516
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.48	5.46	4.47	3.5	2.57	1.69
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.499	0.154	0.15	0.144	0.143	0.111
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		54.1	52.6	51.6	43.8	36.7	27.3
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		455	0.374	0.364	0.319	0.222	0.013
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		139	97.1	147	108	38.6	14.8
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,048	981	749	435	201	81.6
Monetary damages from air pollution - Gas Stations (million \$2019)		71.3	65.7	49.6	29.5	14.4	6.87
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		231	203	149	88.2	43.2	15.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		22.6	18.9	13.3	7.77	3.13	0.903
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		41.1	40.1	33.2	22.8	12.2	4.93
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		48.9	47.5	45.6	43.5	41.3	38.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		183	168	133	86.8	48.5	22.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		22.1	18.5	14.6	10.6	7.22	4.56
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		57.4	48.4	39.6	31	22.8	15
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.4	1.36	1.33	1.27	1.26	0.982

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)		481	467	458	389	325	243

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,099	1,166	985	554	1,123	2,037
By economic sector - Construction (jobs)		5,255	4,882	5,449	6,117	6,640	9,243
By economic sector - Manufacturing (jobs)		3,049	2,729	2,516	2,431	2,580	3,268
By economic sector - Mining (jobs)		2,344	1,622	1,147	781	524	367
By economic sector - Other (jobs)		324	305	374	458	538	713
By economic sector - Pipeline (jobs)		542	477	429	370	347	679
By economic sector - Professional (jobs)		2,988	2,655	2,586	3,056	4,766	7,159
By economic sector - Trade (jobs)		2,630	2,150	2,004	1,996	2,338	3,051
By economic sector - Utilities (jobs)		6,750	6,034	6,574	8,784	9,551	14,318
By resource sector - Biomass (jobs)		2,752	2,718	2,280	1,379	4,423	8,621
By resource sector - CO2 (jobs)		0	0	0	0	400	3,621
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		7,615	7,020	9,637	11,456	11,889	14,896
By resource sector - Natural Gas (jobs)		5,137	4,863	4,260	4,579	4,299	3,288
By resource sector - Nuclear (jobs)		649	508	185	1,637	2,077	4,982
By resource sector - Oil (jobs)		4,996	4,076	3,041	2,199	1,638	1,305
By resource sector - Solar (jobs)		928	707	821	922	1,030	1,475
By resource sector - Wind (jobs)		1,548	1,758	1,840	2,376	2,652	2,648
By education level - All sectors - High school diploma or less (jobs)		10,847	9,669	9,740	10,004	11,412	15,869
By education level - All sectors - Associates degree or some college (jobs)		7,498	6,616	6,777	7,401	8,331	11,365
By education level - All sectors - Bachelors degree (jobs)		5,201	4,488	4,342	4,608	5,469	7,533
By education level - All sectors - Masters or professional degree (jobs)		1,262	1,096	1,064	1,144	1,408	1,966
By education level - All sectors - Doctoral degree (jobs)		173	150	141	154	213	310
Related work experience - All sectors - None (jobs)		3,689	3,281	3,301	3,455	3,963	5,491
Related work experience - All sectors - Up to 1 year (jobs)		5,167	4,609	4,608	4,675	5,434	7,644
Related work experience - All sectors - 1 to 4 years (jobs)		8,934	7,826	7,820	8,341	9,643	13,253
Related work experience - All sectors - 4 to 10 years (jobs)		5,687	4,987	5,019	5,428	6,198	8,487
Related work experience - All sectors - Over 10 years (jobs)		1,505	1,317	1,317	1,411	1,595	2,169
On-the-Job Training - All sectors - None (jobs)		1,361	1,189	1,168	1,210	1,415	1,966
On-the-Job Training - All sectors - Up to 1 year (jobs)		16,782	14,772	14,652	15,251	17,775	24,652
On-the-Job Training - All sectors - 1 to 4 years (jobs)		5,034	4,446	4,559	4,983	5,569	7,581
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,582	1,415	1,490	1,660	1,845	2,529
On-the-Job Training - All sectors - Over 10 years (jobs)		223	197	196	207	229	314
On-Site or In-Plant Training - All sectors - None (jobs)		3,962	3,488	3,454	3,661	4,317	6,003
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		15,220	13,393	13,328	13,895	16,083	22,255

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)		3,940	3,479	3,557	3,856	4,319	5,886
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,648	1,468	1,527	1,682	1,874	2,569
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		211	190	199	216	240	329
Wage income - All (million \$2019)		1,430	1,272	1,292	1,394	1,618	2,251

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	508	474	413	338	271	230	212
Final energy use - Residential (PJ)	247	230	215	188	157	132	115
Final energy use - Commercial (PJ)	194	191	184	171	157	146	140
Final energy use - Industry (PJ)	516	524	516	503	496	492	490

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)		3.38	3.48	6.55	7	5.91	6.17

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	38.5	502	966	2,588	4,210	5,507	6,803
Vehicle stocks - LDV – All others (1000 units)	5,673	5,402	5,131	3,739	2,347	1,328	309
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,089	2,796	4,523	6,855	7,457	7,112
Public EV charging plugs - DC Fast (1000 units)	0.143		2.06		9		14.5
Public EV charging plugs - L2 (1000 units)	0.459		49.6		216		350

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 (%)	3.66	8.85	32.5	79.5	89.5	90.4	90.3
Sales of space heating units - Electric Resistance (%)	13.4	18.8	15	6.74	4.9	4.78	4.99
Sales of space heating units - Gas (%)	73.5	56.3	40.2	7.71	0.776	0.203	0.19
Sales of space heating units - Fossil (%)	9.47	16	12.3	6.05	4.79	4.67	4.5
Sales of water heating units - Electric Heat Pump (%)	0	0.766	10.6	32.6	37.2	37.5	37.6
Sales of water heating units - Electric Resistance (%)	24.6	40.6	46.1	59	62.1	62.3	62.3
Sales of water heating units - Gas Furnace (%)	75.4	58.6	43.2	8.25	0.653	0.021	0
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.114	0.112	0.112	0.113
Sales of cooking units - Electric Resistance (%)	51.1	61.5	93.4	99.7	100	100	100
Sales of cooking units - Gas (%)	48.9	38.5	6.59	0.332	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.31	4.14				

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 (%)	0.938	6.01	29.4	77.8	88.2	89	89.1
Sales of space heating units - Electric Resistance (%)	3.03	3.48	5.44	9.73	10.5	10.6	10.6
Sales of space heating units - Gas (%)	90.4	87.9	64.6	12.4	1.3	0.384	0.356
Sales of space heating units - Fossil (%)	5.62	2.66	0.503	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.306	1.32	13.9	42.1	48.3	48.8	48.8
Sales of water heating units - Electric Resistance (%)	2.97	4.18	16.6	44.4	50.5	51	51
Sales of water heating units - Gas (%)	96.6	94.3	69.4	13.2	1.05	0.035	0
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,303	21,086				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	2,783	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,760	4,826	9,074	9,454	12,578	9,890	11,773
Installed thermal - Nuclear (MW)	1,286	1,286	643	0	698	1,455	3,350
Installed renewables - Rooftop PV (MW)	103	184	235	313	416	536	679
Installed renewables - Solar - Base land use assumptions (MW)	404	404	404	404	404	481	481
Installed renewables - Wind - Base land use assumptions (MW)	737	1,479	2,188	2,904	3,804	5,477	5,514
Installed renewables - Solar - Constrained land use assumptions (MW)	405	405	405	491	597	876	876
Installed renewables - Wind - Constrained land use assumptions (MW)	737	957	1,568	3,421	6,617	16,940	17,087
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	0.075	0
Capital invested - Wind - Base (billion \$2018)		1.09	0.945	0.889	1.06	1.88	0.039
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.095	0.11	0.273	0
Capital invested - Wind - Constrained (billion \$2018)		0.324	0.812	2.3	3.78	11.6	0.156

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	830	830	830	830	830	962	962
Wind - Base land use assumptions (GWh)	3,031	5,681	8,106	10,556	13,566	19,104	19,223
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	830	830	830	982	1,166	1,645	1,645
Wind - Constrained land use assumptions (GWh)	3,031	3,784	5,782	11,836	22,371	56,384	56,867
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 tCO <sub>2</sub> e/y)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-5,624
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-1,673
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-2,104
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,219

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)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285



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)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716

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)							-1,228
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,397
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-94.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-3,720
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,228
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,557
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-189
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-5,975
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							479
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,716
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							172
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,367

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)							479
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,259
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							344
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,082

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)		51.4	0.042	0.041	0.036	0.025	0.001
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		14.3	6.76	3.84	2.49	1.18	0.53
Premature deaths from air pollution - Mobile - On-Road (deaths)		120	122	119	108	86.2	59.5
Premature deaths from air pollution - Gas Stations (deaths)		8.22	8.3	8.02	7.2	5.74	3.99
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		26.1	24.1	22	19.4	16.2	12.6
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.6	2.58	2.57	2.43	2.07	1.68
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.66	4.82	4.95	4.81	4.17	3.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.53	5.36	5.15	4.91	4.66	4.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		20.7	20.3	19.6	18.2	16	13.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.5	2.32	2.13	1.86	1.55	1.24
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.48	5.86	5.25	4.63	4.02	3.45
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.563	0.156	0.154	0.151	0.149	0.144
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		53.3	48.6	42.4	37.2	33	23.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		455	0.374	0.364	0.319	0.222	0.013
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		127	59.8	34	22.1	10.4	4.7
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,066	1,081	1,057	957	766	529
Monetary damages from air pollution - Gas Stations (million \$2019)		72.8	73.5	71	63.8	50.9	35.3

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)		231	214	195	172	144	112
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		23	22.9	22.8	21.5	18.3	14.9
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		41.3	42.7	43.8	42.6	36.9	29.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		48.9	47.5	45.6	43.5	41.3	38.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		183	180	174	161	142	118
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		22.2	20.5	18.8	16.5	13.7	11
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		57.4	51.9	46.4	41	35.6	30.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.97	1.37	1.36	1.33	1.32	1.27
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		474	431	376	330	293	206

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,095	1,156	990	551	1,710	2,754
By economic sector - Construction (jobs)		4,863	4,551	5,327	5,200	7,797	12,146
By economic sector - Manufacturing (jobs)		3,187	3,262	3,082	2,454	3,795	5,495
By economic sector - Mining (jobs)		2,331	1,634	1,224	926	633	385
By economic sector - Other (jobs)		305	310	503	485	711	1,122
By economic sector - Pipeline (jobs)		525	441	371	322	301	583
By economic sector - Professional (jobs)		2,893	2,659	2,875	2,886	6,925	10,547
By economic sector - Trade (jobs)		2,593	2,190	2,276	2,096	3,340	4,641
By economic sector - Utilities (jobs)		5,934	4,639	4,569	4,701	8,423	13,186
By resource sector - Biomass (jobs)		2,811	2,718	2,293	1,396	7,884	13,141
By resource sector - CO2 (jobs)		0	0	0	0	363	3,289
By resource sector - Coal (jobs)		1,355	369	0	0	0	0
By resource sector - Grid (jobs)		6,043	5,265	6,553	7,112	13,429	21,309
By resource sector - Natural Gas (jobs)		4,907	3,512	2,729	2,591	3,172	2,100
By resource sector - Nuclear (jobs)		649	508	185	0	0	0
By resource sector - Oil (jobs)		5,050	4,342	3,736	3,221	2,497	1,691
By resource sector - Solar (jobs)		1,026	1,036	2,028	1,512	1,463	2,564
By resource sector - Wind (jobs)		1,884	3,090	3,692	3,789	4,827	6,765
By education level - All sectors - High school diploma or less (jobs)		10,308	9,177	9,354	8,439	14,277	21,702
By education level - All sectors - Associates degree or some college (jobs)		7,064	6,162	6,384	6,060	10,150	15,421
By education level - All sectors - Bachelors degree (jobs)		4,981	4,307	4,279	3,990	7,068	10,528
By education level - All sectors - Masters or professional degree (jobs)		1,204	1,045	1,047	988	1,841	2,760
By education level - All sectors - Doctoral degree (jobs)		168	149	151	144	299	448

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		3,495	3,079	3,136	2,881	4,938	7,491
Related work experience - All sectors - Up to 1 year (jobs)		4,942	4,442	4,531	4,028	6,987	10,650
Related work experience - All sectors - 1 to 4 years (jobs)		8,475	7,386	7,500	7,010	12,050	18,148
Related work experience - All sectors - 4 to 10 years (jobs)		5,382	4,682	4,783	4,519	7,672	11,579
Related work experience - All sectors - Over 10 years (jobs)		1,431	1,252	1,267	1,183	1,988	2,991
On-the-Job Training - All sectors - None (jobs)		1,305	1,147	1,163	1,059	1,831	2,754
On-the-Job Training - All sectors - Up to 1 year (jobs)		16,009	14,110	14,238	12,997	22,632	34,149
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,730	4,118	4,261	4,061	6,714	10,194
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,467	1,272	1,355	1,322	2,171	3,329
On-the-Job Training - All sectors - Over 10 years (jobs)		215	193	199	181	287	432
On-Site or In-Plant Training - All sectors - None (jobs)		3,782	3,339	3,391	3,132	5,489	8,294
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,500	12,759	12,901	11,799	20,390	30,776
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,710	3,238	3,342	3,162	5,240	7,947
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,537	1,331	1,400	1,355	2,228	3,399
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		197	174	182	173	289	443
Wage income - All (million \$2019)		1,351	1,189	1,221	1,157	2,007	3,068

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	509	478	433	396	369	336	297
Final energy use - Residential (PJ)	247	230	218	208	197	184	171
Final energy use - Commercial (PJ)	194	191	186	183	179	175	171
Final energy use - Industry (PJ)	516	524	517	508	504	500	498

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)		2.66	2.66	3.62	3.74	5.53	5.85

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	29.8	166	302	933	1,564	2,961	4,358
Vehicle stocks - LDV – All others (1000 units)	5,696	5,696	5,696	5,403	5,110	3,938	2,766
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	177	370	1,251	3,933	5,731
Public EV charging plugs - DC Fast (1000 units)	0.143		0.646		3.34		9.32
Public EV charging plugs - L2 (1000 units)	0.459		15.5		80.4		224

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 (%)	3.66	7.03	8.43	13	23.5	36.7	44.5
Sales of space heating units - Electric Resistance (%)	13.4	19	18.7	17.9	16	13.7	12.5
Sales of space heating units - Gas (%)	73.5	57.5	56.6	53.6	46.4	37.4	31.9
Sales of space heating units - Fossil (%)	9.47	16.4	16.3	15.5	14	12.3	11.1
Sales of water heating units - Electric Heat Pump (%)	0	0.205	0.783	2.7	7.35	13.3	17
Sales of water heating units - Electric Resistance (%)	24.6	40.2	40.4	41.4	44.2	47.7	49.9
Sales of water heating units - Gas Furnace (%)	75.4	59.4	58.7	55.8	48.3	38.9	33
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.115	0.115	0.115	0.115
Sales of cooking units - Electric Resistance (%)	50.9	52.2	56.7	68.5	85	95.2	98.7
Sales of cooking units - Gas (%)	49.1	47.8	43.3	31.5	15	4.84	1.3
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.29	4.06				

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 (%)	0.938	4.33	5.66	9.99	20.2	33.1	40.9
Sales of space heating units - Electric Resistance (%)	3.03	3.36	3.47	3.84	4.75	5.92	6.59
Sales of space heating units - Gas (%)	90.4	89.2	87.9	83.5	72.8	59.1	50.7
Sales of space heating units - Fossil (%)	5.62	3.12	3.01	2.66	2.19	1.88	1.77
Sales of water heating units - Electric Heat Pump (%)	0.306	0.605	1.35	3.8	9.77	17.5	22.2
Sales of water heating units - Electric Resistance (%)	2.97	3.47	4.17	6.6	12.5	20.1	24.7
Sales of water heating units - Gas (%)	96.6	95.7	94.3	89.4	77.6	62.3	52.9
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,301	21,085				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	2,783	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,760	4,891	4,595	4,487	5,471	6,034	8,192
Installed thermal - Nuclear (MW)	1,286	1,286	643	0	0	0	0
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	25	28
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	16
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	0	0	21,604	18,471
Biomass purchases (million \$2018/y)		0	0	0	0	2,034	3,688

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	27.8	31.1
Annual - BECCS (MMT)		0	0	0	0	27.8	31.1
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	27.8	58.9
Cumulative - BECCS (MMT)		0	0	0	0	27.8	58.9
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	583	380
All (km)		0	0	0	0	583	380
Cumulative investment - Trunk (million \$2018)		0	0	0	0	0	0
Cumulative investment - Spur (million \$2018)		0	0	0	0	928	788
Cumulative investment - All (million \$2018)		0	0	0	0	928	788

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)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,624
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,673
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-4,219

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)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285



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)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716

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)							-1,571
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,172
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-85.2
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)							-3,828
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							-1,571
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,130
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-170
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)							-5,872

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)							798
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,553
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							155
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							33.6
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							137
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,677
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							798
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							7,286
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							310
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							33.6
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							137
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							8,565

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)		171	99	67.2	55.1	49.6	48.2
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		16.4	15.9	21.1	16.2	13.9	12.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		120	123	127	131	135	139
Premature deaths from air pollution - Gas Stations (deaths)		8.19	8.37	8.52	8.73	8.93	9.1
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		25.9	24.1	22.5	21.4	20.8	20.3
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.53	2.22	1.65	1.04	0.524	0.235
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.51	4.62	4.81	4.96	4.92	4.82
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		5.78	5.86	5.91	5.93	5.94	5.93

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)		20.9	20.6	18.9	16.8	15.5	15.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.59	2.61	2.54	2.41	2.31	2.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		6.77	6.95	7.13	7.29	7.44	7.61
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.35	0.908	0.714	0.671	0.642	0.595
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		53.6	56.7	58.3	56	55.8	52.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		1,514	877	595	488	439	427
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		145	141	187	144	123	110
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,065	1,095	1,126	1,163	1,201	1,239
Monetary damages from air pollution - Gas Stations (million \$2019)		72.5	74.1	75.4	77.3	79	80.6
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		230	214	199	190	185	180
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		22.4	19.7	14.6	9.23	4.65	2.09
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		39.9	41	42.6	44	43.6	42.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		51.1	51.9	52.3	52.5	52.6	52.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		185	182	167	149	137	135
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		22.9	23.1	22.5	21.4	20.4	20
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		59.9	61.5	63.1	64.5	65.9	67.3
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		11.9	8.01	6.3	5.92	5.66	5.25
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		476	504	517	497	496	465

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,087	1,072	1,071	1,047	1,047	1,056
By economic sector - Construction (jobs)		4,539	4,842	5,275	5,441	5,383	5,602
By economic sector - Manufacturing (jobs)		2,442	2,494	2,560	2,651	2,506	2,451
By economic sector - Mining (jobs)		2,444	1,950	1,597	1,309	1,112	888

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		216	270	319	360	378	474
By economic sector - Pipeline (jobs)		540	563	571	542	549	547
By economic sector - Professional (jobs)		2,731	2,639	2,656	2,674	2,700	2,711
By economic sector - Trade (jobs)		2,574	2,297	2,186	2,127	2,076	2,016
By economic sector - Utilities (jobs)		6,591	6,405	6,658	6,398	6,227	5,888
By resource sector - Biomass (jobs)		2,763	2,666	2,574	2,473	2,439	2,405
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		1,747	1,240	908	820	783	300
By resource sector - Grid (jobs)		6,993	6,949	7,827	8,221	7,106	7,364
By resource sector - Natural Gas (jobs)		5,275	5,233	5,525	5,088	5,723	5,080
By resource sector - Nuclear (jobs)		649	639	370	0	0	0
By resource sector - Oil (jobs)		5,077	4,424	3,947	3,684	3,517	3,403
By resource sector - Solar (jobs)			512	713	803	868	1,435
By resource sector - Wind (jobs)		661	871	1,027	1,460	1,542	1,644
By education level - All sectors - High school diploma or less (jobs)		10,052	9,840	10,057	9,958	9,689	9,590
By education level - All sectors - Associates degree or some college (jobs)		6,905	6,770	6,962	6,901	6,749	6,642
By education level - All sectors - Bachelors degree (jobs)		4,865	4,640	4,602	4,460	4,335	4,220
By education level - All sectors - Masters or professional degree (jobs)		1,182	1,129	1,121	1,086	1,061	1,038
By education level - All sectors - Doctoral degree (jobs)		160	153	150	145	144	143
Related work experience - All sectors - None (jobs)		3,429	3,347	3,417	3,374	3,295	3,249
Related work experience - All sectors - Up to 1 year (jobs)		4,771	4,667	4,746	4,697	4,571	4,536
Related work experience - All sectors - 1 to 4 years (jobs)		8,308	8,045	8,152	8,012	7,803	7,660
Related work experience - All sectors - 4 to 10 years (jobs)		5,268	5,124	5,211	5,127	5,006	4,910
Related work experience - All sectors - Over 10 years (jobs)		1,388	1,349	1,366	1,340	1,302	1,276
On-the-Job Training - All sectors - None (jobs)		1,262	1,218	1,219	1,191	1,158	1,143
On-the-Job Training - All sectors - Up to 1 year (jobs)		15,601	15,106	15,264	15,007	14,595	14,351
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,641	4,557	4,688	4,638	4,535	4,466
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,460	1,452	1,517	1,513	1,492	1,478
On-the-Job Training - All sectors - Over 10 years (jobs)		201	199	203	200	196	195
On-Site or In-Plant Training - All sectors - None (jobs)		3,651	3,550	3,590	3,526	3,441	3,389
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,155	13,713	13,871	13,643	13,268	13,047
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,637	3,566	3,662	3,623	3,537	3,485
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,527	1,511	1,567	1,556	1,533	1,514
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		195	193	202	202	199	197
Wage income - All (million \$2019)		1,334	1,310	1,346	1,337	1,320	1,313

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	508	478	436	411	410	422	438

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	247	231	221	214	209	206	203
Final energy use - Commercial (PJ)	193	194	192	189	185	185	190
Final energy use - Industry (PJ)	516	542	554	566	585	606	631

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)		3.26	3.34	4.1	4.26	3.93	4.03

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 (%)	2.81	10.6	10.9	11.5	12	12.6	13.4
Sales of space heating units - Electric Resistance (%)	13.5	18.3	18.1	17.9	17.4	16.8	16.1
Sales of space heating units - Gas (%)	74	55.7	56	56.1	56	56.1	56
Sales of space heating units - Fossil (%)	9.72	15.4	14.9	14.5	14.5	14.6	14.5
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	24.6	40.1	39.9	39.8	39.9	39.7	39.7
Sales of water heating units - Gas Furnace (%)	75.4	59.8	60	60	60	60.1	60.2
Sales of water heating units - Other (%)	0.053	0.114	0.115	0.116	0.115	0.116	0.116
Sales of cooking units - Electric Resistance (%)	50.5	50.5	50.5	50.5	50.5	50.5	50.5
Sales of cooking units - Gas (%)	49.5	49.5	49.5	49.5	49.5	49.5	49.5
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		3.19	3.37				

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 (%)	0.938	11.3	43.3	70.2	74.9	75.5	75.5
Sales of space heating units - Electric Resistance (%)	3.03	4.33	9.16	17.5	23.2	24.1	24.1
Sales of space heating units - Gas (%)	90.4	81.6	46.1	12	1.88	0.453	0.355
Sales of space heating units - Fossil (%)	5.62	2.84	1.46	0.267	0.031	0.001	0
Sales of water heating units - Electric Heat Pump (%)	0.306	0.343	0.347	0.346	0.34	0.342	0.342
Sales of water heating units - Electric Resistance (%)	2.97	3.21	3.18	3.19	3.17	3.16	3.16
Sales of water heating units - Gas (%)	96.6	96.3	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.173	0.186	0.186	0.187	0.186	0.187	0.187
Sales of cooking units - Electric Resistance (%)	41	44.2	44.3	44.3	44.3	44.4	44.5
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,095	19,795				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	4,645	4,282	2,783	2,433	2,433	2,433	0
Installed thermal - Natural gas (MW)	6,760	6,028	7,330	9,621	9,656	7,962	10,633
Installed thermal - Nuclear (MW)	1,286	1,286	1,286	0	0	0	0
Installed renewables - Rooftop PV (MW)	103	184	235	313	416	536	679

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)	404	404	404	404	404	404	404
Installed renewables - Wind - Base land use assumptions (MW)	737	737	1,076	1,594	2,188	2,771	3,025

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	830	830	830	830	830	830	830
Wind - Base land use assumptions (GWh)	3,031	3,031	4,206	6,069	8,106	10,100	10,963
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)	-24.8		-14.9				-13.3
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.73		-3.12				-3.24
Business-as-usual carbon sink - Total (Mt CO2e/y)	-26.6		-18				-16.5

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)							-197
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-351
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,121
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-464
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,121
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-578
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-1,115
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-492
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,422
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-9,861
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-294
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,227
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-5,624
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-680
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,243
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,114
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,673

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-3,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,820
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-21,170
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-392
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-2,104
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-8,126
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-912
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,364
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,651
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-2,230
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-6,496
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-32,495
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-4,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							32.1
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							267
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,588
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							168
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)							82.5
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							73.7
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							32
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							846
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,089
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							48.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							276

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,866
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							253
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)							120
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							231
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,704
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,608
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							64.2
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							285
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,144
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							336
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)							157
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							147
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							185
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,398
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,716