



Net-Zero America - Tennessee data

October 29, 2021 (updated January 9, 2022)

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

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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)		76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		26.1	18.6	10.6	8.51	3.48	1.37
Premature deaths from air pollution - Mobile - On-Road (deaths)		173	161	123	71.1	32.7	13.3
Premature deaths from air pollution - Gas Stations (deaths)		18.7	17.1	12.9	7.58	3.67	1.72
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.41	5.22	2.55	1.18
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.52	1.21	0.813	0.47	0.211	0.075
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.46	3.07	2.32	1.49	0.767	0.335
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		3.38	3.21	3.03	2.84	2.65	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.1	13.2	9.74	6.29	4.07	2.91
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.33	1.95	1.53	1.11	0.759	0.483
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.01	0.845	0.688	0.536	0.393	0.259
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.72	0.874	0.859	0.837	0.839	0.822
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		62.3	58.3	52.7	41	30.2	18.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		678	0.891	0.866	0.635	0.43	0.035
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		231	165	93.7	75.4	30.8	12.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,540	1,435	1,091	632	291	118
Monetary damages from air pollution - Gas Stations (million \$2019)		166	152	114	67.1	32.5	15.3
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	83.4	46.3	22.6	10.5
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.5	10.7	7.2	4.16	1.87	0.668
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		30.6	27.2	20.6	13.2	6.79	2.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		29.9	28.4	26.8	25.1	23.4	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		133	117	86.3	55.7	36	25.8

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)		20.7	17.3	13.6	9.86	6.72	4.27
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		8.93	7.48	6.09	4.75	3.48	2.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		15.2	7.71	7.58	7.39	7.4	7.26
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		553	517	468	364	268	166

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		446	511	888	614	777	586
By economic sector - Construction (jobs)		4,908	5,306	6,808	7,592	9,699	13,910
By economic sector - Manufacturing (jobs)		2,866	2,944	3,428	3,138	2,811	3,258
By economic sector - Mining (jobs)		2,237	1,603	1,043	637	388	238
By economic sector - Other (jobs)		337	397	631	1,000	1,789	3,143
By economic sector - Pipeline (jobs)		452	517	487	296	258	237
By economic sector - Professional (jobs)		2,668	2,471	3,340	3,698	5,146	7,108
By economic sector - Trade (jobs)		2,310	2,015	2,131	2,295	3,076	4,623
By economic sector - Utilities (jobs)		7,759	7,753	9,527	9,650	9,611	12,067
By resource sector - Biomass (jobs)		1,166	1,223	2,297	1,712	2,853	2,565
By resource sector - CO2 (jobs)		13.5	1,134	1,618	735	1,111	1,373
By resource sector - Coal (jobs)		519	20.5	17.8	15.6	14.1	12.5
By resource sector - Grid (jobs)		7,990	8,104	11,539	12,813	13,557	18,310
By resource sector - Natural Gas (jobs)		4,373	3,586	3,247	2,992	1,666	1,688
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	2,397	2,359	2,323
By resource sector - Oil (jobs)		5,546	4,342	3,023	1,949	1,189	650
By resource sector - Solar (jobs)		1,354	1,899	3,132	5,342	10,018	17,208
By resource sector - Wind (jobs)		507	734	973	963	786	1,040
By education level - All sectors - High school diploma or less (jobs)		10,035	10,000	12,168	12,352	14,326	19,186
By education level - All sectors - Associates degree or some college (jobs)		7,275	7,212	8,766	9,100	10,545	14,434
By education level - All sectors - Bachelors degree (jobs)		5,231	4,948	5,745	5,817	6,713	8,917
By education level - All sectors - Masters or professional degree (jobs)		1,270	1,196	1,413	1,449	1,713	2,289
By education level - All sectors - Doctoral degree (jobs)		172	159	191	200	257	345
Related work experience - All sectors - None (jobs)		3,472	3,428	4,156	4,240	4,925	6,648
Related work experience - All sectors - Up to 1 year (jobs)		4,729	4,695	5,728	5,836	6,879	9,247
Related work experience - All sectors - 1 to 4 years (jobs)		8,697	8,478	10,153	10,383	12,026	16,172
Related work experience - All sectors - 4 to 10 years (jobs)		5,581	5,451	6,517	6,693	7,719	10,424
Related work experience - All sectors - Over 10 years (jobs)		1,505	1,464	1,731	1,766	2,004	2,681
On-the-Job Training - All sectors - None (jobs)		1,325	1,281	1,512	1,556	1,852	2,516
On-the-Job Training - All sectors - Up to 1 year (jobs)		15,990	15,600	18,710	18,989	22,006	29,405

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)		4,931	4,888	5,915	6,121	7,049	9,594
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,517	1,529	1,888	1,987	2,337	3,235
On-the-Job Training - All sectors - Over 10 years (jobs)		220	219	259	267	310	421
On-Site or In-Plant Training - All sectors - None (jobs)		3,838	3,752	4,521	4,640	5,462	7,365
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		14,522	14,181	16,993	17,269	19,983	26,749
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,839	3,801	4,595	4,744	5,467	7,430
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,588	1,585	1,931	2,014	2,350	3,228
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		196	197	244	253	291	398
Wage income - All (million \$2019)		1,276	1,255	1,511	1,556	1,806	2,441

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		123	105	78.9	54.7	35.5	20.6
Oil consumption - Cumulative (million bbls)							2,449
Oil production - Annual (million bbls)		0.272	0.273	0.273	0.216	0.176	0.117
Natural gas consumption - Annual (tcf)		303	256	205	154	97.1	67.4
Natural gas consumption - Cumulative (tcf)							6,175
Natural gas production - Annual (tcf)		4.04	3.82	3.33	2.81	2.23	1.73

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	679	622	545	451	367	315	293
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Commercial (PJ)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904

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)		4.81	4.94	6.83	7.17	5.85	5.99

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	42.4	513	983	2,630	4,277	5,593	6,909
Vehicle stocks - LDV – All others (1000 units)	5,761	5,485	5,210	3,797	2,383	1,348	313
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165		2.15		9.36		15.1
Public EV charging plugs - L2 (1000 units)	0.888		51.7		225		363

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 (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.23	5.68				

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 (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Gas Furnace (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,412	22,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,054	9,667	8,705	10,922	10,114	7,630	6,034
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	4,981	4,981	4,981
Installed renewables - Rooftop PV (MW)	127	205	290	412	585	809	1,096
Installed renewables - Solar - Base land use assumptions (MW)	260	532	1,089	2,367	5,134	12,099	23,955
Installed renewables - Wind - Base land use assumptions (MW)	29	75.6	115	115	115	115	115
Installed renewables - Solar - Constrained land use assumptions (MW)	160	160	313	2,907	5,809	11,573	18,894
Installed renewables - Wind - Constrained land use assumptions (MW)	29	29	29	29	29	29	29
Capital invested - Solar PV - Base (billion \$2018)		0.364	0.667	1.41	2.88	6.84	11

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Wind - Base (billion \$2018)		0.069	0.052	0	0	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0.173	0	1.86	2.57	9.47	7
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	3.78	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	538	1,056	2,116	4,533	9,759	22,749	44,773
Wind - Base land use assumptions (GWh)	106	245	361	361	361	361	361
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	282	282	575	5,431	10,875	21,631	35,152
Wind - Constrained land use assumptions (GWh)	106	106	106	106	106	106	106
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	4,245	4,245
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	2	2
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	3	3	7	7
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	0	3,213	0	6,799	0
Biomass purchases (million \$2018/y)		0	0	170	170	506	506

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	5.99	5.7	17.2	16.5
Annual - BECCS (MMT)		0	0	4.13	4.13	12.5	12.5
Annual - NGCC (MMT)		0	0	1.86	1.57	4.69	4.06
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	5.99	11.7	28.9	45.4
Cumulative - BECCS (MMT)		0	0	4.13	8.26	20.7	33.2
Cumulative - NGCC (MMT)		0	0	1.86	3.43	8.12	12.2
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	181	362	362	362	362
Spur (km)		0	0	470	727	1,511	1,301
All (km)		0	181	832	1,089	1,872	1,662
Cumulative investment - Trunk (million \$2018)		0	1,110	2,221	2,221	2,221	2,221
Cumulative investment - Spur (million \$2018)		0	0	464	763	1,435	1,271
Cumulative investment - All (million \$2018)		0	1,110	2,685	2,984	3,656	3,492

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	0.88	1.81	2.58	3.73
Injection wells (wells)		0	1	2	4	7	8
Resource characterization, appraisal, permitting costs (million \$2020)		25.4	71.2	91.5	91.5	91.5	91.5
Wells and facilities construction costs (million \$2020)		0	16.9	66	118	197	244

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)							-579
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,144

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 tCO2e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-19,839
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286

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)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164
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)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209

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 ₂ e/y)							-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-1,769

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 tCO2e/y)							-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,097
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,739
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,176
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,141

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)		76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		19.8	12.3	5.08	2.09	0.743	0.475
Premature deaths from air pollution - Mobile - On-Road (deaths)		176	178	173	156	124	85.5
Premature deaths from air pollution - Gas Stations (deaths)		19.1	19.2	18.4	16.4	13	8.96
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	15.6	13.6	11.1	8.23	5.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.55	1.44	1.33	1.14	0.861	0.572
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.5	3.47	3.39	3.06	2.41	1.7

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)		3.38	3.21	3.03	2.84	2.65	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.2	15	14.3	12.6	10.2	7.68
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.34	2.16	1.98	1.72	1.41	1.12
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.01	0.906	0.807	0.709	0.615	0.527
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.67	0.876	0.867	0.85	0.84	0.797
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		62.1	56	48.3	42	36.9	25.9
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		678	0.891	0.866	0.635	0.43	0.035
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		175	109	45	18.5	6.58	4.21
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,565	1,579	1,538	1,387	1,106	761
Monetary damages from air pollution - Gas Stations (million \$2019)		169	170	163	145	115	79.4
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		154	139	121	98.2	73	48.7
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.8	12.8	11.8	10.1	7.63	5.07
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		31	30.8	30.1	27.2	21.4	15.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		29.9	28.4	26.8	25.1	23.4	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		134	133	127	112	90.4	68
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		20.7	19.1	17.5	15.2	12.5	9.95
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		8.93	8.02	7.14	6.27	5.44	4.66
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		14.7	7.73	7.65	7.5	7.41	7.03
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		551	497	429	373	328	230

Table 18: E- scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		460	481	1,281	907	1,064	586
By economic sector - Construction (jobs)		4,178	5,019	6,267	7,021	11,226	14,881

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		2,717	2,875	3,363	3,337	3,814	3,997
By economic sector - Mining (jobs)		2,261	1,689	1,278	942	691	434
By economic sector - Other (jobs)		284	358	532	878	1,961	3,211
By economic sector - Pipeline (jobs)		455	612	644	406	424	407
By economic sector - Professional (jobs)		2,302	2,155	3,526	4,049	6,339	7,346
By economic sector - Trade (jobs)		2,146	1,933	2,230	2,491	3,766	4,876
By economic sector - Utilities (jobs)		6,261	6,829	8,181	8,277	10,767	12,951
By resource sector - Biomass (jobs)		1,186	1,135	3,846	3,438	4,529	2,481
By resource sector - CO2 (jobs)		13.7	1,934	2,777	1,270	1,906	2,343
By resource sector - Coal (jobs)		528	25.1	17.9	15.7	14.1	12.4
By resource sector - Grid (jobs)		5,663	6,190	7,808	10,196	15,000	19,182
By resource sector - Natural Gas (jobs)		3,608	2,774	2,894	2,210	1,901	1,877
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	2,397	2,359	2,323
By resource sector - Oil (jobs)		5,614	4,681	3,916	3,111	2,329	1,373
By resource sector - Solar (jobs)		1,402	1,970	2,735	4,735	10,929	17,540
By resource sector - Wind (jobs)		534	768	873	937	1,084	1,558
By education level - All sectors - High school diploma or less (jobs)		8,838	9,377	11,828	12,128	17,130	20,727
By education level - All sectors - Associates degree or some college (jobs)		6,281	6,684	8,240	8,653	12,463	15,565
By education level - All sectors - Bachelors degree (jobs)		4,663	4,634	5,644	5,852	8,090	9,595
By education level - All sectors - Masters or professional degree (jobs)		1,125	1,108	1,391	1,461	2,056	2,439
By education level - All sectors - Doctoral degree (jobs)		155	148	199	215	312	363
Related work experience - All sectors - None (jobs)		3,035	3,196	4,020	4,141	5,880	7,167
Related work experience - All sectors - Up to 1 year (jobs)		4,193	4,403	5,619	5,811	8,252	9,940
Related work experience - All sectors - 1 to 4 years (jobs)		7,637	7,907	9,792	10,157	14,345	17,435
Related work experience - All sectors - 4 to 10 years (jobs)		4,873	5,077	6,222	6,483	9,184	11,246
Related work experience - All sectors - Over 10 years (jobs)		1,325	1,368	1,649	1,717	2,390	2,901
On-the-Job Training - All sectors - None (jobs)		1,184	1,206	1,486	1,559	2,219	2,697
On-the-Job Training - All sectors - Up to 1 year (jobs)		14,138	14,586	18,261	18,842	26,420	31,702
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,261	4,539	5,553	5,801	8,311	10,357
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,284	1,410	1,752	1,846	2,731	3,477
On-the-Job Training - All sectors - Over 10 years (jobs)		197	209	250	261	370	457
On-Site or In-Plant Training - All sectors - None (jobs)		3,389	3,509	4,411	4,584	6,525	7,918
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		12,823	13,257	16,522	17,072	23,958	28,843
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,328	3,535	4,332	4,521	6,462	8,022
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,356	1,468	1,809	1,894	2,763	3,476
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		167	182	227	238	344	430
Wage income - All (million \$2019)		1,121	1,171	1,458	1,525	2,156	2,632

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	680	628	570	525	490	449	400
Final energy use - Residential (PJ)	260	244	232	219	204	187	173
Final energy use - Commercial (PJ)	171	171	169	166	161	156	153
Final energy use - Industry (PJ)	755	838	889	910	921	912	909

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)		4.14	4.18	4.77	4.88	5.83	6.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	32.8	171	309	950	1,590	3,008	4,425
Vehicle stocks - LDV – All others (1000 units)	5,784	5,784	5,784	5,487	5,189	3,999	2,808
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	180	376	1,271	3,991	5,817
Public EV charging plugs - DC Fast (1000 units)	0.165		0.677		3.48		9.69
Public EV charging plugs - L2 (1000 units)	0.888		16.3		83.7		233

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 (%)	32.2	41.6	45.3	56	72.3	82.8	86.5
Sales of space heating units - Electric Resistance (%)	31.3	33.1	31	25.2	16.6	11.1	9.21
Sales of space heating units - Gas (%)	32.4	20.3	18.9	14.9	8.67	4.49	3.04
Sales of space heating units - Fossil (%)	4.13	5	4.74	3.81	2.44	1.57	1.28
Sales of water heating units - Electric Heat Pump (%)	0	1.56	6	18.8	38.4	51.1	55.6
Sales of water heating units - Electric Resistance (%)	68.9	78.9	75.9	67	53.3	44.5	41.4
Sales of water heating units - Gas Furnace (%)	27.4	17	15.5	11.7	5.76	1.83	0.477
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.56	2.54	2.54
Sales of cooking units - Electric Resistance (%)	83.1	83.5	85.1	89.2	94.8	98.3	99.6
Sales of cooking units - Gas (%)	16.9	16.5	14.9	10.8	5.17	1.67	0.449
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.17	5.41				

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 (%)	9.56	21.7	26.9	42.4	66.6	83.3	89.7
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.65	4.78	5.23	5.91	6.33
Sales of space heating units - Gas Furnace (%)	85.6	70.4	65.3	50.5	27	10.4	3.89
Sales of space heating units - Fossil (%)	0	3.27	3.09	2.34	1.17	0.379	0.099
Sales of water heating units - Electric Heat Pump (%)	0.155	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	5.74	6.48	8.39	14.4	23.5	29.5	31.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Gas Furnace (%)	92.5	90	83	62.2	30.4	9.74	2.53
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,401	22,003				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,082	5,587	5,479	4,742	6,313	7,284	5,683
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	4,981	4,981	4,981

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)							-579
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-19,839

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209

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)							-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-54
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,097

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,739
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,176
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,141

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)		76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		21.2	15.1	7.9	4.95	1.39	0.523
Premature deaths from air pollution - Mobile - On-Road (deaths)		173	161	123	71.1	32.7	13.3
Premature deaths from air pollution - Gas Stations (deaths)		18.7	17.1	12.9	7.58	3.67	1.72
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.41	5.22	2.55	1.18
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.52	1.21	0.813	0.47	0.211	0.075
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.46	3.07	2.32	1.49	0.767	0.335
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		3.38	3.21	3.03	2.84	2.65	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.1	13.2	9.74	6.29	4.07	2.91

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.33	1.95	1.53	1.11	0.759	0.483
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.01	0.845	0.688	0.536	0.393	0.259
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.86	0.874	0.858	0.836	0.837	0.766
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		61.2	57.4	49.2	35.3	21.4	3.11
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		678	0.891	0.866	0.635	0.43	0.035
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		188	134	70	43.8	12.3	4.63
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,540	1,435	1,091	632	291	118
Monetary damages from air pollution - Gas Stations (million \$2019)		166	152	114	67.1	32.5	15.3
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	83.4	46.3	22.6	10.5
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.5	10.7	7.2	4.16	1.87	0.668
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		30.6	27.2	20.6	13.2	6.79	2.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		29.9	28.4	26.8	25.1	23.4	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		133	117	86.3	55.7	36	25.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		20.7	17.3	13.6	9.86	6.72	4.27
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		8.93	7.48	6.09	4.75	3.48	2.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		16.4	7.71	7.57	7.37	7.39	6.76
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		543	510	437	314	190	27.6

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		447	514	848	577	668	586
By economic sector - Construction (jobs)		4,204	5,186	8,130	15,159	19,620	32,779
By economic sector - Manufacturing (jobs)		2,839	3,115	3,927	4,109	4,953	6,374
By economic sector - Mining (jobs)		2,214	1,548	937	487	198	28.4
By economic sector - Other (jobs)		253	530	1,211	3,208	4,557	8,505
By economic sector - Pipeline (jobs)		443	368	258	162	83.4	30.5
By economic sector - Professional (jobs)		2,349	2,556	4,009	6,972	9,460	15,837

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		2,138	2,086	2,645	4,678	6,266	11,119
By economic sector - Utilities (jobs)		6,837	6,625	8,420	10,596	13,461	21,822
By resource sector - Biomass (jobs)		1,142	1,241	2,108	1,698	2,497	2,641
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		520	20.5	17.8	15.6	14.1	12.3
By resource sector - Grid (jobs)		6,667	7,342	11,527	16,616	24,301	41,572
By resource sector - Natural Gas (jobs)		3,784	3,049	2,337	2,154	1,433	2,085
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	1,914	1,203	698
By resource sector - Oil (jobs)		5,547	4,282	2,893	1,651	702	4.64
By resource sector - Solar (jobs)		973	3,268	7,713	20,410	27,391	47,703
By resource sector - Wind (jobs)		575	852	1,351	1,489	1,725	2,365
By education level - All sectors - High school diploma or less (jobs)		9,094	9,607	13,124	19,760	25,433	41,441
By education level - All sectors - Associates degree or some college (jobs)		6,521	6,832	9,387	14,625	19,017	31,484
By education level - All sectors - Bachelors degree (jobs)		4,794	4,772	6,136	8,954	11,447	18,625
By education level - All sectors - Masters or professional degree (jobs)		1,158	1,157	1,519	2,264	2,923	4,798
By education level - All sectors - Doctoral degree (jobs)		157	160	218	345	447	733
Related work experience - All sectors - None (jobs)		3,134	3,264	4,436	6,738	8,724	14,352
Related work experience - All sectors - Up to 1 year (jobs)		4,299	4,575	6,295	9,545	12,293	20,030
Related work experience - All sectors - 1 to 4 years (jobs)		7,881	8,107	10,864	16,380	21,145	34,669
Related work experience - All sectors - 4 to 10 years (jobs)		5,039	5,182	6,943	10,559	13,615	22,356
Related work experience - All sectors - Over 10 years (jobs)		1,369	1,401	1,845	2,725	3,489	5,673
On-the-Job Training - All sectors - None (jobs)		1,209	1,251	1,671	2,574	3,308	5,437
On-the-Job Training - All sectors - Up to 1 year (jobs)		14,559	15,033	20,130	29,912	38,525	62,795
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,420	4,611	6,289	9,739	12,598	20,790
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,334	1,419	2,003	3,277	4,270	7,145
On-the-Job Training - All sectors - Over 10 years (jobs)		201	214	289	448	565	913
On-Site or In-Plant Training - All sectors - None (jobs)		3,483	3,627	4,924	7,516	9,690	15,849
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		13,211	13,644	18,263	27,204	35,041	57,194
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,448	3,599	4,900	7,555	9,772	16,105
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,406	1,476	2,040	3,270	4,240	7,060
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		174	184	256	402	525	873
Wage income - All (million \$2019)		1,158	1,194	1,595	2,388	3,105	5,140

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	679	622	545	451	367	315	293
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Commercial (PJ)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904

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)		4.81	4.94	6.83	7.17	5.85	5.99

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	42.4	513	983	2,630	4,277	5,593	6,909
Vehicle stocks - LDV – All others (1000 units)	5,761	5,485	5,210	3,797	2,383	1,348	313
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165		2.15		9.36		15.1
Public EV charging plugs - L2 (1000 units)	0.888		51.7		225		363

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 (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.23	5.68				

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 (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Gas Furnace (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,412	22,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,130	7,005	6,550	6,592	5,665	7,266	9,402
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	2,540	2,540	0
Installed renewables - Rooftop PV (MW)	127	205	290	412	585	809	1,096
Installed renewables - Solar - Base land use assumptions (MW)	163	163	1,681	6,524	20,916	37,604	77,802
Installed renewables - Wind - Base land use assumptions (MW)	29	75.6	115	115	115	115	115
Installed renewables - Solar - Constrained land use assumptions (MW)	240	240	1,087	5,808	17,731	34,337	66,337
Installed renewables - Wind - Constrained land use assumptions (MW)	33.2	33.2	33.2	33.2	33.2	33.2	119
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion \$2018)		0	1.82	5.34	15	16.4	37.2
Capital invested - Wind - Base (billion \$2018)		0.069	0.052	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	355	355	3,227	12,251	39,100	70,108	144,501
Wind - Base land use assumptions (GWh)	106	245	361	361	361	361	361
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,002	1,002	4,184	21,860	66,347	127,856	246,439
Wind - Constrained land use assumptions (GWh)	212	212	212	212	212	212	721
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)							-57.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-19,839
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164
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)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-54
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-2,097
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-3,739
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,176
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,141

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)		76.6	0.101	0.098	0.072	0.049	0.004

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		24.1	17	17.6	13.5	4.64	1.51
Premature deaths from air pollution - Mobile - On-Road (deaths)		173	161	123	71.1	32.7	13.3
Premature deaths from air pollution - Gas Stations (deaths)		18.7	17.1	12.9	7.58	3.67	1.72
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.3	14.1	9.41	5.22	2.55	1.18
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.52	1.21	0.813	0.47	0.211	0.075
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.46	3.07	2.32	1.49	0.767	0.335
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		3.38	3.21	3.03	2.84	2.65	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.1	13.2	9.74	6.29	4.07	2.91
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.33	1.95	1.53	1.11	0.759	0.483
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.01	0.845	0.688	0.536	0.393	0.259
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.59	0.873	0.859	0.836	0.839	0.766
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		63	60.8	59.4	50.2	41.8	31
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		678	0.891	0.866	0.635	0.43	0.035
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		214	151	156	120	41.1	13.4
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,540	1,435	1,091	632	291	118
Monetary damages from air pollution - Gas Stations (million \$2019)		166	152	114	67.1	32.5	15.3
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		153	125	83.4	46.3	22.6	10.5
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.5	10.7	7.2	4.16	1.87	0.668
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		30.6	27.2	20.6	13.2	6.79	2.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		29.9	28.4	26.8	25.1	23.4	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		133	117	86.3	55.7	36	25.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		20.7	17.3	13.6	9.86	6.72	4.27

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		8.93	7.48	6.09	4.75	3.48	2.29
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		14	7.7	7.58	7.38	7.4	6.76
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		560	540	527	446	371	275

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		455	486	1,291	776	867	586
By economic sector - Construction (jobs)		4,245	4,939	6,265	6,956	7,294	7,986
By economic sector - Manufacturing (jobs)		2,580	2,328	2,573	2,543	2,453	2,397
By economic sector - Mining (jobs)		2,253	1,646	1,138	748	523	384
By economic sector - Other (jobs)		255	268	372	609	693	778
By economic sector - Pipeline (jobs)		462	661	715	441	453	462
By economic sector - Professional (jobs)		2,327	2,121	3,406	3,601	4,365	4,898
By economic sector - Trade (jobs)		2,131	1,829	1,975	2,058	2,171	2,384
By economic sector - Utilities (jobs)		6,778	7,634	9,363	10,538	12,806	18,342
By resource sector - Biomass (jobs)		1,148	1,135	3,979	2,618	3,406	2,498
By resource sector - CO2 (jobs)		13.8	2,191	3,144	1,429	2,146	2,644
By resource sector - Coal (jobs)		518	20.5	17.8	15.6	14.1	12.3
By resource sector - Grid (jobs)		6,638	6,562	9,886	13,342	13,277	14,165
By resource sector - Natural Gas (jobs)		3,768	3,900	3,224	3,910	3,091	3,168
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	2,397	5,469	11,794
By resource sector - Oil (jobs)		5,545	4,342	3,023	1,949	1,253	835
By resource sector - Solar (jobs)		943	964	1,137	2,218	2,625	2,826
By resource sector - Wind (jobs)		398	323	254	390	343	275
By education level - All sectors - High school diploma or less (jobs)		9,001	9,303	11,732	12,050	13,215	15,467
By education level - All sectors - Associates degree or some college (jobs)		6,440	6,736	8,259	8,858	9,778	11,751
By education level - All sectors - Bachelors degree (jobs)		4,740	4,614	5,539	5,731	6,682	8,499
By education level - All sectors - Masters or professional degree (jobs)		1,148	1,112	1,378	1,435	1,706	2,187
By education level - All sectors - Doctoral degree (jobs)		156	146	191	196	244	314
Related work experience - All sectors - None (jobs)		3,103	3,209	4,015	4,167	4,599	5,446
Related work experience - All sectors - Up to 1 year (jobs)		4,250	4,324	5,513	5,640	6,285	7,436
Related work experience - All sectors - 1 to 4 years (jobs)		7,798	7,910	9,728	10,172	11,417	13,872
Related work experience - All sectors - 4 to 10 years (jobs)		4,985	5,107	6,212	6,566	7,364	9,008
Related work experience - All sectors - Over 10 years (jobs)		1,351	1,363	1,632	1,724	1,959	2,456
On-the-Job Training - All sectors - None (jobs)		1,197	1,187	1,447	1,497	1,723	2,147
On-the-Job Training - All sectors - Up to 1 year (jobs)		14,386	14,471	18,005	18,571	20,855	25,157
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,375	4,593	5,600	5,990	6,633	8,043
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,330	1,457	1,808	1,960	2,131	2,517

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		198	203	240	250	283	354
On-Site or In-Plant Training - All sectors - None (jobs)		3,442	3,480	4,332	4,496	5,114	6,252
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		13,058	13,171	16,325	16,894	18,938	22,873
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,413	3,563	4,352	4,635	5,125	6,187
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,401	1,512	1,858	1,994	2,181	2,598
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		172	186	232	250	268	308
Wage income - All (million \$2019)		1,147	1,179	1,459	1,543	1,779	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)	679	622	545	451	367	315	293
Final energy use - Residential (PJ)	260	243	223	197	176	163	157
Final energy use - Commercial (PJ)	171	171	165	155	148	145	145
Final energy use - Industry (PJ)	755	838	888	904	913	905	904

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)		4.81	4.94	6.83	7.17	5.85	5.99

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	42.4	513	983	2,630	4,277	5,593	6,909
Vehicle stocks - LDV – All others (1000 units)	5,761	5,485	5,210	3,797	2,383	1,348	313
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		1,105	2,839	4,591	6,958	7,569	7,219
Public EV charging plugs - DC Fast (1000 units)	0.165		2.15		9.36		15.1
Public EV charging plugs - L2 (1000 units)	0.888		51.7		225		363

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 (%)	32.2	47.8	80.2	87.5	87.8	87.7	87.7
Sales of space heating units - Electric Resistance (%)	31.3	29.8	12.5	8.63	8.46	8.57	8.59
Sales of space heating units - Gas (%)	32.4	17.9	5.43	2.67	2.55	2.52	2.52
Sales of space heating units - Fossil (%)	4.13	4.49	1.84	1.23	1.19	1.17	1.17
Sales of water heating units - Electric Heat Pump (%)	0	9.08	48.1	56.8	57.1	57.2	57.2
Sales of water heating units - Electric Resistance (%)	68.9	73.7	46.7	40.6	40.3	40.3	40.3
Sales of water heating units - Gas Furnace (%)	27.4	14.7	2.75	0.116	0	0	0
Sales of water heating units - Other (%)	3.71	2.57	2.53	2.53	2.54	2.54	2.54
Sales of cooking units - Electric Resistance (%)	83.2	86.7	97.7	99.9	100	100	100
Sales of cooking units - Gas (%)	16.8	13.3	2.27	0.114	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.23	5.68				

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 (%)	9.56	30.6	77.3	90.8	91.9	92	92
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.92	6.26	6.57	6.58	6.55
Sales of space heating units - Gas Furnace (%)	85.6	62	17.3	2.94	1.48	1.43	1.43
Sales of space heating units - Fossil (%)	0	2.83	0.549	0.023	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.155	10.6	55.7	65.7	66.1	66.2	66.1
Sales of water heating units - Electric Resistance (%)	5.74	9.97	28	32.1	32.3	32.3	32.3
Sales of water heating units - Gas Furnace (%)	92.5	77.8	14.7	0.62	0	0	0
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	55.3	83.4	88.9	89.2	89.2	89.1
Sales of cooking units - Gas (%)	56.5	44.7	16.6	11.1	10.8	10.8	10.9
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,412	22,037				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,078	5,849	5,100	6,979	12,236	12,657	10,150
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	4,981	6,329	10,221
Installed renewables - Rooftop PV (MW)	127	205	290	412	585	809	1,096
Installed renewables - Solar - Base land use assumptions (MW)	519	519	519	519	1,509	2,585	2,700
Installed renewables - Wind - Base land use assumptions (MW)	29	75.6	75.6	75.6	115	162	162
Installed renewables - Solar - Constrained land use assumptions (MW)	240	240	240	452	1,067	2,808	2,808
Installed renewables - Wind - Constrained land use assumptions (MW)	29	29	29	29	29	29	29
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	1.03	1.06	0.107
Capital invested - Wind - Base (billion \$2018)		0.069	0	0	0.046	0	0
Capital invested - Solar PV - Constrained (billion \$2018)		0	0	0.233	0.639	1.71	0
Capital invested - Wind - Constrained (billion \$2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,029	1,029	1,029	1,029	2,901	4,915	5,134
Wind - Base land use assumptions (GWh)	106	245	245	245	361	361	361
Offshore Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Constrained land use assumptions (GWh)	501	501	501	902	2,052	5,309	5,309
Wind - Constrained land use assumptions (GWh)	106	106	106	106	106	106	106
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-579
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-19,839
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-591
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,834

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164
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)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-274
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO ₂ e/y)							-1,769
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-54
Carbon sink potential - Moderate deployment - Total (1000 tCO ₂ e/y)							-2,097
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO ₂ e/y)							-274
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO ₂ e/y)							-3,357
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO ₂ e/y)							-108
Carbon sink potential - Aggressive deployment - Total (1000 tCO ₂ e/y)							-3,739

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							965
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							98.3
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,176
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							112
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							197
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							2,141

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)		76.6	0.101	0.098	0.072	0.049	0.004
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		22.6	13.3	6.67	4.27	2.16	0.915
Premature deaths from air pollution - Mobile - On-Road (deaths)		176	178	173	156	124	85.5
Premature deaths from air pollution - Gas Stations (deaths)		19.1	19.2	18.4	16.4	13	8.96
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.4	15.6	13.6	11.1	8.23	5.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.55	1.44	1.33	1.14	0.861	0.572
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.5	3.47	3.39	3.06	2.41	1.7
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		3.38	3.21	3.03	2.84	2.65	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.2	15	14.3	12.6	10.2	7.68
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.34	2.16	1.98	1.72	1.41	1.12
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.01	0.906	0.807	0.709	0.615	0.527
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.72	0.876	0.867	0.851	0.852	0.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		62.1	56	48.3	42	36.9	25.9
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		678	0.891	0.866	0.635	0.43	0.035
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		200	118	59.1	37.9	19.1	8.1
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,565	1,579	1,538	1,387	1,106	761
Monetary damages from air pollution - Gas Stations (million \$2019)		169	170	163	145	115	79.4
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		154	139	121	98.2	73	48.7
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.8	12.8	11.8	10.1	7.63	5.07
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		31	30.8	30.1	27.2	21.4	15.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		29.9	28.4	26.8	25.1	23.4	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		134	133	127	112	90.4	68
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		20.7	19.1	17.5	15.2	12.5	9.95
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		8.93	8.02	7.14	6.27	5.44	4.66
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		15.2	7.73	7.65	7.51	7.52	7.32
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		551	497	429	373	328	230

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		453	798	1,021	1,747	1,554	1,357
By economic sector - Construction (jobs)		4,373	5,159	5,999	6,753	9,477	14,105
By economic sector - Manufacturing (jobs)		2,786	3,028	3,056	3,346	3,561	4,029
By economic sector - Mining (jobs)		2,253	1,687	1,284	990	698	405
By economic sector - Other (jobs)		299	368	487	760	1,450	2,971
By economic sector - Pipeline (jobs)		451	618	656	420	426	404
By economic sector - Professional (jobs)		2,406	2,576	3,077	5,270	6,611	8,514
By economic sector - Trade (jobs)		2,194	2,017	2,089	2,785	3,491	4,972
By economic sector - Utilities (jobs)		6,674	7,137	7,835	8,171	9,970	12,312
By resource sector - Biomass (jobs)		1,175	1,987	3,027	6,960	7,179	6,461
By resource sector - CO2 (jobs)		13.6	1,981	2,849	1,313	1,964	2,387
By resource sector - Coal (jobs)		519	20.5	17.9	15.7	14.2	12.5
By resource sector - Grid (jobs)		6,267	6,261	7,621	10,092	13,547	17,881
By resource sector - Natural Gas (jobs)		3,843	3,237	2,393	1,980	1,617	1,621
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	2,397	2,359	2,323
By resource sector - Oil (jobs)		5,614	4,681	3,916	3,270	2,347	1,278

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Solar (jobs)		1,389	1,951	2,478	3,680	7,540	16,067
By resource sector - Wind (jobs)		554	794	768	534	671	1,039
By education level - All sectors - High school diploma or less (jobs)		9,174	10,023	11,034	13,047	15,932	20,924
By education level - All sectors - Associates degree or some college (jobs)		6,563	7,064	7,734	8,913	11,293	15,319
By education level - All sectors - Bachelors degree (jobs)		4,826	4,940	5,266	6,389	7,712	9,873
By education level - All sectors - Masters or professional degree (jobs)		1,167	1,195	1,290	1,635	1,987	2,551
By education level - All sectors - Doctoral degree (jobs)		160	164	181	258	314	401
Related work experience - All sectors - None (jobs)		3,158	3,415	3,751	4,442	5,469	7,227
Related work experience - All sectors - Up to 1 year (jobs)		4,345	4,727	5,219	6,368	7,771	10,202
Related work experience - All sectors - 1 to 4 years (jobs)		7,937	8,426	9,150	10,832	13,325	17,527
Related work experience - All sectors - 4 to 10 years (jobs)		5,074	5,377	5,836	6,807	8,465	11,219
Related work experience - All sectors - Over 10 years (jobs)		1,376	1,442	1,549	1,793	2,207	2,893
On-the-Job Training - All sectors - None (jobs)		1,224	1,281	1,389	1,688	2,079	2,751
On-the-Job Training - All sectors - Up to 1 year (jobs)		14,664	15,615	16,999	20,480	24,883	32,345
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,449	4,787	5,227	5,941	7,510	10,146
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,349	1,485	1,654	1,867	2,434	3,376
On-the-Job Training - All sectors - Over 10 years (jobs)		204	219	236	265	332	450
On-Site or In-Plant Training - All sectors - None (jobs)		3,517	3,760	4,101	4,950	6,093	8,040
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		13,305	14,156	15,407	18,454	22,486	29,317
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,472	3,732	4,074	4,659	5,860	7,887
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,420	1,546	1,708	1,934	2,486	3,399
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		175	192	213	245	313	424
Wage income - All (million \$2019)		1,165	1,245	1,366	1,632	2,019	2,659

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	680	628	570	525	490	449	400
Final energy use - Residential (PJ)	260	244	232	219	204	187	173
Final energy use - Commercial (PJ)	171	171	169	166	161	156	153
Final energy use - Industry (PJ)	755	838	889	910	921	912	909

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)		4.14	4.18	4.77	4.88	5.83	6.04

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	32.8	171	309	950	1,590	3,008	4,425
Vehicle stocks - LDV – All others (1000 units)	5,784	5,784	5,784	5,487	5,189	3,999	2,808
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	180	376	1,271	3,991	5,817
Public EV charging plugs - DC Fast (1000 units)	0.165		0.677		3.48		9.69
Public EV charging plugs - L2 (1000 units)	0.888		16.3		83.7		233

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 (%)	32.2	41.6	45.3	56	72.3	82.8	86.5
Sales of space heating units - Electric Resistance (%)	31.3	33.1	31	25.2	16.6	11.1	9.21
Sales of space heating units - Gas (%)	32.4	20.3	18.9	14.9	8.67	4.49	3.04
Sales of space heating units - Fossil (%)	4.13	5	4.74	3.81	2.44	1.57	1.28
Sales of water heating units - Electric Heat Pump (%)	0	1.56	6	18.8	38.4	51.1	55.6
Sales of water heating units - Electric Resistance (%)	68.9	78.9	75.9	67	53.3	44.5	41.4
Sales of water heating units - Gas Furnace (%)	27.4	17	15.5	11.7	5.76	1.83	0.477
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.56	2.54	2.54
Sales of cooking units - Electric Resistance (%)	83.1	83.5	85.1	89.2	94.8	98.3	99.6
Sales of cooking units - Gas (%)	16.9	16.5	14.9	10.8	5.17	1.67	0.449
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.17	5.41				

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 (%)	9.56	21.7	26.9	42.4	66.6	83.3	89.7
Sales of space heating units - Electric Resistance (%)	4.81	4.61	4.65	4.78	5.23	5.91	6.33
Sales of space heating units - Gas Furnace (%)	85.6	70.4	65.3	50.5	27	10.4	3.89
Sales of space heating units - Fossil (%)	0	3.27	3.09	2.34	1.17	0.379	0.099
Sales of water heating units - Electric Heat Pump (%)	0.155	1.96	7.08	21.8	44.4	59.2	64.3
Sales of water heating units - Electric Resistance (%)	5.74	6.48	8.39	14.4	23.5	29.5	31.6
Sales of water heating units - Gas Furnace (%)	92.5	90	83	62.2	30.4	9.74	2.53
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	47.1	51.3	61.6	76.1	85	88
Sales of cooking units - Gas (%)	56.5	52.9	48.7	38.4	23.9	15	12
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,401	22,003				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	34.6	0	0	0	0	0
Installed thermal - Natural gas (MW)	6,106	7,000	5,301	5,301	4,778	5,399	3,803
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	4,981	4,981	4,981

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass power plant (billion \$2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.046	0	0	0
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	2.97	0.004	6.62	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	3,332	3,337	10,762	10,762	10,762
Biomass w/ccu allam power plant (GWh)	0	0	0	45.5	45.5	45.5	45.5

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	2	3	9	9	9
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	4	15	18	18
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1
Conversion capital investment - Cumulative 5-yr (million \$2018)		0	2,724	4,018	15,288	3,181	0
Biomass purchases (million \$2018/y)		0	214	575	1,886	2,174	2,174

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	3.3	8.41	27.6	31.7	31.7
Annual - BECCS (MMT)		0	3.3	8.41	27.6	31.7	31.7
Annual - NGCC (MMT)		0	0	0	0	0	0.01
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	3.3	11.7	39.3	71	103
Cumulative - BECCS (MMT)		0	3.3	11.7	39.3	71	103
Cumulative - NGCC (MMT)		0	0	0	0	0	0.01
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	181	362	543	543	543
Spur (km)		0	318	1,029	2,203	1,644	2,401
All (km)		0	499	1,390	2,745	2,186	2,944
Cumulative investment - Trunk (million \$2018)		0	1,293	2,585	3,878	3,878	3,878
Cumulative investment - Spur (million \$2018)		0	310	1,287	2,763	2,431	2,976
Cumulative investment - All (million \$2018)		0	1,603	3,872	6,641	6,309	6,854

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0.92	3.21	7.13	9.85	10
Injection wells (wells)		0	2	7	12	20	24
Resource characterization, appraisal, permitting costs (million \$2020)		25.4	112	173	173	173	173
Wells and facilities construction costs (million \$2020)		0	50.8	198	353	590	732

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)							-57.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-19,839
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-591

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164
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)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-652
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,638
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-48.9
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,339
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-652
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,109

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-97.8
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,859
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							877
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							89
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							110
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							442
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,810
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							292
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							4,110
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							178
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							110
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							442
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							5,132

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)		273	187	148	127	120	119
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		21.5	23.2	25.1	29.4	24.8	23.6
Premature deaths from air pollution - Mobile - On-Road (deaths)		176	180	184	190	195	200
Premature deaths from air pollution - Gas Stations (deaths)		19.1	19.3	19.6	19.9	20.2	20.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		17.1	15.3	13.7	12.6	12.1	11.7
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.52	1.28	0.933	0.631	0.407	0.277
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		3.3	3.16	3.09	3.06	3.03	2.99
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		3.53	3.51	3.47	3.43	3.37	3.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		15.2	14.8	13.6	12.1	11.5	11.7
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.42	2.42	2.36	2.23	2.13	2.08
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		1.05	1.07	1.1	1.12	1.14	1.16
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		3.29	2.37	1.97	1.87	1.81	1.71
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		62.5	65.8	67.3	64.3	63.8	59.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		2,416	1,654	1,308	1,128	1,064	1,053
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		191	205	222	261	220	209
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		1,564	1,601	1,639	1,685	1,732	1,780
Monetary damages from air pollution - Gas Stations (million \$2019)		169	171	173	177	179	182
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		152	136	121	112	107	104
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		13.5	11.3	8.27	5.6	3.6	2.45
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		29.2	28	27.3	27.1	26.9	26.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		31.3	31.1	30.8	30.4	29.9	29.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		135	131	120	107	101	103
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		21.5	21.5	20.9	19.8	18.8	18.4
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		9.33	9.51	9.71	9.89	10.1	10.3
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		29.1	20.9	17.4	16.5	16	15

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		555	585	598	571	566	530

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		450	443	442	431	431	435
By economic sector - Construction (jobs)		3,898	4,174	4,444	5,379	5,328	5,778
By economic sector - Manufacturing (jobs)		2,092	2,105	2,128	2,417	2,269	2,281
By economic sector - Mining (jobs)		2,288	1,830	1,483	1,213	1,033	878
By economic sector - Other (jobs)		172	242	286	392	417	568
By economic sector - Pipeline (jobs)		463	472	473	452	459	460
By economic sector - Professional (jobs)		2,245	2,085	2,106	2,477	2,335	2,507
By economic sector - Trade (jobs)		2,089	1,888	1,787	1,924	1,825	1,940
By economic sector - Utilities (jobs)		6,923	6,526	6,807	8,369	7,806	7,959
By resource sector - Biomass (jobs)		1,153	1,112	1,072	1,029	1,015	1,002
By resource sector - CO2 (jobs)		0	0.02	0.025	0.027	0.03	0.032
By resource sector - Coal (jobs)		544	49	42	27.3	18.5	16.1
By resource sector - Grid (jobs)		6,770	6,594	6,949	9,214	9,054	9,064
By resource sector - Natural Gas (jobs)		3,933	3,873	4,110	4,981	4,083	4,351
By resource sector - Nuclear (jobs)		2,514	2,474	2,435	2,397	2,359	2,323
By resource sector - Oil (jobs)		5,666	4,818	4,234	3,926	3,753	3,630
By resource sector - Solar (jobs)			718	963	1,192	1,413	2,255
By resource sector - Wind (jobs)		41.6	126	152	289	208	164
By education level - All sectors - High school diploma or less (jobs)		8,594	8,348	8,469	9,787	9,372	9,776
By education level - All sectors - Associates degree or some college (jobs)		6,164	5,941	6,064	7,146	6,769	7,086
By education level - All sectors - Bachelors degree (jobs)		4,593	4,292	4,251	4,796	4,515	4,651
By education level - All sectors - Masters or professional degree (jobs)		1,118	1,042	1,034	1,171	1,103	1,140
By education level - All sectors - Doctoral degree (jobs)		152	141	139	155	146	152
Related work experience - All sectors - None (jobs)		2,982	2,867	2,908	3,378	3,212	3,354
Related work experience - All sectors - Up to 1 year (jobs)		4,039	3,921	3,965	4,553	4,362	4,554
Related work experience - All sectors - 1 to 4 years (jobs)		7,508	7,161	7,214	8,323	7,895	8,210
Related work experience - All sectors - 4 to 10 years (jobs)		4,797	4,579	4,628	5,371	5,081	5,286
Related work experience - All sectors - Over 10 years (jobs)		1,295	1,235	1,243	1,430	1,354	1,401
On-the-Job Training - All sectors - None (jobs)		1,147	1,094	1,092	1,237	1,177	1,226
On-the-Job Training - All sectors - Up to 1 year (jobs)		13,803	13,184	13,252	15,198	14,444	15,001
On-the-Job Training - All sectors - 1 to 4 years (jobs)		4,202	4,051	4,132	4,857	4,605	4,811
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,284	1,253	1,297	1,554	1,478	1,559
On-the-Job Training - All sectors - Over 10 years (jobs)		185	181	183	210	200	209
On-Site or In-Plant Training - All sectors - None (jobs)		3,288	3,145	3,166	3,639	3,450	3,597
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		12,537	11,985	12,057	13,846	13,164	13,675

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		3,275	3,158	3,216	3,768	3,578	3,736
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,356	1,315	1,351	1,602	1,522	1,600
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		166	161	167	200	190	199
Wage income - All (million \$2019)		1,111	1,071	1,092	1,273	1,225	1,288

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	680	628	576	545	545	562	584
Final energy use - Residential (PJ)	260	244	236	230	227	228	229
Final energy use - Commercial (PJ)	171	174	176	176	177	181	190
Final energy use - Industry (PJ)	755	847	903	938	959	961	976

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)		4.86	5	5.95	6.18	5.74	5.89

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 (%)	30.6	53.8	54.6	55.9	57.2	58.9	61.6
Sales of space heating units - Electric Resistance (%)	32	27.2	26.7	25.9	24.9	23.3	20.6
Sales of space heating units - Gas (%)	33.2	15.8	15.4	14.9	14.7	14.6	14.6
Sales of space heating units - Fossil (%)	4.21	3.29	3.32	3.27	3.22	3.18	3.2
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	68.9	80	80.1	80	79.9	79.9	79.9
Sales of water heating units - Gas Furnace (%)	27.4	17.5	17.3	17.5	17.6	17.5	17.6
Sales of water heating units - Other (%)	3.71	2.57	2.54	2.55	2.57	2.56	2.57
Sales of cooking units - Electric Resistance (%)	82.9	82.9	82.9	82.9	82.9	82.9	82.9
Sales of cooking units - Gas (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		5.15	4.97				

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 (%)	9.56	27.5	56.9	76.1	79	79.4	79.4
Sales of space heating units - Electric Resistance (%)	4.81	5.67	10	15.4	18.7	19.2	19.2
Sales of space heating units - Gas Furnace (%)	85.6	63.9	31.8	8.33	2.28	1.48	1.43
Sales of space heating units - Fossil (%)	0	2.93	1.3	0.192	0.019	0	0
Sales of water heating units - Electric Heat Pump (%)	0.155	0.153	0.147	0.149	0.149	0.146	0.148
Sales of water heating units - Electric Resistance (%)	5.74	5.75	5.58	5.66	5.62	5.56	5.61
Sales of water heating units - Gas Furnace (%)	92.5	92.5	92.7	92.6	92.7	92.7	92.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Other (%)	1.59	1.58	1.58	1.58	1.58	1.57	1.56
Sales of cooking units - Electric Resistance (%)	43.5	45.6	45.9	45.7	46	45.9	45.7
Sales of cooking units - Gas (%)	56.5	54.4	54.1	54.3	54	54.1	54.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		19,056	19,846				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	3,610	50	50	50	0	0	0
Installed thermal - Natural gas (MW)	6,030	7,010	6,898	6,110	11,103	11,365	10,382
Installed thermal - Nuclear (MW)	4,981	4,981	4,981	4,981	4,981	4,981	4,981
Installed renewables - Rooftop PV (MW)	127	205	290	412	585	809	1,096
Installed renewables - Solar - Base land use assumptions (MW)	163	163	163	163	163	163	163
Installed renewables - Wind - Base land use assumptions (MW)	29	29	29	29	29	75.6	75.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	355	355	355	355	355	355	355
Wind - Base land use assumptions (GWh)	106	106	106	106	106	245	245
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)	-8.29		-10.7				-8.71
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.86		-3.1				-3.26
Business-as-usual carbon sink - Total (Mt CO2e/y)	-10.1		-13.8				-12

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)							-579
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-363
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,221
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-301
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,278
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-325
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-763
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-726
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,289
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,323

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO ₂ e/y)							-86.8
Carbon sink potential - Mid - Avoid deforestation (1000 tCO ₂ e/y)							-1,271
Carbon sink potential - Mid - Extend rotation length (1000 tCO ₂ e/y)							-4,002
Carbon sink potential - Mid - Improve plantations (1000 tCO ₂ e/y)							-441
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO ₂ e/y)							-4,556
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO ₂ e/y)							-626
Carbon sink potential - Mid - Reforest cropland (1000 tCO ₂ e/y)							-1,144
Carbon sink potential - Mid - Reforest pasture (1000 tCO ₂ e/y)							-5,156
Carbon sink potential - Mid - Restore productivity (1000 tCO ₂ e/y)							-2,556
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO ₂ e/y)							-19,839
Carbon sink potential - High - Accelerate regeneration (1000 tCO ₂ e/y)							-116
Carbon sink potential - High - Avoid deforestation (1000 tCO ₂ e/y)							-2,178
Carbon sink potential - High - Extend rotation length (1000 tCO ₂ e/y)							-5,783
Carbon sink potential - High - Improve plantations (1000 tCO ₂ e/y)							-591
Carbon sink potential - High - Increase retention of HWP (1000 tCO ₂ e/y)							-6,834
Carbon sink potential - High - Increase trees outside forests (1000 tCO ₂ e/y)							-928
Carbon sink potential - High - Reforest cropland (1000 tCO ₂ e/y)							-1,525
Carbon sink potential - High - Reforest pasture (1000 tCO ₂ e/y)							-9,586
Carbon sink potential - High - All (not counting overlap) (1000 tCO ₂ e/y)							-31,364
Carbon sink potential - High - Restore productivity (1000 tCO ₂ e/y)							-3,823
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							9.46
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							277
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,130
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							109
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)							46.4
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							50.4

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							47.2
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							767
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							2,436
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							14.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							286
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,039
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							164
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)							67.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							75.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							341
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,544
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							4,532
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							18.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							295
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							2,949
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							218
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)							88.2
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							101
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							272
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,267

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							5,209