



## **Net-Zero America - California data**

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		242	136	122	105	59.2	26.4
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,541	3,341	2,565	1,495	676	251
Premature deaths from air pollution - Gas Stations (deaths)		32	29.5	22.3	13.1	6.11	2.58
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		543	415	247	120	47.5	15.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		9.71	8.33	7.04	5.75	4.47	3.2
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.5	20.8	15.6	11.3	8.12	6.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.8	1.76	1.72	1.67	1.61	1.53
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		249	221	160	99.6	59.5	34.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.9	38.1	30.8	24	17.6	11.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		84.2	71.2	58.8	46.5	34.4	22.7
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.443	0.059	0.055	0.05	0.047	0.046
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		163	156	145	116	87.5	55.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		251	0.33	0.328	0.173	0.099	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,148	1,204	1,078	930	524	234
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		31,487	29,710	22,808	13,295	6,015	2,235
Monetary damages from air pollution - Gas Stations (million \$2019)		283	261	197	116	54.1	22.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,813	3,676	2,191	1,060	421	137
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		86.1	73.9	62.4	51	39.6	28.4
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		217	184	139	101	71.9	53.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		15.9	15.6	15.2	14.8	14.2	13.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,201	1,956	1,412	881	527	303

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)		415	337	272	212	156	103
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		745	630	520	411	304	201
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.91	0.519	0.488	0.44	0.414	0.404
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,449	1,390	1,289	1,028	777	490

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		807	1,391	1,956	1,911	1,642	1,347
By economic sector - Construction (jobs)		60,036	68,964	86,441	101,662	113,325	148,016
By economic sector - Manufacturing (jobs)		30,232	36,465	40,895	37,308	33,498	34,813
By economic sector - Mining (jobs)		32,912	26,356	20,984	13,552	9,002	5,320
By economic sector - Other (jobs)		8,218	10,008	13,792	18,233	22,670	34,683
By economic sector - Pipeline (jobs)		2,738	3,005	2,338	1,855	1,425	1,184
By economic sector - Professional (jobs)		29,060	33,837	44,279	53,147	61,559	81,381
By economic sector - Trade (jobs)		24,188	25,606	30,569	35,225	40,610	55,366
By economic sector - Utilities (jobs)		31,587	38,837	55,611	67,533	76,602	95,500
By resource sector - Biomass (jobs)		2,736	3,655	5,346	5,622	6,006	5,813
By resource sector - CO2 (jobs)		127	5,222	3,730	3,209	3,425	4,510
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		42,372	57,258	93,660	117,892	137,108	176,247
By resource sector - Natural Gas (jobs)		24,459	18,978	17,499	16,093	13,996	11,710
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,368	64,969	55,609	40,007	29,393	18,443
By resource sector - Solar (jobs)		61,168	67,821	86,157	105,706	123,569	184,667
By resource sector - Wind (jobs)		13,834	26,559	34,864	41,897	46,836	56,220
By education level - All sectors - High school diploma or less (jobs)		91,439	102,542	124,841	138,968	150,964	191,434
By education level - All sectors - Associates degree or some college (jobs)		66,541	75,202	92,749	104,773	115,263	147,701
By education level - All sectors - Bachelors degree (jobs)		48,332	52,148	61,734	67,204	72,676	91,195
By education level - All sectors - Masters or professional degree (jobs)		11,715	12,682	15,249	16,899	18,554	23,575
By education level - All sectors - Doctoral degree (jobs)		1,750	1,895	2,292	2,582	2,876	3,704
Related work experience - All sectors - None (jobs)		31,071	34,828	42,623	47,808	52,373	66,865
Related work experience - All sectors - Up to 1 year (jobs)		43,283	48,587	59,328	66,347	72,431	92,574
Related work experience - All sectors - 1 to 4 years (jobs)		80,229	88,797	107,437	119,171	129,796	164,426
Related work experience - All sectors - 4 to 10 years (jobs)		51,394	57,034	69,198	77,054	84,082	106,567
Related work experience - All sectors - Over 10 years (jobs)		13,800	15,222	18,279	20,046	21,649	27,179
On-the-Job Training - All sectors - None (jobs)		12,406	13,576	16,307	18,137	19,853	25,486
On-the-Job Training - All sectors - Up to 1 year (jobs)		145,590	161,449	195,145	215,747	234,378	296,619

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)		45,454	50,958	62,435	70,165	76,857	97,859
On-the-Job Training - All sectors - 4 to 10 years (jobs)		14,112	16,031	20,066	23,191	25,826	33,332
On-the-Job Training - All sectors - Over 10 years (jobs)		2,215	2,454	2,912	3,187	3,419	4,313
On-Site or In-Plant Training - All sectors - None (jobs)		35,764	39,741	48,180	53,709	58,685	74,885
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		132,025	146,402	177,081	195,976	213,024	269,739
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		35,487	39,728	48,564	54,418	59,503	75,683
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		14,749	16,582	20,511	23,428	25,918	33,204
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,753	2,016	2,529	2,894	3,201	4,099
Wage income - All (million \$2019)		14,114	15,810	19,448	21,911	24,219	31,022

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		546	474	371	277	202	142
Oil consumption - Cumulative (million bbls)							11,511
Oil production - Annual (million bbls)		222	223	223	177	143	95.5
Natural gas consumption - Annual (tcf)		1,654	1,394	1,118	842	530	367
Natural gas consumption - Cumulative (tcf)							33,681
Natural gas production - Annual (tcf)		236	223	194	164	130	101

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2,562	4,931	7,300	15,592	23,885	30,512	37,138
Vehicle stocks - LDV – All others (1000 units)	30,967	29,487	28,006	20,409	12,812	7,249	1,685
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452

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 (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		27.7	36.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Gas (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		120,478	131,958				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,459	32,156	39,229	50,374	55,658	51,069	57,596
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10,012	15,483	20,658	26,842	34,107	42,472	52,234
Installed renewables - Solar - Base land use assumptions (MW)	26,881	29,945	38,698	56,616	84,697	124,004	167,110
Installed renewables - Wind - Base land use assumptions (MW)	7,083	7,083	7,083	7,083	7,123	7,193	7,193
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	0	0	282
Installed renewables - Solar - Constrained land use assumptions (MW)	26,752	28,404	35,769	54,798	90,317	121,013	166,122
Installed renewables - Wind - Constrained land use assumptions (MW)	7,217	7,252	7,252	7,903	8,613	8,866	9,415
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	2,768

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion \$2018)		4.1	10.5	19.8	29.2	38.6	39.9
Capital invested - Wind - Base (billion \$2018)		0	0	0	0.06	0.103	0
Capital invested - Offshore Wind - Base (billion \$2018)		0.292	0	0	0.987	1.09	7.32
Capital invested - Solar PV - Constrained (billion \$2018)		13.6	9.2	26.8	27.8	30.2	38.8
Capital invested - Wind - Constrained (billion \$2018)		0.068	0	0.657	1.24	0.43	0.3
Capital invested - Offshore Wind - Constrained (billion \$2018)		0.153	0	0.119	0.769	1.26	6.35
Capital invested - Biomass power plant (billion \$2018)	0	0.007	0.811	0	0.169	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.073	0.003	0.003	0.022
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	0.556	0.001	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	66,975	74,628	96,427	139,989	204,029	291,499	388,310
Wind - Base land use assumptions (GWh)	28,124	28,124	28,124	28,124	28,259	28,498	28,498
OffshoreWind - Base land use assumptions (GWh)	0	418	418	418	3,109	6,763	37,067
Solar - Constrained land use assumptions (GWh)	64,339	68,428	86,888	131,184	210,139	277,511	377,239
Wind - Constrained land use assumptions (GWh)	28,240	28,364	28,364	30,135	31,893	32,448	33,570
OffshoreWind - Constrained land use assumptions (GWh)	0	418	418	418	3,109	6,763	37,067
Biomass power plant (GWh)	0	13.5	1,606	1,606	1,952	1,952	1,952
Biomass w/ccu power plant (GWh)	0	0	624	625	625	625	625
Biomass w/ccu allam power plant (GWh)	0	0	0	72.5	75.5	78.9	101

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	1	1	1	2	2	2
Number of facilities - Power ccu (quantity)	0	0	4	6	6	6	6
Number of facilities - Allam power w ccu (quantity)	0	0	0	4	5	6	7
Number of facilities - Beccs hydrogen (quantity)	0	0	0	8	14	18	21
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	4	6	7	8
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	4	6	7	8
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	4	4	4	4	4
Conversion capital investment - Cumulative 5-yr (million \$2018)		7.67	1,415	7,867	3,886	3,650	2,020
Biomass purchases (million \$2018/y)		8.07	113	386	525	652	722



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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.75	26.1	37.5	49.8	57.6
Annual - BECCS (MMT)		0	0.62	10.6	15.3	20	22.5
Annual - NGCC (MMT)		0	0.13	8.85	12.3	16.2	21
Annual - Cement and lime (MMT)		0	0	6.71	9.95	13.7	14.1
Cumulative - All (MMT)		0	0.75	26.9	64.4	114	172
Cumulative - BECCS (MMT)		0	0.62	11.2	26.5	46.5	69
Cumulative - NGCC (MMT)		0	0.13	8.98	21.3	37.4	58.4
Cumulative - Cement and lime (MMT)		0	0	6.71	16.7	30.4	44.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	1,285	1,529	1,529	1,529	1,529
Spur (km)		0	798	3,159	4,463	5,023	6,219
All (km)		0	2,083	4,688	5,992	6,553	7,748
Cumulative investment - Trunk (million \$2018)		0	4,920	5,686	5,686	5,686	5,686
Cumulative investment - Spur (million \$2018)		0	423	2,013	2,845	3,310	4,083
Cumulative investment - All (million \$2018)		0	5,343	7,698	8,531	8,996	9,769

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	28.2	41.6	53.4	80.1
Injection wells (wells)		0	0	62	92	122	174
Resource characterization, appraisal, permitting costs (million \$2020)		250	900	1,370	1,370	1,370	1,370
Wells and facilities construction costs (million \$2020)		0	0	1,860	2,760	3,660	5,220

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,082
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887

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)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		230	114	66.3	25.6	7.98	3.54
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,611	3,710	3,661	3,339	2,685	1,852
Premature deaths from air pollution - Gas Stations (deaths)		32.8	33.5	32.8	29.6	23.6	16.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		551	504	443	350	236	137
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.1	9.19	8.33	7.47	6.61	5.74
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.9	24.5	23.8	21.4	17.3	13.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.8	1.76	1.72	1.67	1.61	1.53
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		252	261	257	231	185	136
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.9	40.8	36.1	31.7	27.5	23.5
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		84.2	76.3	68.9	61.4	53.8	46.2
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.418	0.06	0.059	0.056	0.048	0.032
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		163	151	133	119	107	76.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		251	0.33	0.328	0.173	0.099	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,037	1,010	587	227	70.7	31.3
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		32,107	32,984	32,552	29,690	23,875	16,465
Monetary damages from air pollution - Gas Stations (million \$2019)		290	297	290	262	209	144
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,884	4,464	3,926	3,099	2,095	1,217
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		89.9	81.4	73.8	66.2	58.5	50.9
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		221	217	211	189	154	119
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		15.9	15.6	15.2	14.8	14.2	13.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,227	2,308	2,274	2,046	1,642	1,200
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		415	362	319	281	244	208
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		745	675	610	544	476	409
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.69	0.528	0.521	0.498	0.419	0.285

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,445	1,337	1,182	1,054	950	680

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		902	1,617	2,963	3,003	2,178	1,348
By economic sector - Construction (jobs)		59,956	70,379	80,330	95,314	119,572	155,974
By economic sector - Manufacturing (jobs)		30,478	37,139	38,601	38,871	41,887	41,411
By economic sector - Mining (jobs)		32,995	26,633	22,064	16,996	13,182	8,051
By economic sector - Other (jobs)		8,277	10,139	12,821	16,954	23,550	35,477
By economic sector - Pipeline (jobs)		2,748	3,407	2,626	2,367	2,142	1,872
By economic sector - Professional (jobs)		29,039	34,108	42,940	53,278	66,868	87,484
By economic sector - Trade (jobs)		24,231	25,954	29,919	35,550	44,540	59,454
By economic sector - Utilities (jobs)		30,349	38,523	47,429	58,362	77,362	99,505
By resource sector - Biomass (jobs)		2,879	4,195	9,441	12,266	9,274	5,624
By resource sector - CO2 (jobs)		127	8,845	6,375	5,521	5,872	7,709
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		39,934	54,317	77,371	99,210	138,144	183,137
By resource sector - Natural Gas (jobs)		24,228	17,293	14,245	13,323	12,256	10,005
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,636	66,277	59,015	51,302	43,659	27,899
By resource sector - Solar (jobs)		62,129	69,294	80,148	98,327	128,898	185,809
By resource sector - Wind (jobs)		14,328	27,670	33,097	40,747	53,176	70,393
By education level - All sectors - High school diploma or less (jobs)		91,158	104,174	117,693	134,625	163,780	204,716
By education level - All sectors - Associates degree or some college (jobs)		66,209	76,219	86,447	100,216	124,083	157,774
By education level - All sectors - Bachelors degree (jobs)		48,184	52,776	58,791	66,539	79,959	98,658
By education level - All sectors - Masters or professional degree (jobs)		11,674	12,812	14,537	16,709	20,295	25,426
By education level - All sectors - Doctoral degree (jobs)		1,749	1,917	2,225	2,605	3,163	4,003
Related work experience - All sectors - None (jobs)		30,942	35,342	40,108	46,232	56,665	71,457
Related work experience - All sectors - Up to 1 year (jobs)		43,194	49,353	56,113	64,534	78,645	98,926
Related work experience - All sectors - 1 to 4 years (jobs)		79,922	89,993	101,309	115,881	141,162	176,527
Related work experience - All sectors - 4 to 10 years (jobs)		51,170	57,797	64,986	74,561	91,175	114,374
Related work experience - All sectors - Over 10 years (jobs)		13,746	15,413	17,176	19,486	23,633	29,293
On-the-Job Training - All sectors - None (jobs)		12,382	13,775	15,490	17,768	21,624	27,287
On-the-Job Training - All sectors - Up to 1 year (jobs)		145,138	163,711	184,646	210,821	255,737	318,628
On-the-Job Training - All sectors - 1 to 4 years (jobs)		45,220	51,652	58,215	67,120	82,752	104,634
On-the-Job Training - All sectors - 4 to 10 years (jobs)		14,019	16,263	18,598	21,887	27,433	35,389
On-the-Job Training - All sectors - Over 10 years (jobs)		2,215	2,497	2,745	3,098	3,735	4,639
On-Site or In-Plant Training - All sectors - None (jobs)		35,674	40,329	45,546	52,294	63,774	80,268
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		131,584	148,434	167,340	191,165	232,190	289,605

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		35,316	40,273	45,366	52,201	64,196	80,963
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		14,659	16,820	19,097	22,287	27,693	35,371
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,740	2,043	2,344	2,748	3,427	4,371
Wage income - All (million \$2019)		14,044	16,009	18,299	21,242	26,267	33,291

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,060	2,970	2,767	2,590	2,445	2,267	2,054
Final energy use - Residential (PJ)	878	825	766	706	626	537	459
Final energy use - Commercial (PJ)	793	800	806	802	788	770	759
Final energy use - Industry (PJ)	1,021	1,058	1,081	1,146	1,217	1,253	1,293

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)		9.31	9.32	16.2	17	25.6	27.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	1,983	2,669	3,356	6,535	9,714	16,751	23,787
Vehicle stocks - LDV – All others (1000 units)	31,093	31,093	31,093	29,494	27,894	21,495	15,096
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	1,128	1,859	6,771	19,756	29,318
Public EV charging plugs - DC Fast (1000 units)	4.35		5.46		15.8		38.7
Public EV charging plugs - L2 (1000 units)	21.5		131		380		930

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 (%)	5.99	14.3	19.7	35.3	59.2	74.8	80.3
Sales of space heating units - Electric Resistance (%)	16.4	25.3	24.3	21.5	17.3	14.5	13.6
Sales of space heating units - Gas (%)	74.3	54.1	50	38	19.4	7.29	3.04
Sales of space heating units - Fossil (%)	3.33	6.29	6.05	5.3	4.13	3.36	3.07
Sales of water heating units - Electric Heat Pump (%)	0	1.93	7.42	23.2	47.5	63.3	68.9
Sales of water heating units - Electric Resistance (%)	17.5	32.1	31.6	30.2	28.2	26.9	26.5
Sales of water heating units - Gas Furnace (%)	79.8	63.2	58.2	43.8	21.5	6.93	1.83
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.8	2.81	2.83
Sales of cooking units - Electric Resistance (%)	39.8	41.4	46.9	61.4	81.6	94.1	98.4
Sales of cooking units - Gas (%)	60.2	58.6	53.1	38.6	18.4	5.94	1.6
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		27.5	36.2				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	13	17.8	31.6	53.4	68.7	74.5
Sales of space heating units - Electric Resistance (%)	11.4	13.3	14	15.8	18.8	21.2	22.2
Sales of space heating units - Gas (%)	86.9	73.7	68.3	52.6	27.8	10.2	3.31
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.63	2.65	7.89	23	46.1	61.3	66.6
Sales of water heating units - Electric Resistance (%)	2.03	3.16	5.36	11.7	21.4	27.8	30.1
Sales of water heating units - Gas (%)	96.8	93.6	86.1	64.7	31.8	10.2	2.7
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		120,137	130,140				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,464	30,969	35,119	38,381	38,198	29,008	32,522
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,365



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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,054
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,082
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887

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)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		169	128	65.5	36.1	13.7	2.89
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,541	3,341	2,565	1,495	676	251
Premature deaths from air pollution - Gas Stations (deaths)		32	29.5	22.3	13.1	6.11	2.58
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		543	415	247	120	47.5	15.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		9.71	8.33	7.04	5.75	4.47	3.2

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.5	20.8	15.6	11.3	8.12	6.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.8	1.76	1.72	1.67	1.61	1.53
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		249	221	160	99.6	59.5	34.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.9	38.1	30.8	24	17.6	11.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		84.2	71.2	58.8	46.5	34.4	22.7
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.507	0.059	0.055	0.049	0.046	0.016
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		160	154	136	99.8	62.1	9.23
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		251	0.33	0.328	0.173	0.099	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		1,498	1,137	581	320	121	25.6
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		31,487	29,710	22,808	13,295	6,015	2,235
Monetary damages from air pollution - Gas Stations (million \$2019)		283	261	197	116	54.1	22.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,813	3,676	2,191	1,060	421	137
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		86.1	73.9	62.4	51	39.6	28.4
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		217	184	139	101	71.9	53.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		15.9	15.6	15.2	14.8	14.2	13.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,201	1,956	1,412	881	527	303
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		415	337	272	212	156	103
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		745	630	520	411	304	201
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		4.48	0.519	0.484	0.434	0.408	0.139
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,423	1,369	1,204	886	551	81.9

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		810	1,280	1,847	1,749	1,412	1,335
By economic sector - Construction (jobs)		66,969	72,326	96,611	123,078	140,579	190,328
By economic sector - Manufacturing (jobs)		33,036	39,159	47,493	47,343	44,020	64,511
By economic sector - Mining (jobs)		32,721	26,008	19,646	11,947	6,655	1,109
By economic sector - Other (jobs)		9,569	10,969	15,991	23,053	28,250	42,055
By economic sector - Pipeline (jobs)		2,684	2,325	1,778	1,212	735	218
By economic sector - Professional (jobs)		31,462	36,158	49,959	65,495	79,021	109,419
By economic sector - Trade (jobs)		25,705	26,939	33,745	42,454	50,536	70,833
By economic sector - Utilities (jobs)		32,991	39,213	59,458	76,688	93,743	133,229
By resource sector - Biomass (jobs)		2,572	3,406	4,803	5,529	5,260	5,937
By resource sector - CO2 (jobs)		0	0.001	0	0.001	0.001	0
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		45,696	62,992	105,038	141,134	175,369	255,865
By resource sector - Natural Gas (jobs)		23,482	18,372	15,203	11,947	10,814	9,720
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,372	64,720	54,027	36,359	22,491	3,688
By resource sector - Solar (jobs)		73,298	75,861	99,601	134,726	151,650	217,267
By resource sector - Wind (jobs)		15,815	29,019	47,855	63,323	79,365	120,559
By education level - All sectors - High school diploma or less (jobs)		98,640	106,725	137,434	165,247	185,784	255,719
By education level - All sectors - Associates degree or some college (jobs)		71,755	78,289	102,380	125,101	143,021	198,856
By education level - All sectors - Bachelors degree (jobs)		51,265	54,172	67,489	79,506	89,561	122,130
By education level - All sectors - Masters or professional degree (jobs)		12,423	13,203	16,694	20,058	22,984	31,447
By education level - All sectors - Doctoral degree (jobs)		1,865	1,989	2,530	3,107	3,600	4,885
Related work experience - All sectors - None (jobs)		33,401	36,187	46,833	56,767	64,518	89,180
Related work experience - All sectors - Up to 1 year (jobs)		46,830	50,809	65,695	79,557	89,803	124,313
Related work experience - All sectors - 1 to 4 years (jobs)		85,882	92,290	117,886	141,325	159,923	219,713
Related work experience - All sectors - 4 to 10 years (jobs)		55,075	59,255	76,017	91,535	103,922	142,971
Related work experience - All sectors - Over 10 years (jobs)		14,760	15,837	20,096	23,834	26,785	36,859
On-the-Job Training - All sectors - None (jobs)		13,329	14,169	17,976	21,680	24,542	33,813
On-the-Job Training - All sectors - Up to 1 year (jobs)		156,040	168,126	214,605	256,562	289,248	398,299
On-the-Job Training - All sectors - 1 to 4 years (jobs)		48,907	52,915	68,665	83,397	95,011	131,144
On-the-Job Training - All sectors - 4 to 10 years (jobs)		15,272	16,606	22,050	27,544	31,904	43,957
On-the-Job Training - All sectors - Over 10 years (jobs)		2,401	2,562	3,232	3,834	4,246	5,824
On-Site or In-Plant Training - All sectors - None (jobs)		38,476	41,446	53,191	64,236	72,802	100,563
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		141,515	152,411	194,677	232,946	262,788	361,877
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		38,173	41,274	53,403	64,663	73,477	101,339
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		15,891	17,154	22,470	27,730	31,915	43,748
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,893	2,093	2,786	3,443	3,967	5,509
Wage income - All (million \$2019)		15,076	16,397	21,270	25,877	29,786	41,365

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2,562	4,931	7,300	15,592	23,885	30,512	37,138
Vehicle stocks - LDV – All others (1000 units)	30,967	29,487	28,006	20,409	12,812	7,249	1,685
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452

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 (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		27.7	36.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Gas (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		120,478	131,958				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,464	30,382	39,336	48,811	45,329	39,735	50,598
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10,012	15,483	20,658	26,842	34,107	42,472	52,234
Installed renewables - Solar - Base land use assumptions (MW)	26,881	37,103	48,315	74,256	119,346	164,761	227,819
Installed renewables - Wind - Base land use assumptions (MW)	7,083	7,083	7,083	7,123	7,279	7,385	7,465
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	0	376	10,563
Installed renewables - Solar - Constrained land use assumptions (MW)	26,884	34,186	46,320	71,300	124,405	172,545	227,372
Installed renewables - Wind - Constrained land use assumptions (MW)	8,023	8,058	8,111	9,235	10,094	11,169	13,961
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	39.9	39.9	87.6	898	6,264	17,413
Capital invested - Solar PV - Base (billion \$2018)		13.7	13.4	28.6	46.9	44.6	58.4
Capital invested - Wind - Base (billion \$2018)		0	0	0.063	0.24	0.154	0.11
Capital invested - Offshore Wind - Base (billion \$2018)		0.292	0	0	1.57	9.82	13.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	66,975	92,334	119,520	180,379	282,184	383,350	523,234
Wind - Base land use assumptions (GWh)	28,124	28,124	28,124	28,259	28,777	29,112	29,351
OffshoreWind - Base land use assumptions (GWh)	0	418	418	418	4,696	37,533	86,533
Solar - Constrained land use assumptions (GWh)	133,950	170,119	229,275	341,268	574,837	786,552	1,025,722
Wind - Constrained land use assumptions (GWh)	56,479	56,727	57,022	62,932	66,635	70,629	82,299
OffshoreWind - Constrained land use assumptions (GWh)	0	438	438	953	9,850	64,792	175,138

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,054
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,082
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887

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)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		237	76.6	116	152	76.1	19.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,541	3,341	2,565	1,495	676	251
Premature deaths from air pollution - Gas Stations (deaths)		32	29.5	22.3	13.1	6.11	2.58
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		543	415	247	120	47.5	15.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		9.71	8.33	7.04	5.75	4.47	3.2
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.5	20.8	15.6	11.3	8.12	6.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.8	1.76	1.72	1.67	1.61	1.53
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		249	221	160	99.6	59.5	34.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.9	38.1	30.8	24	17.6	11.6
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		84.2	71.2	58.8	46.5	34.4	22.7
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.379	0.058	0.055	0.049	0.047	0.016
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		165	163	163	142	121	91.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		251	0.33	0.328	0.173	0.099	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		2,098	678	1,028	1,343	674	172
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		31,487	29,710	22,808	13,295	6,015	2,235
Monetary damages from air pollution - Gas Stations (million \$2019)		283	261	197	116	54.1	22.8
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,813	3,676	2,191	1,060	421	137
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		86.1	73.9	62.4	51	39.6	28.4
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		217	184	139	101	71.9	53.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		15.9	15.6	15.2	14.8	14.2	13.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,201	1,956	1,412	881	527	303
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		415	337	272	212	156	103
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		745	630	520	411	304	201
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.35	0.514	0.486	0.437	0.414	0.138
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,467	1,450	1,452	1,259	1,073	813

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		870	1,695	2,977	2,509	1,811	1,357
By economic sector - Construction (jobs)		61,667	62,610	68,859	75,854	75,839	105,388
By economic sector - Manufacturing (jobs)		31,658	31,239	34,963	31,388	24,826	25,340
By economic sector - Mining (jobs)		33,026	26,637	21,930	14,299	9,962	6,732
By economic sector - Other (jobs)		8,666	8,856	10,702	13,443	14,750	25,985
By economic sector - Pipeline (jobs)		2,793	3,675	2,935	2,560	2,220	2,089
By economic sector - Professional (jobs)		29,133	29,552	35,558	39,206	40,191	54,900
By economic sector - Trade (jobs)		24,385	23,287	25,344	26,812	27,333	39,133
By economic sector - Utilities (jobs)		30,323	34,387	43,113	48,546	51,253	62,031
By resource sector - Biomass (jobs)		2,611	4,237	9,772	9,105	7,104	5,700
By resource sector - CO2 (jobs)		127	9,991	7,210	6,227	6,620	8,704
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		40,575	45,408	68,407	79,715	82,542	103,230
By resource sector - Natural Gas (jobs)		23,896	18,226	16,839	15,891	17,294	15,940
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,364	64,969	55,609	40,006	30,168	20,957
By resource sector - Solar (jobs)		67,740	62,039	67,980	80,528	81,953	146,370
By resource sector - Wind (jobs)		12,493	17,061	20,562	23,144	22,505	22,055
By education level - All sectors - High school diploma or less (jobs)		92,881	93,284	103,997	107,623	104,327	135,886
By education level - All sectors - Associates degree or some college (jobs)		67,376	67,933	75,924	79,810	78,731	103,841
By education level - All sectors - Bachelors degree (jobs)		48,721	47,496	51,826	52,211	50,443	64,207
By education level - All sectors - Masters or professional degree (jobs)		11,780	11,513	12,725	12,996	12,733	16,442
By education level - All sectors - Doctoral degree (jobs)		1,762	1,712	1,908	1,976	1,953	2,580
Related work experience - All sectors - None (jobs)		31,457	31,668	35,388	36,857	36,114	47,335
Related work experience - All sectors - Up to 1 year (jobs)		44,022	43,953	49,255	51,199	49,666	65,462
Related work experience - All sectors - 1 to 4 years (jobs)		81,132	80,755	89,365	91,954	89,611	116,072
Related work experience - All sectors - 4 to 10 years (jobs)		51,946	51,770	57,198	59,136	57,844	74,976

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - Over 10 years (jobs)		13,962	13,792	15,175	15,470	14,950	19,110
On-the-Job Training - All sectors - None (jobs)		12,581	12,334	13,575	14,011	13,648	18,097
On-the-Job Training - All sectors - Up to 1 year (jobs)		147,426	146,567	162,870	167,121	161,942	209,494
On-the-Job Training - All sectors - 1 to 4 years (jobs)		45,990	46,233	51,257	53,546	52,680	68,851
On-the-Job Training - All sectors - 4 to 10 years (jobs)		14,261	14,580	16,272	17,475	17,556	23,427
On-the-Job Training - All sectors - Over 10 years (jobs)		2,262	2,224	2,408	2,464	2,360	3,086
On-Site or In-Plant Training - All sectors - None (jobs)		36,261	36,000	39,934	41,324	40,274	52,867
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		133,672	132,933	147,644	151,673	147,132	190,491
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		35,921	36,061	39,979	41,645	40,857	53,331
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		14,894	15,122	16,765	17,781	17,739	23,397
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,770	1,821	2,059	2,194	2,184	2,870
Wage income - All (million \$2019)		14,240	14,396	16,167	16,872	16,723	21,814

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2,562	4,931	7,300	15,592	23,885	30,512	37,138
Vehicle stocks - LDV – All others (1000 units)	30,967	29,487	28,006	20,409	12,812	7,249	1,685
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452

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 (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		27.7	36.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Gas (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		120,478	131,958				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,414	25,834	25,128	25,852	21,738	29,902	47,494
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10,012	15,483	20,658	26,842	34,107	42,472	52,234
Installed renewables - Solar - Base land use assumptions (MW)	30,573	39,450	45,561	51,303	67,404	79,769	103,103
Installed renewables - Wind - Base land use assumptions (MW)	7,005	7,005	7,005	7,005	7,005	7,005	7,044
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	76.3	76.3	76.3	76.3	435	760
Installed renewables - Solar - Constrained land use assumptions (MW)	31,528	39,912	48,016	57,728	71,295	84,010	106,674
Installed renewables - Wind - Constrained land use assumptions (MW)	7,089	7,089	7,124	7,124	7,350	7,531	8,263
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	39.9	39.9	39.9	87.6	468	750
Capital invested - Solar PV - Base (billion \$2018)		11.9	7.32	6.33	16.7	12.1	21.6
Capital invested - Wind - Base (billion \$2018)		0	0	0	0	0	0.054
Capital invested - Offshore Wind - Base (billion \$2018)		0.292	0	0	0	0.588	0.429

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion \$2018)		11.2	9.7	10.7	14.1	12.5	21
Capital invested - Wind - Constrained (billion \$2018)		0	0.062	0	0.347	0.265	1.01
Capital invested - Offshore Wind - Constrained (billion \$2018)		0.153	0	0	0.097	0.622	0.374

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	76,176	98,009	113,175	127,060	164,853	192,978	245,329
Wind - Base land use assumptions (GWh)	27,863	27,863	27,863	27,863	27,863	27,863	27,998
OffshoreWind - Base land use assumptions (GWh)	0	418	418	418	418	2,400	4,197
Solar - Constrained land use assumptions (GWh)	78,455	99,044	118,573	141,109	171,332	199,522	249,459
Wind - Constrained land use assumptions (GWh)	27,871	27,871	27,995	27,995	28,624	29,123	31,003
OffshoreWind - Constrained land use assumptions (GWh)	0	219	219	219	477	2,558	4,106

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777



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 - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO <sub>2</sub> e/y)							-2,054

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO <sub>2</sub> e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO <sub>2</sub> e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO <sub>2</sub> e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO <sub>2</sub> e/y)							-4,082
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887

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)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		216	106	68.8	51.1	28.6	20.3
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,611	3,710	3,661	3,339	2,685	1,852
Premature deaths from air pollution - Gas Stations (deaths)		32.8	33.5	32.8	29.6	23.6	16.3
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		551	504	443	350	236	137
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.1	9.19	8.33	7.47	6.61	5.74
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.9	24.5	23.8	21.4	17.3	13.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.8	1.76	1.72	1.67	1.61	1.53
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		252	261	257	231	185	136

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		46.9	40.8	36.1	31.7	27.5	23.5
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		84.2	76.3	68.9	61.4	53.8	46.2
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		0.44	0.06	0.059	0.057	0.054	0.05
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		163	151	133	119	107	76.6
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		251	0.33	0.328	0.173	0.099	0
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		1,910	936	610	452	254	180
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		32,107	32,984	32,552	29,690	23,875	16,465
Monetary damages from air pollution - Gas Stations (million \$2019)		290	297	290	262	209	144
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,884	4,464	3,926	3,099	2,095	1,217
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		89.9	81.4	73.8	66.2	58.5	50.9
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		221	217	211	189	154	119
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		15.9	15.6	15.2	14.8	14.2	13.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,227	2,308	2,274	2,046	1,642	1,200
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		415	362	319	281	244	208
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		745	675	610	544	476	409
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		3.88	0.526	0.522	0.502	0.474	0.439
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,445	1,337	1,182	1,054	950	680

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		857	1,350	2,146	2,114	1,783	1,594
By economic sector - Construction (jobs)		59,717	70,439	77,189	84,636	99,338	139,510
By economic sector - Manufacturing (jobs)		30,550	37,330	36,123	32,353	34,350	36,817
By economic sector - Mining (jobs)		32,954	26,612	22,096	17,197	13,252	7,756
By economic sector - Other (jobs)		8,248	10,112	12,240	14,870	19,220	32,669
By economic sector - Pipeline (jobs)		2,728	3,430	2,661	2,427	2,141	1,837
By economic sector - Professional (jobs)		28,963	33,920	40,554	46,224	55,220	76,895

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		24,190	25,944	28,865	31,870	37,382	52,888
By economic sector - Utilities (jobs)		30,007	38,647	45,560	52,448	65,669	87,293
By resource sector - Biomass (jobs)		2,798	3,478	6,847	8,508	8,239	7,580
By resource sector - CO2 (jobs)		127	9,048	6,505	5,686	6,043	7,875
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		39,529	54,268	73,557	87,216	114,629	157,622
By resource sector - Natural Gas (jobs)		23,833	17,311	14,391	14,014	12,818	11,423
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,637	66,277	59,016	51,957	43,905	26,773
By resource sector - Solar (jobs)		61,872	68,901	76,057	85,821	104,480	176,428
By resource sector - Wind (jobs)		14,706	28,493	31,062	30,934	38,241	49,557
By education level - All sectors - High school diploma or less (jobs)		90,820	104,056	112,287	119,074	137,373	183,061
By education level - All sectors - Associates degree or some college (jobs)		65,962	76,272	82,754	88,711	103,793	140,425
By education level - All sectors - Bachelors degree (jobs)		48,049	52,752	56,355	59,212	67,462	87,682
By education level - All sectors - Masters or professional degree (jobs)		11,638	12,794	13,916	14,840	17,079	22,545
By education level - All sectors - Doctoral degree (jobs)		1,745	1,911	2,123	2,299	2,648	3,545
Related work experience - All sectors - None (jobs)		30,823	35,315	38,318	40,957	47,555	63,817
Related work experience - All sectors - Up to 1 year (jobs)		43,046	49,280	53,419	56,785	65,688	88,433
Related work experience - All sectors - 1 to 4 years (jobs)		79,648	89,950	96,965	102,904	118,688	157,258
Related work experience - All sectors - 4 to 10 years (jobs)		50,994	57,815	62,275	66,207	76,568	101,716
Related work experience - All sectors - Over 10 years (jobs)		13,704	15,424	16,458	17,284	19,857	26,034
On-the-Job Training - All sectors - None (jobs)		12,345	13,765	14,815	15,735	18,127	24,392
On-the-Job Training - All sectors - Up to 1 year (jobs)		144,657	163,556	176,319	186,564	214,745	284,158
On-the-Job Training - All sectors - 1 to 4 years (jobs)		45,049	51,687	55,813	59,612	69,389	93,081
On-the-Job Training - All sectors - 4 to 10 years (jobs)		13,955	16,276	17,862	19,491	22,976	31,484
On-the-Job Training - All sectors - Over 10 years (jobs)		2,209	2,500	2,628	2,735	3,119	4,143
On-Site or In-Plant Training - All sectors - None (jobs)		35,557	40,298	43,481	46,173	53,351	71,537
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		131,143	148,318	159,881	169,289	195,015	258,278
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		35,185	40,291	43,476	46,357	53,859	72,081
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		14,596	16,832	18,352	19,882	23,261	31,477
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,733	2,045	2,245	2,435	2,870	3,886
Wage income - All (million \$2019)		13,992	16,001	17,530	18,903	22,122	29,618

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,060	2,970	2,767	2,590	2,445	2,267	2,054
Final energy use - Residential (PJ)	878	825	766	706	626	537	459
Final energy use - Commercial (PJ)	793	800	806	802	788	770	759
Final energy use - Industry (PJ)	1,021	1,058	1,081	1,146	1,217	1,253	1,293

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)		9.31	9.32	16.2	17	25.6	27.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	1,983	2,669	3,356	6,535	9,714	16,751	23,787
Vehicle stocks - LDV – All others (1000 units)	31,093	31,093	31,093	29,494	27,894	21,495	15,096
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million \$2018)		0	1,128	1,859	6,771	19,756	29,318
Public EV charging plugs - DC Fast (1000 units)	4.35		5.46		15.8		38.7
Public EV charging plugs - L2 (1000 units)	21.5		131		380		930

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 (%)	5.99	14.3	19.7	35.3	59.2	74.8	80.3
Sales of space heating units - Electric Resistance (%)	16.4	25.3	24.3	21.5	17.3	14.5	13.6
Sales of space heating units - Gas (%)	74.3	54.1	50	38	19.4	7.29	3.04
Sales of space heating units - Fossil (%)	3.33	6.29	6.05	5.3	4.13	3.36	3.07
Sales of water heating units - Electric Heat Pump (%)	0	1.93	7.42	23.2	47.5	63.3	68.9
Sales of water heating units - Electric Resistance (%)	17.5	32.1	31.6	30.2	28.2	26.9	26.5
Sales of water heating units - Gas Furnace (%)	79.8	63.2	58.2	43.8	21.5	6.93	1.83
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.8	2.81	2.83
Sales of cooking units - Electric Resistance (%)	39.8	41.4	46.9	61.4	81.6	94.1	98.4
Sales of cooking units - Gas (%)	60.2	58.6	53.1	38.6	18.4	5.94	1.6
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		27.5	36.2				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	13	17.8	31.6	53.4	68.7	74.5
Sales of space heating units - Electric Resistance (%)	11.4	13.3	14	15.8	18.8	21.2	22.2
Sales of space heating units - Gas (%)	86.9	73.7	68.3	52.6	27.8	10.2	3.31
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.63	2.65	7.89	23	46.1	61.3	66.6
Sales of water heating units - Electric Resistance (%)	2.03	3.16	5.36	11.7	21.4	27.8	30.1
Sales of water heating units - Gas (%)	96.8	93.6	86.1	64.7	31.8	10.2	2.7
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		120,137	130,140				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,462	30,129	35,165	37,977	40,999	34,342	44,049
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0
Capital invested - Biomass power plant (billion \$2018)	0	0.012	0.833	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion \$2018)	0	0	0	0.105	0.017	0.003	0.03
Capital invested - Biomass w/ccu power plant (billion \$2018)	0	0	1.31	0.033	0.129	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	22.5	1,658	1,658	1,658	1,658	1,658
Biomass w/ccu power plant (GWh)	0	0	1,475	1,512	1,657	1,657	1,657
Biomass w/ccu allam power plant (GWh)	0	0	0	105	122	125	155

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	2	2	2	2	2	2
Number of facilities - Power ccu (quantity)	0	0	4	6	7	7	7
Number of facilities - Allam power w ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Beccs hydrogen (quantity)	0	0	0	12	18	20	21
Number of facilities - Diesel (quantity)	0	0	0	2	2	2	2
Number of facilities - Diesel ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Pyrolysis (quantity)	0	0	0	2	2	2	2
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Sng (quantity)	0	2	2	2	2	2	2
Number of facilities - Sng ccu (quantity)	0	0	4	4	4	4	4
Conversion capital investment - Cumulative 5-yr (million \$2018)		12.9	2,135	12,011	6,685	2,104	577
Biomass purchases (million \$2018/y)		9.04	119	484	687	752	768

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	1.48	30.2	45	54.6	61
Annual - BECCS (MMT)		0	1.47	16.7	25.2	27.9	28.5
Annual - NGCC (MMT)		0	0.01	6.82	9.85	13	18.3
Annual - Cement and lime (MMT)		0	0	6.71	9.95	13.7	14.1
Cumulative - All (MMT)		0	1.48	31.7	76.7	131	192
Cumulative - BECCS (MMT)		0	1.47	18.1	43.4	71.3	99.8
Cumulative - NGCC (MMT)		0	0.01	6.83	16.7	29.6	47.9
Cumulative - Cement and lime (MMT)		0	0	6.71	16.7	30.4	44.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	1,285	1,529	1,529	1,529	1,529
Spur (km)		0	772	3,598	4,559	5,016	5,868
All (km)		0	2,057	5,127	6,088	6,545	7,397
Cumulative investment - Trunk (million \$2018)		0	4,920	5,686	5,686	5,686	5,686
Cumulative investment - Spur (million \$2018)		0	423	2,309	3,082	3,425	3,978

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative investment - All (million \$2018)		0	5,343	7,995	8,768	9,111	9,664

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	34.2	57	61.1	75.2
Injection wells (wells)		0	0	66	96	128	182
Resource characterization, appraisal, permitting costs (million \$2020)		250	918	1,410	1,410	1,410	1,410
Wells and facilities construction costs (million \$2020)		0	0	1,946	2,887	3,828	5,460

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147



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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
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)							-2,054

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
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)							-4,081
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							0.126
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							10.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,973
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							9,415
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							0.125
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							10.6
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							9,499

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)		49.2	25.9	13.3	9.76	8.97	8.47

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		202	135	168	191	214	200
Premature deaths from air pollution - Mobile - On-Road (deaths)		3,600	3,750	3,896	4,064	4,228	4,387
Premature deaths from air pollution - Gas Stations (deaths)		32.6	33.8	34.9	36.3	37.5	38.6
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		546	508	480	468	465	464
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		11	10.8	10.7	10.7	10.6	10.6
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		24.8	25.3	26.4	28	29.6	31.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.88	1.93	1.98	2.02	2.05	2.07
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		252	258	255	257	273	298
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		49	48.4	49	49.9	50.8	51.8
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		88	90.5	93.7	96.7	99.5	102
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.18	0.782	0.608	0.577	0.555	0.516
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		164	177	185	181	184	176
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million \$2019)		436	229	118	86.5	79.5	75
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million \$2019)		1,786	1,197	1,492	1,695	1,893	1,768
Monetary damages from air pollution - Mobile - On-Road (million \$2019)		32,012	33,340	34,643	36,132	37,595	39,009
Monetary damages from air pollution - Gas Stations (million \$2019)		289	299	309	321	332	341
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million \$2019)		4,837	4,502	4,253	4,145	4,119	4,112
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million \$2019)		97.2	95.8	95.2	94.6	94	93.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million \$2019)		220	224	234	248	262	277
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million \$2019)		16.6	17.1	17.5	17.8	18.1	18.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million \$2019)		2,233	2,287	2,253	2,277	2,418	2,639
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million \$2019)		434	429	434	442	450	458

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million \$2019)		779	801	830	856	881	902
Monetary damages from air pollution - Industrial Processes - Coal Mining (million \$2019)		10.4	6.9	5.37	5.09	4.9	4.56
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million \$2019)		1,453	1,569	1,645	1,612	1,636	1,564

Table 65: REF scenario - IMPACTS - Jobs

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		832	785	780	704	704	732
By economic sector - Construction (jobs)		23,598	47,849	56,590	59,283	60,051	80,442
By economic sector - Manufacturing (jobs)		21,294	25,483	29,978	29,685	25,362	25,563
By economic sector - Mining (jobs)		33,101	27,503	22,809	18,565	15,356	11,875
By economic sector - Other (jobs)		1,079	6,716	8,854	9,984	11,000	19,603
By economic sector - Pipeline (jobs)		2,796	2,877	2,905	2,780	2,810	2,759
By economic sector - Professional (jobs)		15,891	23,752	27,567	29,779	31,137	42,119
By economic sector - Trade (jobs)		15,897	20,475	22,313	23,284	24,069	32,752
By economic sector - Utilities (jobs)		25,195	25,680	33,342	37,239	38,487	40,842
By resource sector - Biomass (jobs)		2,645	2,507	2,367	2,184	2,198	2,205
By resource sector - CO2 (jobs)		0	0.041	0.052	0.056	0.062	0.066
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		30,922	34,473	49,249	56,514	56,853	62,842
By resource sector - Natural Gas (jobs)		25,025	22,530	23,395	23,236	25,003	22,696
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,954	67,054	60,639	54,997	50,651	44,041
By resource sector - Solar (jobs)			45,721	57,544	59,376	61,189	111,259
By resource sector - Wind (jobs)		5,426	8,826	11,944	14,996	13,080	13,643
By education level - All sectors - High school diploma or less (jobs)		56,048	75,313	85,987	88,603	87,464	107,785
By education level - All sectors - Associates degree or some college (jobs)		40,741	54,595	62,967	65,480	65,146	81,018
By education level - All sectors - Bachelors degree (jobs)		33,691	40,082	43,954	44,687	43,895	52,576
By education level - All sectors - Masters or professional degree (jobs)		8,082	9,690	10,654	10,910	10,836	13,225
By education level - All sectors - Doctoral degree (jobs)		1,124	1,440	1,575	1,622	1,634	2,083
Related work experience - All sectors - None (jobs)		19,486	25,648	29,305	30,346	30,176	37,365
Related work experience - All sectors - Up to 1 year (jobs)		25,822	35,370	40,400	41,637	41,069	51,494
Related work experience - All sectors - 1 to 4 years (jobs)		52,196	66,380	74,798	76,943	76,120	92,912
Related work experience - All sectors - 4 to 10 years (jobs)		33,055	42,345	47,864	49,314	48,818	59,563
Related work experience - All sectors - Over 10 years (jobs)		9,126	11,375	12,770	13,063	12,792	15,353
On-the-Job Training - All sectors - None (jobs)		7,760	10,164	11,365	11,636	11,500	14,454
On-the-Job Training - All sectors - Up to 1 year (jobs)		94,278	120,279	135,611	139,302	137,306	167,813
On-the-Job Training - All sectors - 1 to 4 years (jobs)		28,247	37,337	42,711	44,220	43,916	53,982
On-the-Job Training - All sectors - 4 to 10 years (jobs)		8,096	11,538	13,422	14,081	14,245	17,953

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - Over 10 years (jobs)		1,304	1,800	2,029	2,063	2,007	2,485
On-Site or In-Plant Training - All sectors - None (jobs)		22,284	29,286	33,100	34,042	33,629	41,848
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		85,362	109,063	123,056	126,459	124,714	152,424
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		22,150	29,202	33,350	34,486	34,204	42,005
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		8,837	12,124	13,938	14,535	14,638	18,194
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		1,051	1,444	1,694	1,781	1,789	2,216
Wage income - All (million \$2019)		9,296	11,835	13,505	14,094	14,170	17,379

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	3,057	2,998	2,847	2,765	2,800	2,893	3,001
Final energy use - Residential (PJ)	878	827	784	756	740	729	719
Final energy use - Commercial (PJ)	793	809	826	837	860	902	960
Final energy use - Industry (PJ)	1,021	1,088	1,143	1,208	1,279	1,368	1,470

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)		11.4	11.7	20.7	22	18.4	19.1

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 (%)	4.04	25.4	26.3	27.8	29.1	30.6	32.8
Sales of space heating units - Electric Resistance (%)	16.9	22.7	22.3	21.7	21	19.5	17.3
Sales of space heating units - Gas (%)	75.7	46.9	46.4	45.5	45	44.9	44.9
Sales of space heating units - Fossil (%)	3.38	4.97	5	5	4.95	4.95	4.96
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	17.5	32.2	32.2	32.2	32.2	32.1	32.1
Sales of water heating units - Gas Furnace (%)	79.8	65	65	65	65.1	65.1	65.1
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.79	2.81	2.82
Sales of cooking units - Electric Resistance (%)	39.3	39.3	39.3	39.3	39.3	39.3	39.3
Sales of cooking units - Gas (%)	60.7	60.7	60.7	60.7	60.7	60.7	60.7
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion \$2018)		26.2	28.8				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.74	24.2	61.6	69.2	69.7	69.7	69.6
Sales of space heating units - Electric Resistance (%)	11.4	15.3	21.9	26.1	29.1	29.6	29.7
Sales of space heating units - Gas (%)	86.9	60.6	16.5	4.65	1.21	0.731	0.683
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of water heating units - Electric Heat Pump (%)	0.63	0.808	0.81	0.813	0.819	0.823	0.824
Sales of water heating units - Electric Resistance (%)	2.03	2.38	2.39	2.4	2.4	2.4	2.41
Sales of water heating units - Gas (%)	96.8	96.2	96.2	96.2	96.2	96.1	96.1
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625
Sales of cooking units - Electric Resistance (%)	27.5	29	29	29	29	28.9	28.9
Sales of cooking units - Gas (%)	72.5	71	71	71	71	71.1	71.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million \$2018)		119,229	123,203				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	55	55	0	0	0	0	0
Installed thermal - Natural gas (MW)	36,402	33,275	34,574	37,750	41,477	42,077	42,803
Installed thermal - Nuclear (MW)	2,323	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10,012	15,483	20,658	26,842	34,107	42,472	52,234
Installed renewables - Solar - Base land use assumptions (MW)	26,297	26,297	26,297	28,497	30,380	30,380	30,380
Installed renewables - Wind - Base land use assumptions (MW)	7,081	7,081	7,081	7,081	7,081	7,081	7,081
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	76.3	76.3	76.3	76.3	178	178
Installed renewables - Solar - Constrained land use assumptions (MW)	582	582	582	582	582	582	582
Installed renewables - Wind - Constrained land use assumptions (MW)	2.8	2.8	2.8	2.8	2.8	2.8	2.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	66,975	66,975	66,975	72,358	76,986	76,986	76,986
Wind - Base land use assumptions (GWh)	28,124	28,124	28,124	28,124	28,124	28,124	28,124
Offshore Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO <sub>2</sub> e/y)	-13.7		-7.63				-6.35
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO <sub>2</sub> e/y)	-1.79		-3				-3.16
Business-as-usual carbon sink - Total (Mt CO <sub>2</sub> e/y)	-15.5		-10.6				-9.51

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-1,878
Carbon sink potential - Low - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO <sub>2</sub> e/y)							-661

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO <sub>2</sub> e/y)							-2,642
Carbon sink potential - Low - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-14,511
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-2,813
Carbon sink potential - Mid - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO <sub>2</sub> e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO <sub>2</sub> e/y)							-5,240
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-28,914
Carbon sink potential - High - Accelerate regeneration (1000 tCO <sub>2</sub> e/y)							-3,748
Carbon sink potential - High - Avoid deforestation (1000 tCO <sub>2</sub> e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO <sub>2</sub> e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO <sub>2</sub> e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO <sub>2</sub> e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO <sub>2</sub> e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO <sub>2</sub> e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO <sub>2</sub> e/y)							-2,778
Carbon sink potential - High - All (not counting overlap) (1000 tCO <sub>2</sub> e/y)							-43,341
Carbon sink potential - High - Restore productivity (1000 tCO <sub>2</sub> e/y)							-7,838
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646

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 - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0



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 - Increase trees outside forests (1000 hectares)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598