Net-Zero America - Georgia data

October 29, 2021 (updated November 17, 2023)

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

E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, Final Report, Princeton University, Princeton, NJ, 29 October 2021. Report available at https://net-zeroamerica.princeton.edu.

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		35	32.8	19.8	15	7.59	2.87
Premature deaths from air pollution - Mobile - On-Road (deaths)		388	375	295	176	82.2	32.5
Premature deaths from air pollution - Gas Stations (deaths)		36.7	35	27.2	16.5	8.04	3.66
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		44.5	37	24.8	13.9	7.13	4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.45	1.21	0.858	0.532	0.271	0.128
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.42	4.04	3.18	2.18	1.27	0.712
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.78	2.73	2.65	2.56	2.46	2.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		22.9	20.5	15.1	9.47	6.01	4.39
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.14	1.86	1.51	1.15	0.832	0.559
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.17	1.92	1.64	1.34	1.03	0.702
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.6	0.969	0.99	1	1.04	1.06
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		47.1	45.4	42.3	33.8	25.6	16.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		458	0.84	0.762	0.536	0.353	0.029
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		310	291	175	133	67.2	25.4
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,449	3,336	2,621	1,565	731	289
Monetary damages from air pollution - Gas Stations (million $2019)		325	310	241	146	71.2	32.4
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		395	327	219	123	63.2	35.4
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		12.9	10.7	7.61	4.71	2.41	1.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		39.2	35.8	28.2	19.3	11.3	6.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		24.6	24.1	23.5	22.7	21.8	20.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		203	182	133	83.9	53.2	38.8

Table 1: *E+ scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19	16.4	13.4	10.2	7.36	4.95
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		19.2	17	14.6	11.9	9.08	6.22
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		14.1	8.55	8.74	8.85	9.19	9.31
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		418	403	375	300	227	144

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		518	841	494	1,466	1,699	1,468
By economic sector - Construction (jobs)		8,121	13,736	26,055	24,836	36,551	40,475
By economic sector - Manufacturing (jobs)		5,270	8,145	8,583	8,043	9,747	10,031
By economic sector - Mining (jobs)		3,112	2,251	1,494	912	602	360
By economic sector - Other (jobs)		602	1,633	4,570	4,624	8,141	9,485
By economic sector - Pipeline (jobs)		733	929	757	444	412	396
By economic sector - Professional (jobs)		4,638	6,059	10,522	11,816	17,849	19,949
By economic sector - Trade (jobs)		3,338	4,085	7,150	7,315	11,500	13,267
By economic sector - Utilities (jobs)		12,270	14,730	20,124	21,715	27,082	31,878
By resource sector - Biomass (jobs)		1,824	2,220	1,284	4,341	6,208	6,302
By resource sector - CO2 (jobs)		54.7	2,697	2,528	1,044	1,978	2,463
By resource sector - Coal (jobs)		1,328	0	0	0	0	0
By resource sector - Grid (jobs)		13,077	17,056	29,306	32,706	45,422	56,210
By resource sector - Natural Gas (jobs)		7,360	6,976	5,694	6,745	4,317	3,553
By resource sector - Nuclear (jobs)		3,150	3,100	3,051	3,003	2,790	2,511
By resource sector - Oil (jobs)		7,190	5,570	3,788	2,362	1,358	666
By resource sector - Solar (jobs)		4,593	14,432	33,821	30,166	49,643	54,275
By resource sector - Wind (jobs)		25	357	277	805	1,868	1,330
By education level - All sectors - High school diploma or less (jobs)		16,010	22,423	34,319	34,883	48,767	54,458
By education level - All sectors - Associates degree or some college (jobs)		11,921	16,498	25,615	25,883	36,350	40,985
By education level - All sectors - Bachelors degree (jobs)		8,360	10,589	15,451	15,834	22,007	24,625
By education level - All sectors - Masters or professional degree (jobs)		2,033	2,550	3,815	3,986	5,609	6,300
By education level - All sectors - Doctoral degree (jobs)		278	349	551	585	850	942
Related work experience - All sectors - None (jobs)		5,571	7,636	11,681	11,943	16,742	18,810
Related work experience - All sectors - Up to 1 year (jobs)		7,516	10,563	16,316	16,649	23,504	26,203
Related work experience - All sectors - 1 to 4 years (jobs)		14,028	18,811	28,460	29,025	40,542	45,486
Related work experience - All sectors - 4 to 10 years (jobs)		9,053	12,158	18,487	18,711	26,097	29,306
Related work experience - All sectors - Over 10 years (jobs)		2,434	3,242	4,806	4,843	6,697	7,505
On-the-Job Training - All sectors - None (jobs)		2,100	2,825	4,376	4,431	6,304	7,046
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,609	34,488	51,691	52,939	73,944	82,737

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)		8,049	11,073	17,153	17,269	24,112	27,140
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,487	3,511	5,741	5,764	8,145	9,201
On-the-Job Training - All sectors - Over 10 years (jobs)		359	512	789	769	1,077	1,186
On-Site or In-Plant Training - All sectors - None (jobs)		6,213	8,469	12,933	13,188	18,551	20,696
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,240	31,318	47,088	48,120	67,225	75,301
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,245	8,592	13,278	13,381	18,698	21,035
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,584	3,579	5,742	5,765	8,104	9,139
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		322	451	708	717	1,005	1,139
Wage income - All (million $2019)		2,042	2,725	4,117	4,267	5,995	6,817

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		162	137	101	67.5	41.5	21.7
Oil consumption - Cumulative (million bbls)							3,127
Oil production - Annual (million bbls)		0	0	0	0	0	0
Natural gas consumption - Annual (tcf)		572	482	387	291	183	127
Natural gas consumption - Cumulative (tcf)							11,650
Natural gas production - Annual (tcf)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Commercial (PJ)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431

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)		7.03	7.31	10.9	11.6	9.14	9.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	193	878	1,563	3,961	6,359	8,275	10,191
Vehicle stocks - LDV – All others (1000 units)	8,497	8,091	7,685	5,600	3,516	1,989	462
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376		3.15		12.8		20.6
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494

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 (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		8.06	8.87				

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 (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Gas (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,949	38,935				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	9,817	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	16,644	16,340	19,883	20,348	12,711	12,877	13,973
Installed thermal - Nuclear (MW)	6,242	6,242	6,242	6,242	6,242	5,385	5,385
Installed renewables - Rooftop PV (MW)	381	614	869	1,237	1,756	2,428	3,288
Installed renewables - Solar - Base land use assumptions (MW)	1,091	1,091	6,520	27,243	41,337	73,177	100,462
Installed renewables - Solar - Constrained land use assumptions (MW)	1,062	1,062	6,241	20,181	41,990	70,525	95,524
Capital invested - Solar PV - Base (billion $2018)		0	6.5	23.3	14.7	31.2	25.3
Capital invested - Solar PV - Constrained (billion $2018)		1.41	10.8	26.5	21	26.4	28.1
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.034	0	0	0.013

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0.007	6.93	0.666	0.001

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,538	2,538	13,248	54,705	82,365	144,675	198,271
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,371	2,371	12,565	39,857	82,678	138,608	187,741
Wind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	8.06	7,781	8,528	8,529
Biomass w/ccu allam power plant (GWh)	0	0	0	33.7	33.7	33.7	47

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	1	6	7	8
Number of facilities - Allam power w ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Beccs hydrogen (quantity)	0	0	0	1	6	14	16
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	1	1	1	2
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	408	13,059	7,815	2,416
Biomass purchases (million $2018/y)		0	0	18.6	628	1,015	1,134

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0.55	18.4	25.9	31.9
Annual - BECCS (MMT)		0	0	0.47	16.5	25.8	28.8
Annual - NGCC (MMT)		0	0	0.08	1.93	0.05	3.05
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0.55	19	44.8	76.7
Cumulative - BECCS (MMT)		0	0	0.47	17	42.8	71.6
Cumulative - NGCC (MMT)		0	0	0.08	2.01	2.06	5.11
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	570	906	906	906	906
Spur (km)		0	0	376	1,159	2,199	2,645
All (km)		0	570	1,282	2,064	3,105	3,550

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

Item	2020	2025	2030	2035	2040	2045	2050
Cumulative investment - Trunk (million $2018)		0	2,891	4,819	4,819	4,819	4,819
Cumulative investment - Spur (million $2018)		0	0	206	978	1,906	2,226
Cumulative investment - All (million $2018)		0	2,891	5,025	5,797	6,725	7,046

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	5.28	7.23	12.1	16.8
Injection wells (wells)		0	4	18	30	52	66
Resource characterization, appraisal, permitting costs (million $2020)		101	277	379	379	379	379
Wells and facilities construction costs (million $2020)		0	135	528	941	1,573	1,953

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)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
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)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342

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)							-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,075

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,940
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							935
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,771

Table 17: *E- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		34.8	23.7	9.91	3.38	1.04	0.593
Premature deaths from air pollution - Mobile - On-Road (deaths)		395	415	418	389	319	225
Premature deaths from air pollution - Gas Stations (deaths)		37.5	39.3	39.2	36.2	29.6	20.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		45	43	39.6	33.4	25.1	16.8
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.48	1.43	1.39	1.24	0.97	0.673
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.48	4.63	4.71	4.42	3.63	2.69
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.78	2.73	2.65	2.56	2.46	2.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		23.1	23.8	23.5	21.1	17	12.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.15	2.04	1.93	1.74	1.51	1.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.17	2.06	1.93	1.78	1.61	1.43
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.56	0.971	0.997	1.01	1.04	1.03
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		47	43.7	38.7	34.6	31.2	22.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		458	0.84	0.762	0.536	0.353	0.029
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		308	210	87.8	29.9	9.22	5.25
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,513	3,692	3,720	3,460	2,838	1,999
Monetary damages from air pollution - Gas Stations (million $2019)		332	348	347	321	262	185
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		399	381	351	296	223	149
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		13.1	12.7	12.3	11	8.6	5.96
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		39.7	41.1	41.8	39.1	32.1	23.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		24.6	24.1	23.5	22.7	21.8	20.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		205	210	208	187	150	111
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19	18.1	17.1	15.4	13.4	11.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		19.2	18.2	17.1	15.7	14.2	12.7
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		13.8	8.56	8.8	8.95	9.2	9.11
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		417	388	344	307	277	199

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		586	694	484	2,352	2,297	1,469
By economic sector - Construction (jobs)		7,984	13,887	22,771	23,361	39,803	40,985
By economic sector - Manufacturing (jobs)		5,405	8,245	7,384	8,409	12,220	11,033
By economic sector - Mining (jobs)		3,190	2,385	1,871	1,378	1,101	678
By economic sector - Other (jobs)		594	1,633	3,827	4,144	8,768	9,532
By economic sector - Pipeline (jobs)		737	1,144	977	587	674	678
By economic sector - Professional (jobs)		4,631	5,601	9,124	13,138	20,480	19,831

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Trade (jobs)		3,379	4,035	6,437	7,692	13,007	13,392
By economic sector - Utilities (jobs)		12,001	14,001	17,875	20,165	28,301	31,165
By resource sector - Biomass (jobs)		1,927	1,782	1,389	9,692	9,784	6,093
By resource sector - CO2 (jobs)		56.5	4,583	4,334	1,803	3,392	4,206
By resource sector - Coal (jobs)		1,550	113	0	0	0	0
By resource sector - Grid (jobs)		12,431	14,541	22,713	30,210	47,228	54,773
By resource sector - Natural Gas (jobs)		7,320	5,962	5,844	5,279	4,089	2,859
By resource sector - Nuclear (jobs)		3,150	3,100	3,051	3,003	2,622	2,108
By resource sector - Oil (jobs)		7,285	6,041	5,021	3,946	2,904	1,625
By resource sector - Solar (jobs)		4,761	15,129	28,154	26,509	53,877	54,994
By resource sector - Wind (jobs)		26.4	375	245	784	2,755	2,104
By education level - All sectors - High school diploma or less (jobs)		16,000	22,149	30,386	34,945	54,432	55,200
By education level - All sectors - Associates degree or some college (jobs)		11,856	16,283	22,640	25,295	40,194	41,425
By education level - All sectors - Bachelors degree (jobs)		8,347	10,383	13,833	16,235	24,757	24,867
By education level - All sectors - Masters or professional degree (jobs)		2,027	2,475	3,400	4,119	6,298	6,327
By education level - All sectors - Doctoral degree (jobs)		278	336	491	632	970	943
Related work experience - All sectors - None (jobs)		5,554	7,525	10,368	11,942	18,652	19,026
Related work experience - All sectors - Up to 1 year (jobs)		7,520	10,409	14,400	16,879	26,361	26,531
Related work experience - All sectors - 1 to 4 years (jobs)		13,996	18,508	25,283	29,025	45,167	45,989
Related work experience - All sectors - 4 to 10 years (jobs)		9,013	11,987	16,429	18,564	29,004	29,620
Related work experience - All sectors - Over 10 years (jobs)		2,425	3,197	4,268	4,817	7,467	7,598
On-the-Job Training - All sectors - None (jobs)		2,097	2,790	3,890	4,497	7,066	7,125
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,596	33,909	45,881	53,619	82,877	83,732
On-the-Job Training - All sectors - 1 to 4 years (jobs)		7,997	10,940	15,196	16,819	26,598	27,426
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,459	3,473	5,083	5,536	8,907	9,271
On-the-Job Training - All sectors - Over 10 years (jobs)		358	514	701	755	1,203	1,208
On-Site or In-Plant Training - All sectors - None (jobs)		6,204	8,345	11,472	13,271	20,737	20,932
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,216	30,808	41,790	48,583	75,243	76,196
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,210	8,487	11,760	13,087	20,664	21,267
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,558	3,542	5,102	5,586	8,897	9,217
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		319	444	626	699	1,109	1,150
Wage income - All (million $2019)		2,036	2,676	3,669	4,287	6,682	6,883

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Commercial (PJ)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439

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)		5.72	5.83	7.6	7.92	9.61	10.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	149	350	551	1,481	2,411	4,469	6,527
Vehicle stocks - LDV – All others (1000 units)	8,532	8,532	8,532	8,093	7,654	5,898	4,142
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	274	545	1,871	5,792	8,472
Public EV charging plugs - DC Fast (1000 units)	0.376		1.11		4.86		13.2
Public EV charging plugs - L2 (1000 units)	2.43		26.7		117		316

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 (%)	25.4	38	42.2	54.2	72.4	84.2	88.3
Sales of space heating units - Electric Resistance (%)	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of water heating units - Electric Heat Pump (%)	0	1.99	7.66	24	49	65.3	70.9
Sales of water heating units - Electric Resistance (%)	47.2	62.3	59.3	50.6	37.5	28.9	26
Sales of water heating units - Gas Furnace (%)	50	33.6	30.9	23.3	11.4	3.65	0.952
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15
Sales of cooking units - Electric Resistance (%)	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		7.98	8.75				

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 (%)	7.3	19.2	24.1	38.5	61	76.9	83
Sales of space heating units - Electric Resistance (%)	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Sales of space heating units - Gas (%)	86	68.4	63.6	49.6	27.2	11	4.45
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of water heating units - Electric Heat Pump (%)	0.221	2.04	7.05	21.5	43.6	58	63
Sales of water heating units - Electric Resistance (%)	5.5	7.53	9.45	15.2	24	29.8	31.8
Sales of water heating units - Gas (%)	92.1	86.3	79.4	59.6	29.1	9.31	2.42
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,927	38,922				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	9,817	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	16,847	16,448	16,209	13,020	10,571	8,599	6,080
Installed thermal - Nuclear (MW)	6,242	6,242	6,242	6,242	6,242	4,520	4,520

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
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)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788
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)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342

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)							-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,075
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,940
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							835

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							935
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,771

Table 27: *E+RE+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		37.1	31.4	15.5	9.18	2.11	0.755
Premature deaths from air pollution - Mobile - On-Road (deaths)		388	375	295	176	82.2	32.5
Premature deaths from air pollution - Gas Stations (deaths)		36.7	35	27.2	16.5	8.04	3.66
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		44.5	37	24.8	13.9	7.13	4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.45	1.21	0.858	0.532	0.271	0.128
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.42	4.04	3.18	2.18	1.27	0.712
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.78	2.73	2.65	2.56	2.46	2.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		22.9	20.5	15.1	9.47	6.01	4.39
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.14	1.86	1.51	1.15	0.832	0.559
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.17	1.92	1.64	1.34	1.03	0.702
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.71	0.969	0.99	1	1.04	1
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		46.3	44.7	39.5	29.1	18.1	2.68
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		458	0.84	0.762	0.536	0.353	0.029

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		329	278	138	81.3	18.7	6.69
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,449	3,336	2,621	1,565	731	289
Monetary damages from air pollution - Gas Stations (million $2019)		325	310	241	146	71.2	32.4
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		395	327	219	123	63.2	35.4
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		12.9	10.7	7.61	4.71	2.41	1.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		39.2	35.8	28.2	19.3	11.3	6.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		24.6	24.1	23.5	22.7	21.8	20.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		203	182	133	83.9	53.2	38.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19	16.4	13.4	10.2	7.36	4.95
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		19.2	17	14.6	11.9	9.08	6.22
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		15.1	8.55	8.73	8.84	9.19	8.87
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		411	397	350	258	161	23.8

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		520	859	488	1,339	1,456	1,461
By economic sector - Construction (jobs)		9,278	14,400	38,803	45,822	44,252	55,047
By economic sector - Manufacturing (jobs)		6,439	8,450	12,699	11,599	11,687	19,200
By economic sector - Mining (jobs)		3,049	2,111	1,239	615	220	40.7
By economic sector - Other (jobs)		764	1,964	7,811	9,895	10,079	12,163
By economic sector - Pipeline (jobs)		715	591	407	250	125	57.4
By economic sector - Professional (jobs)		5,080	6,760	15,816	20,563	20,935	26,006
By economic sector - Trade (jobs)		3,573	4,472	10,802	13,486	13,756	17,319
By economic sector - Utilities (jobs)		13,582	14,414	23,196	30,071	31,556	46,455
By resource sector - Biomass (jobs)		1,706	2,312	1,222	4,273	5,419	6,465
By resource sector - CO2 (jobs)		0	0	0	0	0.001	0
By resource sector - Coal (jobs)		1,328	0	0	0	0	0
By resource sector - Grid (jobs)		15,183	18,972	38,704	52,754	59,164	91,724
By resource sector - Natural Gas (jobs)		7,871	6,844	4,869	5,477	3,180	3,729
By resource sector - Nuclear (jobs)		3,150	3,100	2,705	2,175	1,690	605
By resource sector - Oil (jobs)		7,192	5,486	3,606	1,945	689	0.253
By resource sector - Solar (jobs)		6,548	16,823	58,936	64,608	60,238	72,975
By resource sector - Wind (jobs)		23.1	485	1,220	2,407	3,687	2,251
By education level - All sectors - High school diploma or less (jobs)		17,905	23,104	48,121	57,615	57,660	76,386

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

Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - Associates degree or some college (jobs)		13,382	16,940	35,772	43,007	43,179	57,611
By education level - All sectors - Bachelors degree (jobs)		9,187	10,946	21,295	25,561	25,701	33,967
By education level - All sectors - Masters or professional degree (jobs)		2,225	2,659	5,280	6,474	6,544	8,562
By education level - All sectors - Doctoral degree (jobs)		301	373	793	983	984	1,222
Related work experience - All sectors - None (jobs)		6,211	7,844	16,261	19,663	19,768	26,240
Related work experience - All sectors - Up to 1 year (jobs)		8,407	10,980	23,162	27,732	27,770	36,523
Related work experience - All sectors - 1 to 4 years (jobs)		15,592	19,380	39,554	47,613	47,819	63,460
Related work experience - All sectors - 4 to 10 years (jobs)		10,079	12,485	25,637	30,756	30,813	40,936
Related work experience - All sectors - Over 10 years (jobs)		2,712	3,332	6,647	7,875	7,898	10,590
On-the-Job Training - All sectors - None (jobs)		2,323	2,940	6,204	7,424	7,422	9,655
On-the-Job Training - All sectors - Up to 1 year (jobs)		28,482	35,639	72,120	86,599	87,074	115,636
On-the-Job Training - All sectors - 1 to 4 years (jobs)		9,009	11,334	23,813	28,585	28,602	38,075
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,784	3,581	7,997	9,734	9,697	12,729
On-the-Job Training - All sectors - Over 10 years (jobs)		404	528	1,127	1,298	1,272	1,654
On-Site or In-Plant Training - All sectors - None (jobs)		6,920	8,766	18,209	21,831	21,839	28,671
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		25,851	32,340	65,646	78,810	79,235	105,305
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,987	8,809	18,466	22,152	22,180	29,530
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,880	3,647	7,958	9,656	9,616	12,634
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		363	460	981	1,190	1,197	1,608
Wage income - All (million $2019)		2,260	2,799	5,663	6,914	7,037	9,469

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Commercial (PJ)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431

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)		7.03	7.31	10.9	11.6	9.14	9.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	193	878	1,563	3,961	6,359	8,275	10,191
Vehicle stocks - LDV – All others (1000 units)	8,497	8,091	7,685	5,600	3,516	1,989	462

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376		3.15		12.8		20.6
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494

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 (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		8.06	8.87				

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 (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Gas (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,949	38,935				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	9,817	0	0	0	0	0	0
Installed thermal - Natural gas (MW)	16,847	20,418	21,484	18,855	9,757	8,130	15,585
Installed thermal - Nuclear (MW)	6,242	6,242	6,242	4,520	4,520	2,200	0
Installed renewables - Rooftop PV (MW)	381	614	869	1,237	1,756	2,428	3,288
Installed renewables - Solar - Base land use assumptions (MW)	1,091	1,725	8,604	48,130	85,743	111,876	145,494
Installed renewables - Offshore Wind - Base land use assumptions (MW)	0	0	0	0	0	145	14,875

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Solar - Constrained land use assumptions (MW)	1,092	2,736	17,775	50,967	86,438	121,621	155,268
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	14,499
Capital invested - Solar PV - Base (billion $2018)		0.849	8.24	44	39.1	25.6	31.1
Capital invested - Offshore Wind - Base (billion $2018)		0	0	0	0	0.214	18.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,538	3,787	17,297	95,627	169,536	220,970	287,120
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	514	52,926
Solar - Constrained land use assumptions (GWh)	5,076	11,571	70,639	200,934	340,126	478,238	610,957
Wind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	103,114

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)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
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)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8

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 - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788
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)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-66

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,075
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,940
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							935
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,771

Table 38: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		35.5	33.1	34.3	27	9.2	2.83
Premature deaths from air pollution - Mobile - On-Road (deaths)		388	375	295	176	82.2	32.5
Premature deaths from air pollution - Gas Stations (deaths)		36.7	35	27.2	16.5	8.04	3.66
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		44.5	37	24.8	13.9	7.13	4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.45	1.21	0.858	0.532	0.271	0.128

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.42	4.04	3.18	2.18	1.27	0.712
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.78	2.73	2.65	2.56	2.46	2.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		22.9	20.5	15.1	9.47	6.01	4.39
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.14	1.86	1.51	1.15	0.832	0.559
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.17	1.92	1.64	1.34	1.03	0.702
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.5	0.968	0.99	1	1.04	1
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		47.7	47.4	47.7	41.5	35.5	27
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		458	0.84	0.762	0.536	0.353	0.029
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		315	293	303	240	81.5	25.1
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,449	3,336	2,621	1,565	731	289
Monetary damages from air pollution - Gas Stations (million $2019)		325	310	241	146	71.2	32.4
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		395	327	219	123	63.2	35.4
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		12.9	10.7	7.61	4.71	2.41	1.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		39.2	35.8	28.2	19.3	11.3	6.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		24.6	24.1	23.5	22.7	21.8	20.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		203	182	133	83.9	53.2	38.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19	16.4	13.4	10.2	7.36	4.95
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		19.2	17	14.6	11.9	9.08	6.22
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		13.2	8.54	8.74	8.85	9.2	8.86
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		424	421	423	369	315	240

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		563	718	470	1,952	1,888	1,473
By economic sector - Construction (jobs)		8,452	10,963	14,060	16,945	21,535	19,384
By economic sector - Manufacturing (jobs)		4,705	4,836	4,522	5,206	5,469	4,783
By economic sector - Mining (jobs)		3,190	2,392	1,765	1,191	945	646
By economic sector - Other (jobs)		651	799	1,520	2,343	3,685	2,872
By economic sector - Pipeline (jobs)		752	1,257	1,113	669	751	793
By economic sector - Professional (jobs)		4,696	4,615	5,523	9,468	11,504	11,130
By economic sector - Trade (jobs)		3,408	3,231	3,736	5,196	6,607	5,937
By economic sector - Utilities (jobs)		12,466	15,515	17,036	19,834	21,938	31,631
By resource sector - Biomass (jobs)		1,734	1,782	1,373	7,147	7,399	6,156
By resource sector - CO2 (jobs)		57.2	5,182	4,905	2,030	3,822	4,748
By resource sector - Coal (jobs)		1,550	318	301	286	273	105
By resource sector - Grid (jobs)		13,287	14,321	20,018	26,767	30,447	31,406
By resource sector - Natural Gas (jobs)		7,491	8,821	6,850	8,256	7,691	6,517
By resource sector - Nuclear (jobs)		3,150	3,100	3,051	3,003	2,622	15,054
By resource sector - Oil (jobs)		7,188	5,570	3,788	2,362	1,447	909
By resource sector - Solar (jobs)		4,314	5,093	9,445	12,915	20,512	13,710
By resource sector - Wind (jobs)		110	140	13.6	40.4	108	45.8
By education level - All sectors - High school diploma or less (jobs)		16,157	18,759	21,184	26,845	31,756	32,560
By education level - All sectors - Associates degree or some college (jobs)		12,016	14,069	15,976	19,714	23,579	24,578
By education level - All sectors - Bachelors degree (jobs)		8,382	9,031	9,854	12,559	14,663	16,608
By education level - All sectors - Masters or professional degree (jobs)		2,047	2,182	2,412	3,194	3,747	4,281
By education level - All sectors - Doctoral degree (jobs)		281	284	319	466	555	623
Related work experience - All sectors - None (jobs)		5,620	6,519	7,328	9,278	11,002	11,407
Related work experience - All sectors - Up to 1 year (jobs)		7,566	8,623	9,795	12,732	15,119	15,616
Related work experience - All sectors - 1 to 4 years (jobs)		14,140	16,014	17,892	22,531	26,615	28,379
Related work experience - All sectors - 4 to 10 years (jobs)		9,120	10,429	11,685	14,491	17,163	18,377
Related work experience - All sectors - Over 10 years (jobs)		2,437	2,740	3,047	3,746	4,401	4,873
On-the-Job Training - All sectors - None (jobs)		2,113	2,335	2,634	3,376	4,029	4,363
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,738	28,915	32,203	41,224	48,518	51,531
On-the-Job Training - All sectors - 1 to 4 years (jobs)		8,132	9,551	10,828	13,220	15,758	16,633
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,542	3,112	3,614	4,398	5,321	5,407
On-the-Job Training - All sectors - Over 10 years (jobs)		359	413	466	560	672	718
On-Site or In-Plant Training - All sectors - None (jobs)		6,247	7,055	7,906	10,126	12,020	12,807
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,370	26,331	29,391	37,419	44,085	46,857
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,306	7,368	8,348	10,240	12,194	12,823
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,634	3,177	3,650	4,439	5,336	5,498
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		326	394	451	555	664	666
Wage income - All (million $2019)		2,058	2,351	2,642	3,368	4,004	4,488

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,057	990	878	740	614	535	499
Final energy use - Residential (PJ)	362	344	319	286	259	244	240
Final energy use - Commercial (PJ)	252	253	245	233	223	221	224
Final energy use - Industry (PJ)	420	427	428	425	426	427	431

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)		7.03	7.31	10.9	11.6	9.14	9.44

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	193	878	1,563	3,961	6,359	8,275	10,191
Vehicle stocks - LDV – All others (1000 units)	8,497	8,091	7,685	5,600	3,516	1,989	462
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		1,609	4,204	6,681	10,172	11,015	10,532
Public EV charging plugs - DC Fast (1000 units)	0.376		3.15		12.8		20.6
Public EV charging plugs - L2 (1000 units)	2.43		75.7		308		494

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 (%)	25.4	45	81.3	89.4	89.8	89.7	89.7
Sales of space heating units - Electric Resistance (%)	18.4	19.7	8.27	5.67	5.52	5.61	5.63
Sales of space heating units - Gas (%)	51.8	29.7	8.3	3.54	3.35	3.36	3.35
Sales of space heating units - Fossil (%)	4.42	5.56	2.13	1.36	1.33	1.31	1.31
Sales of water heating units - Electric Heat Pump (%)	0	11.6	61.4	72.5	73	72.9	72.9
Sales of water heating units - Electric Resistance (%)	47.2	57.2	31	25.2	24.9	24.9	24.9
Sales of water heating units - Gas Furnace (%)	50	29.1	5.49	0.232	0	0	0
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.11	2.12	2.14	2.15
Sales of cooking units - Electric Resistance (%)	66.9	74	95.5	99.8	100	100	100
Sales of cooking units - Gas (%)	33.1	26	4.45	0.224	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		8.06	8.87				

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 (%)	7.3	27.4	70.6	84	85.3	85.4	85.4
Sales of space heating units - Electric Resistance (%)	6.68	8.23	10.2	12.3	12.7	12.7	12.7
Sales of space heating units - Gas (%)	86	60.5	18.4	3.67	2	1.95	1.94
Sales of space heating units - Fossil (%)	0	3.85	0.732	0.031	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.221	10.5	54.6	64.4	64.8	64.8	64.8
Sales of water heating units - Electric Resistance (%)	5.5	10.9	28.4	32.3	32.5	32.5	32.5
Sales of water heating units - Gas (%)	92.1	74.6	14.1	0.594	0	0	0
Sales of water heating units - Other (%)	2.13	3.93	2.95	2.7	2.71	2.7	2.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,949	38,935				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	9,817	850	850	850	850	850	0
Installed thermal - Natural gas (MW)	16,646	15,954	17,543	20,454	23,657	27,087	27,732
Installed thermal - Nuclear (MW)	6,242	6,242	6,242	6,242	6,242	4,520	10,219
Installed renewables - Rooftop PV (MW)	381	614	869	1,237	1,756	2,428	3,288
Installed renewables - Solar - Base land use assumptions (MW)	1,091	1,533	2,388	6,587	14,619	29,933	31,192
Installed renewables - Solar - Constrained land use assumptions (MW)	1,092	1,092	1,092	8,102	17,419	29,506	30,160
Installed renewables - Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		0.592	1.02	4.63	8.35	15	1.17
Capital invested - Solar PV - Constrained (billion $2018)		0	0	7.72	9.68	11.9	0.605

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,538	3,410	5,100	13,337	29,100	59,194	61,675
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,538	2,538	2,538	16,270	34,550	58,217	59,496
Wind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788
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)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342

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 tCO2e/y)							-66
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,975
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-33.9
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,075
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-66
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,806
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-67.7
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,940
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							835
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							61.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							935
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							38.6
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,609
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							123
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,771

Table 49: *E-B+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Electric Generation - Coal (deaths)		51.7	0.095	0.086	0.06	0.04	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		39.8	24.3	11	6.66	3.37	1.38
Premature deaths from air pollution - Mobile - On-Road (deaths)		395	415	418	389	319	225
Premature deaths from air pollution - Gas Stations (deaths)		37.5	39.3	39.2	36.2	29.6	20.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		45	43	39.6	33.4	25.1	16.8
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.48	1.43	1.39	1.24	0.97	0.673
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.48	4.63	4.71	4.42	3.63	2.69
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.78	2.73	2.65	2.56	2.46	2.34
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		23.1	23.8	23.5	21.1	17	12.5
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.15	2.04	1.93	1.74	1.51	1.26
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.17	2.06	1.93	1.78	1.61	1.43
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		1.6	0.97	0.997	1.01	1.05	1.06
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		47	43.7	38.7	34.6	31.2	22.4
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		458	0.84	0.762	0.536	0.353	0.029
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		352	215	97.2	59	29.9	12.2
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,513	3,692	3,720	3,460	2,838	1,999
Monetary damages from air pollution - Gas Stations (million $2019)		332	348	347	321	262	185
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		399	381	351	296	223	149
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		13.1	12.7	12.3	11	8.6	5.96
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		39.7	41.1	41.8	39.1	32.1	23.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		24.6	24.1	23.5	22.7	21.8	20.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		205	210	208	187	150	111

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19	18.1	17.1	15.4	13.4	11.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		19.2	18.2	17.1	15.7	14.2	12.7
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		14.1	8.56	8.8	8.95	9.3	9.37
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		417	388	344	307	277	199

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		554	694	1,403	1,512	1,783	1,615
By economic sector - Construction (jobs)		8,279	13,878	21,567	18,981	29,312	36,114
By economic sector - Manufacturing (jobs)		5,437	8,202	7,150	6,262	8,693	9,771
By economic sector - Mining (jobs)		3,132	2,380	1,881	1,450	1,115	640
By economic sector - Other (jobs)		617	1,623	3,435	3,239	6,107	8,486
By economic sector - Pipeline (jobs)		730	1,157	996	606	676	674
By economic sector - Professional (jobs)		4,754	5,618	9,668	10,066	15,417	18,461
By economic sector - Trade (jobs)		3,401	4,043	6,274	6,218	9,656	12,133
By economic sector - Utilities (jobs)		12,606	14,203	17,824	17,265	22,674	27,005
By resource sector - Biomass (jobs)		1,869	1,782	4,521	6,146	8,244	7,652
By resource sector - CO2 (jobs)		56.6	4,694	4,441	1,865	3,493	4,292
By resource sector - Coal (jobs)		1,328	0	0	0	0	0
By resource sector - Grid (jobs)		13,339	14,078	23,499	24,686	36,047	45,739
By resource sector - Natural Gas (jobs)		7,738	6,771	4,914	5,038	3,539	2,372
By resource sector - Nuclear (jobs)		3,150	3,100	3,051	3,003	2,790	2,511
By resource sector - Oil (jobs)		7,286	6,041	5,021	4,172	2,930	1,493
By resource sector - Solar (jobs)		4,716	14,944	24,539	20,282	36,770	49,459
By resource sector - Wind (jobs)		27.5	387	212	408	1,621	1,381
By education level - All sectors - High school diploma or less (jobs)		16,390	22,193	30,319	28,107	40,895	49,159
By education level - All sectors - Associates degree or some college (jobs)		12,214	16,359	22,128	20,521	30,172	36,733
By education level - All sectors - Bachelors degree (jobs)		8,545	10,424	13,817	13,150	18,834	22,408
By education level - All sectors - Masters or professional degree (jobs)		2,078	2,485	3,430	3,320	4,796	5,728
By education level - All sectors - Doctoral degree (jobs)		284	337	504	500	737	872
Related work experience - All sectors - None (jobs)		5,706	7,555	10,315	9,637	14,048	16,959
Related work experience - All sectors - Up to 1 year (jobs)		7,692	10,420	14,419	13,481	19,773	23,777
Related work experience - All sectors - 1 to 4 years (jobs)		14,358	18,574	25,094	23,489	34,073	41,010
Related work experience - All sectors - 4 to 10 years (jobs)		9,266	12,041	16,173	15,077	21,896	26,384
Related work experience - All sectors - Over 10 years (jobs)		2,490	3,208	4,198	3,914	5,644	6,771
On-the-Job Training - All sectors - None (jobs)		2,145	2,796	3,854	3,623	5,319	6,409
On-the-Job Training - All sectors - Up to 1 year (jobs)		26,210	33,999	45,887	43,133	62,507	74,938

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

Item	2020	2025	2030	2035	2040	2045	2050
On-the-Job Training - All sectors - 1 to 4 years (jobs)		8,242	10,992	14,846	13,702	20,014	24,285
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,548	3,496	4,934	4,528	6,696	8,189
On-the-Job Training - All sectors - Over 10 years (jobs)		367	515	677	611	897	1,079
On-Site or In-Plant Training - All sectors - None (jobs)		6,359	8,373	11,402	10,666	15,588	18,753
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,782	30,890	41,698	39,146	56,757	68,125
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,394	8,522	11,518	10,645	15,544	18,845
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,645	3,565	4,969	4,572	6,709	8,160
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		330	447	612	568	835	1,018
Wage income - All (million $2019)		2,089	2,687	3,655	3,480	5,068	6,151

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,059	999	916	848	794	730	654
Final energy use - Residential (PJ)	362	345	337	326	309	288	268
Final energy use - Commercial (PJ)	252	254	251	248	242	237	235
Final energy use - Industry (PJ)	420	427	430	431	435	436	439

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)		5.72	5.83	7.6	7.92	9.61	10.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	149	350	551	1,481	2,411	4,469	6,527
Vehicle stocks - LDV – All others (1000 units)	8,532	8,532	8,532	8,093	7,654	5,898	4,142
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	274	545	1,871	5,792	8,472
Public EV charging plugs - DC Fast (1000 units)	0.376		1.11		4.86		13.2
Public EV charging plugs - L2 (1000 units)	2.43		26.7		117		316

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 (%)	25.4	38	42.2	54.2	72.4	84.2	88.3
Sales of space heating units - Electric Resistance (%)	18.4	21.9	20.5	16.6	10.8	7.24	5.98
Sales of space heating units - Gas (%)	51.8	33.9	31.4	24.5	13.8	6.68	4.21
Sales of space heating units - Fossil (%)	4.42	6.22	5.88	4.75	3	1.86	1.47
Sales of water heating units - Electric Heat Pump (%)	0	1.99	7.66	24	49	65.3	70.9
Sales of water heating units - Electric Resistance (%)	47.2	62.3	59.3	50.6	37.5	28.9	26
Sales of water heating units - Gas Furnace (%)	50	33.6	30.9	23.3	11.4	3.65	0.952
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.14	2.15

Table 54: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	66.8	67.7	70.7	78.7	89.9	96.7	99.1
Sales of cooking units - Gas (%)	33.2	32.3	29.3	21.3	10.1	3.27	0.881
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		7.98	8.75				

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 (%)	7.3	19.2	24.1	38.5	61	76.9	83
Sales of space heating units - Electric Resistance (%)	6.68	7.92	8.16	8.87	10.2	11.6	12.4
Sales of space heating units - Gas (%)	86	68.4	63.6	49.6	27.2	11	4.45
Sales of space heating units - Fossil (%)	0	4.46	4.13	3.1	1.52	0.487	0.128
Sales of water heating units - Electric Heat Pump (%)	0.221	2.04	7.05	21.5	43.6	58	63
Sales of water heating units - Electric Resistance (%)	5.5	7.53	9.45	15.2	24	29.8	31.8
Sales of water heating units - Gas (%)	92.1	86.3	79.4	59.6	29.1	9.31	2.42
Sales of water heating units - Other (%)	2.13	4.12	4.13	3.73	3.23	2.87	2.75
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,927	38,922				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	1	1	1	1	1	1	1
Installed thermal - Natural gas (MW)	1	1	1	1	1	1	1
Installed thermal - Nuclear (MW)	1	1	1	1	1	1	1
Capital invested - Biomass power plant (billion $2018)	1	1	1	1	1	1	1
Capital invested - Biomass w/ccu allam power plant (billion $2018)	2	1	1	1	1	1	1
Capital invested - Biomass w/ccu power plant (billion $2018)	1	1	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	1	1	1	1	1	1	1
Biomass w/ccu power plant (GWh)	1	1	1	1	1	1	1
Biomass w/ccu allam power plant (GWh)	2	1	1	1	1	1	1

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	18	30	30	30
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	9	10
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0

Table 58: *E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	18,864	12,338	8,109	678
Biomass purchases (million $2018/y)		0	0	1,341	2,217	2,884	2,939

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	22.9	37.8	48.2	48.1
Annual - BECCS (MMT)		0	0	22.8	37.8	48.2	48.1
Annual - NGCC (MMT)		0	0	0.07	0.05	0.05	0.04
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	22.9	60.7	109	157
Cumulative - BECCS (MMT)		0	0	22.8	60.6	109	157
Cumulative - NGCC (MMT)		0	0	0.07	0.12	0.17	0.21
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	570	906	906	906	906
Spur (km)		0	0	1,095	1,945	2,525	3,144
All (km)		0	570	2,000	2,851	3,430	4,050
Cumulative investment - Trunk (million $2018)		0	2,891	4,819	5,012	5,012	5,012
Cumulative investment - Spur (million $2018)		0	0	1,333	2,272	3,144	3,560
Cumulative investment - All (million $2018)		0	2,891	6,153	7,284	8,156	8,572

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	6.42	11.9	15.8	16.7
Injection wells (wells)		0	4	18	32	54	68
Resource characterization, appraisal, permitting costs (million $2020)		101	292	404	404	404	404
Wells and facilities construction costs (million $2020)		0	141	548	976	1,633	2,027

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)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788
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)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342

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)							-306
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,784
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-29.3
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)							-2,120
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-306
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-3,445
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-58.6
Carbon sink potential - Aggressive deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-3,810
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							191
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							757
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							53.3
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							85.3
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							147

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,233
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							191
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,605
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							107
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							85.3
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							147
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,135

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)		221	150	122	110	106	105
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		34.5	43	45.1	49.6	54.5	59.4
Premature deaths from air pollution - Mobile - On-Road (deaths)		394	420	445	473	500	528
Premature deaths from air pollution - Gas Stations (deaths)		37.4	39.6	41.7	44.1	46.3	48.5
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		43.8	41.2	38.7	37.6	38.4	39.6
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.44	1.26	0.96	0.682	0.47	0.348
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		4.22	4.23	4.33	4.51	4.73	4.94
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		2.91	2.98	3.05	3.1	3.13	3.15
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		23.2	23.2	22	20.5	20.3	21.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		2.22	2.31	2.35	2.34	2.34	2.38
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		2.26	2.44	2.62	2.8	2.97	3.15
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.81	2.17	1.91	1.88	1.89	1.85
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		47.3	51.4	54.1	53.2	54.2	52

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		1,960	1,332	1,081	978	936	927
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		306	381	400	439	483	526
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,505	3,734	3,959	4,203	4,447	4,695
Monetary damages from air pollution - Gas Stations (million $2019)		331	351	369	390	410	430
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		388	365	343	333	340	351
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		12.8	11.2	8.51	6.05	4.17	3.09
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		37.4	37.5	38.3	40	41.9	43.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		25.7	26.4	27	27.4	27.7	27.9
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		205	205	194	182	180	190
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		19.7	20.4	20.8	20.7	20.7	21
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		20	21.6	23.2	24.8	26.3	27.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		24.8	19.1	16.9	16.6	16.7	16.3
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		420	456	481	472	481	462

Table 65: *REF scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		536	502	498	444	443	464
By economic sector - Construction (jobs)		7,733	9,594	10,518	9,911	10,329	12,757
By economic sector - Manufacturing (jobs)		3,328	3,622	3,696	3,532	3,461	5,005
By economic sector - Mining (jobs)		3,382	2,725	2,215	1,664	1,414	1,198
By economic sector - Other (jobs)		386	693	836	920	1,050	1,577
By economic sector - Pipeline (jobs)		750	772	778	735	745	741
By economic sector - Professional (jobs)		4,731	5,058	5,169	4,812	4,726	5,697
By economic sector - Trade (jobs)		3,527	3,586	3,537	3,191	3,207	3,894
By economic sector - Utilities (jobs)		14,056	15,094	15,906	14,414	14,020	16,400
By resource sector - Biomass (jobs)		1,758	1,663	1,565	1,437	1,450	1,458
By resource sector - CO2 (jobs)		0	0.028	0.036	0.039	0.043	0.046
By resource sector - Coal (jobs)		2,481	1,651	1,564	565	0	0
By resource sector - Grid (jobs)		15,918	17,837	19,873	15,471	16,363	20,624
By resource sector - Natural Gas (jobs)		7,755	8,806	8,551	10,295	9,686	10,332
By resource sector - Nuclear (jobs)		3,150	3,100	3,051	2,834	2,551	2,511
By resource sector - Oil (jobs)		7,323	6,167	5,372	4,962	4,732	4,573
By resource sector - Solar (jobs)			2,291	3,057	3,948	4,603	7,449
By resource sector - Wind (jobs)		44.7	132	119	113	11.4	786

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

Item	2020	2025	2030	2035	2040	2045	2050
By education level - All sectors - High school diploma or less (jobs)		15,836	17,359	18,109	16,572	16,623	20,251
By education level - All sectors - Associates degree or some college (jobs)		11,891	13,060	13,635	12,591	12,534	15,296
By education level - All sectors - Bachelors degree (jobs)		8,362	8,774	8,916	8,170	7,999	9,531
By education level - All sectors - Masters or professional degree (jobs)		2,062	2,163	2,201	2,019	1,975	2,344
By education level - All sectors - Doctoral degree (jobs)		278	291	293	272	265	312
Related work experience - All sectors - None (jobs)		5,569	6,066	6,310	5,814	5,796	7,034
Related work experience - All sectors - Up to 1 year (jobs)		7,338	8,032	8,357	7,651	7,666	9,373
Related work experience - All sectors - 1 to 4 years (jobs)		14,062	15,158	15,668	14,362	14,253	17,219
Related work experience - All sectors - 4 to 10 years (jobs)		9,062	9,809	10,155	9,352	9,263	11,183
Related work experience - All sectors - Over 10 years (jobs)		2,398	2,581	2,664	2,446	2,417	2,924
On-the-Job Training - All sectors - None (jobs)		2,062	2,218	2,279	2,097	2,081	2,516
On-the-Job Training - All sectors - Up to 1 year (jobs)		25,401	27,330	28,212	25,818	25,645	31,068
On-the-Job Training - All sectors - 1 to 4 years (jobs)		8,075	8,865	9,255	8,540	8,500	10,311
On-the-Job Training - All sectors - 4 to 10 years (jobs)		2,558	2,866	3,024	2,810	2,814	3,402
On-the-Job Training - All sectors - Over 10 years (jobs)		334	369	383	359	357	437
On-Site or In-Plant Training - All sectors - None (jobs)		6,099	6,600	6,815	6,290	6,233	7,562
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		23,102	24,890	25,718	23,528	23,385	28,328
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		6,252	6,853	7,150	6,586	6,562	7,967
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,651	2,941	3,087	2,865	2,860	3,443
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		326	363	382	355	355	432
Wage income - All (million $2019)		2,059	2,235	2,336	2,170	2,176	2,645

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	1,058	1,005	938	900	906	935	973
Final energy use - Residential (PJ)	362	345	342	342	347	357	368
Final energy use - Commercial (PJ)	252	257	260	262	266	276	290
Final energy use - Industry (PJ)	420	441	459	477	500	522	549

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)		7.5	7.83	10.5	11.1	9.45	9.79

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 (%)	23.1	53.2	54.3	56	57.1	58.3	60.1
Sales of space heating units - Electric Resistance (%)	19	17.4	17.2	16.5	15.9	14.8	12.9
Sales of space heating units - Gas (%)	53.4	25.6	24.8	23.8	23.3	23.2	23.3
Sales of space heating units - Fossil (%)	4.53	3.7	3.73	3.74	3.7	3.7	3.74
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	47.2	63.3	63.3	63.2	63.1	63	63
Sales of water heating units - Gas Furnace (%)	50	34.6	34.6	34.7	34.8	34.8	34.9
Sales of water heating units - Other (%)	2.84	2.09	2.1	2.12	2.13	2.15	2.16
Sales of cooking units - Electric Resistance (%)	66.5	66.5	66.5	66.5	66.5	66.5	66.5
Sales of cooking units - Gas (%)	33.5	33.5	33.5	33.5	33.5	33.5	33.5
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		7.85	7.66				

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 (%)	7.3	29.1	63.5	71.8	72.4	72.4	72.4
Sales of space heating units - Electric Resistance (%)	6.68	9.42	14.6	20.2	24.8	25.6	25.6
Sales of space heating units - Gas (%)	86	57.4	19.3	6.83	2.61	2	1.94
Sales of space heating units - Fossil (%)	0	4.09	2.54	1.21	0.181	0.016	0
Sales of water heating units - Electric Heat Pump (%)	0.221	0.279	0.274	0.275	0.276	0.274	0.275
Sales of water heating units - Electric Resistance (%)	5.5	6.83	6.74	6.75	6.78	6.74	6.75
Sales of water heating units - Gas (%)	92.1	88.7	88.7	88.7	88.7	88.7	88.7
Sales of water heating units - Other (%)	2.13	4.16	4.3	4.23	4.29	4.32	4.3
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		34,430	35,753				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	9,817	4,414	4,414	4,414	0	0	0
Installed thermal - Natural gas (MW)	16,644	18,376	22,832	22,892	17,795	24,102	33,824
Installed thermal - Nuclear (MW)	6,242	6,242	6,242	6,242	5,385	5,385	5,385
Installed renewables - Rooftop PV (MW)	381	614	869	1,237	1,756	2,428	3,288
Installed renewables - Solar - Base land use assumptions (MW)	1,091	1,091	1,091	1,091	1,091	1,091	1,091

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Wind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Business-as-usual carbon sink - Natural uptake (Mt CO2e/y)	-11.1		-19				-15.4
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-6.93		-11.6				-12.2
Business-as-usual carbon sink - Total (Mt CO2e/y)	-18		-30.5				-27.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-391
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-461
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-4,610
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-3,281
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-8,490
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-350
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-944
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-429
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,996
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-20,952
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-586
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,612
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-8,306
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-4,808
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-16,980
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-675
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-1,415
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-3,047
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-3,959
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-41,389
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-781
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-2,764
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-12,001
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-6,449
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-25,469

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,000
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,887
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-5,666
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-61,940
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-5,922
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							63.9
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							351
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,345
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							1,188
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)							50
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							62.4
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							27.9
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,188
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,276
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							95.8
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							363
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,232
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							1,788
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)							72.5
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							93.6
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							202

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							2,392
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,239
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							128
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							374
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,120
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							2,376
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)							95
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							125
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							161
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,963
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,342