Net-Zero America - Ohio 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:

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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)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		43.2	34.9	22.2	18.4	10	3.88
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.27	0.936	0.914	0.883	0.88	0.863
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	162	142	109	78.4	47.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		382	309	197	163	88.6	34.3
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million $2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		514	467	364	235	132	62.5

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)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		20	8.26	8.06	7.79	7.77	7.61
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,576	1,441	1,264	972	696	419

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		991	1,049	946	522	643	1,916
By economic sector - Construction (jobs)		10,256	10,979	20,269	20,807	22,041	21,263
By economic sector - Manufacturing (jobs)		9,317	9,766	11,331	10,168	8,510	9,575
By economic sector - Mining (jobs)		11,133	8,438	6,292	4,037	2,522	1,363
By economic sector - Other (jobs)		454	584	2,641	2,977	3,850	3,490
By economic sector - Pipeline (jobs)		1,603	1,561	1,101	823	555	476
By economic sector - Professional (jobs)		5,635	5,503	9,514	9,962	11,408	13,287
By economic sector - Trade (jobs)		5,432	4,861	7,044	6,907	7,482	7,529
By economic sector - Utilities (jobs)		12,408	12,143	17,592	18,990	18,493	19,934
By resource sector - Biomass (jobs)		2,429	2,442	2,131	1,241	2,390	8,335
By resource sector - CO2 (jobs)		0	1,539	0	0	131	1,132
By resource sector - Coal (jobs)		1,710	216	18	13.3	10.4	8.76
By resource sector - Grid (jobs)		10,721	11,497	25,660	29,591	31,067	34,857
By resource sector - Natural Gas (jobs)		18,143	15,108	12,583	10,498	6,865	4,378
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,280	16,571	13,779	9,722	6,954	4,254
By resource sector - Solar (jobs)		1,617	2,544	15,658	16,241	20,540	16,484
By resource sector - Wind (jobs)		2,667	4,315	6,262	7,256	6,926	8,772
By education level - All sectors - High school diploma or less (jobs)		23,702	23,003	32,558	31,770	31,873	33,469
By education level - All sectors - Associates degree or some college (jobs)		17,178	16,646	23,961	23,885	24,057	24,778
By education level - All sectors - Bachelors degree (jobs)		12,877	12,008	15,827	15,260	15,199	15,920
By education level - All sectors - Masters or professional degree (jobs)		3,063	2,846	3,848	3,750	3,814	4,055
By education level - All sectors - Doctoral degree (jobs)		409	380	538	527	560	612
Related work experience - All sectors - None (jobs)		8,184	7,894	11,120	10,928	11,005	11,534
Related work experience - All sectors - Up to 1 year (jobs)		10,976	10,648	15,293	14,905	15,088	16,066
Related work experience - All sectors - 1 to 4 years (jobs)		20,969	19,996	27,690	27,130	27,227	28,312
Related work experience - All sectors - 4 to 10 years (jobs)		13,418	12,836	17,864	17,585	17,598	18,180
Related work experience - All sectors - Over 10 years (jobs)		3,682	3,509	4,765	4,644	4,587	4,743
On-the-Job Training - All sectors - None (jobs)		3,105	2,939	4,130	4,016	4,078	4,251
On-the-Job Training - All sectors - Up to 1 year (jobs)		38,336	36,640	50,535	49,183	49,301	52,035

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)		11,757	11,357	16,176	16,065	16,101	16,459
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,490	3,419	5,150	5,214	5,316	5,375
On-the-Job Training - All sectors - Over 10 years (jobs)		542	528	740	716	708	715
On-Site or In-Plant Training - All sectors - None (jobs)		9,090	8,710	12,257	12,012	12,161	12,759
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,773	33,235	45,932	44,750	44,825	47,155
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,174	8,859	12,581	12,456	12,480	12,790
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,731	3,625	5,296	5,306	5,367	5,434
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		461	455	665	668	671	695
Wage income - All (million $2019)		3,228	3,112	4,323	4,283	4,333	4,571

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		183	157	120	85.6	58.3	37
Oil consumption - Cumulative (million bbls)							3,717
Oil production - Annual (million bbls)		30.1	30.2	30.2	23.9	19.4	12.9
Natural gas consumption - Annual (tcf)		882	743	596	449	282	196
Natural gas consumption - Cumulative (tcf)							17,958
Natural gas production - Annual (tcf)		2,865	2,708	2,358	1,994	1,581	1,228

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

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)		6.24	6.43	13.3	14.2	13.1	13.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 7: *E+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.7	12.8				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,680	40,065				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	14,788	15,171	18,473	14,988	12,493	9,851
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	552	1,071	12,379	21,718	34,525	39,741
Installed renewables - Wind - Base land use assumptions (MW)	638	827	4,636	15,584	33,653	35,902	38,809
Installed renewables - Solar - Constrained land use assumptions (MW)	539	539	2,105	11,799	23,367	36,327	43,696
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	9,867	19,628	19,628	19,628	19,628
Capital invested - Solar PV - Base (billion $2018)		0	0.621	12.5	9.71	12.6	4.83
Capital invested - Wind - Base (billion $2018)		0	5.07	13.6	21.4	2.52	3.08

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion $2018)		1.55	0.276	10.4	9.72	11.5	5.9
Capital invested - Wind - Constrained (billion $2018)		0	12.9	11.3	0	0	0.2
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	2,369	22,189	38,393	60,473	69,347
Wind - Base land use assumptions (GWh)	2,973	2,973	14,885	48,163	98,677	104,614	112,056
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,334	1,334	4,096	21,004	41,108	63,417	76,016
Wind - Constrained land use assumptions (GWh)	2,973	2,973	28,568	53,532	53,532	53,532	53,532
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	7	30
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	0	0	6,167	22,362
Biomass purchases (million $2018/y)		0	0	0	0	402	1,858

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	7.93	36.7
Annual - BECCS (MMT)		0	0	0	0	7.93	36.7
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	7.93	44.6
Cumulative - BECCS (MMT)		0	0	0	0	7.93	44.6
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	477	477	477	477	477
Spur (km)		0	0	0	0	301	1,550
All (km)		0	477	477	477	778	2,027
Cumulative investment - Trunk (million $2018)		0	1,555	1,555	1,555	1,555	1,555
Cumulative investment - Spur (million $2018)		0	0	0	0	350	1,462
Cumulative investment - All (million $2018)		0	1,555	1,555	1,555	1,905	3,017

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million $2020)		0	0	0	0	0	0
Wells and facilities construction costs (million $2020)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

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)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,883

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

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)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		39.5	25.5	9.81	4.31	1.44	0.866
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	459	446	402	320	220
Premature deaths from air pollution - Gas Stations (deaths)		60.1	60.6	58.5	52.5	41.8	28.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88.3	80.5	71.9	61.1	47	31.3
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		11.1	10.7	10.3	8.94	6.52	4.01
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.5	10.7	10.7	9.99	8.12	5.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.2	56.7	54.4	49.1	40.6	30.1
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.76	5.12	4.52	3.82	3.11	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.51	3.12	2.74	2.37	2.02
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.18	0.939	0.925	0.903	0.882	0.824
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	155	128	107	91.1	64.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		350	226	86.9	38.1	12.7	7.67
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,048	4,080	3,966	3,572	2,847	1,959
Monetary damages from air pollution - Gas Stations (million $2019)		532	537	518	465	370	256
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		782	713	637	541	417	278
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		98.3	95.2	91.1	79.2	57.8	35.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		93.1	94.5	94.7	88.6	72	51.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		515	502	482	435	359	267
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		51	45.3	40	33.8	27.5	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		34.6	31	27.6	24.2	21	17.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		19.2	8.28	8.17	7.97	7.78	7.27
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,571	1,374	1,133	947	809	570

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,003	1,023	936	510	859	1,915
By economic sector - Construction (jobs)		9,975	10,820	16,311	17,322	23,035	22,075

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		9,386	9,819	10,200	9,964	10,882	11,910
By economic sector - Mining (jobs)		11,148	8,410	6,386	4,816	3,578	2,069
By economic sector - Other (jobs)		434	560	2,132	2,518	4,076	3,530
By economic sector - Pipeline (jobs)		1,605	1,639	1,038	845	713	733
By economic sector - Professional (jobs)		5,512	5,273	7,968	8,741	12,645	13,918
By economic sector - Trade (jobs)		5,385	4,827	6,320	6,475	8,431	8,105
By economic sector - Utilities (jobs)		11,826	11,457	12,595	13,908	17,588	19,727
By resource sector - Biomass (jobs)		2,447	2,363	2,118	1,230	3,658	8,057
By resource sector - CO2 (jobs)		0	2,638	0	0	225	1,942
By resource sector - Coal (jobs)		1,695	217	19.6	15.8	10.6	4.86
By resource sector - Grid (jobs)		9,658	9,893	17,093	20,412	29,448	33,543
By resource sector - Natural Gas (jobs)		17,970	13,848	10,237	8,717	6,444	4,688
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,377	17,062	15,072	12,950	10,831	6,847
By resource sector - Solar (jobs)		1,680	2,653	12,895	14,084	22,232	16,602
By resource sector - Wind (jobs)		2,784	4,503	5,811	7,059	8,335	11,686
By education level - All sectors - High school diploma or less (jobs)		23,307	22,596	27,086	27,407	34,503	35,585
By education level - All sectors - Associates degree or some college (jobs)		16,847	16,289	19,627	20,325	25,715	26,289
By education level - All sectors - Bachelors degree (jobs)		12,699	11,791	13,456	13,579	16,777	17,135
By education level - All sectors - Masters or professional degree (jobs)		3,016	2,781	3,252	3,312	4,184	4,321
By education level - All sectors - Doctoral degree (jobs)		404	371	464	477	627	652
Related work experience - All sectors - None (jobs)		8,039	7,738	9,210	9,389	11,861	12,234
Related work experience - All sectors - Up to 1 year (jobs)		10,803	10,460	12,776	12,902	16,416	17,067
Related work experience - All sectors - 1 to 4 years (jobs)		20,621	19,606	23,097	23,572	29,540	30,205
Related work experience - All sectors - 4 to 10 years (jobs)		13,185	12,581	14,820	15,188	18,996	19,380
Related work experience - All sectors - Over 10 years (jobs)		3,624	3,443	3,981	4,048	4,993	5,095
On-the-Job Training - All sectors - None (jobs)		3,060	2,891	3,485	3,525	4,462	4,532
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,743	35,962	42,368	42,914	53,822	55,599
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,530	11,118	13,264	13,687	17,183	17,458
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,405	3,335	4,143	4,342	5,562	5,617
On-the-Job Training - All sectors - Over 10 years (jobs)		535	522	624	631	777	775
On-Site or In-Plant Training - All sectors - None (jobs)		8,949	8,549	10,241	10,444	13,230	13,610
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,224	32,615	38,451	38,973	48,842	50,345
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,002	8,677	10,352	10,652	13,364	13,584
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,648	3,542	4,304	4,470	5,661	5,710
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		451	444	538	560	710	732
Wage income - All (million $2019)		3,173	3,048	3,600	3,712	4,688	4,866

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663

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)		5.04	5.08	6.88	7.14	11.1	11.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV - EV (1000 units)	41.9	304	566	1,780	2,994	5,681	8,368
Vehicle stocks - LDV – All others (1000 units)	10,939	10,939	10,939	10,376	9,813	7,562	5,311
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326		1.12		5.95		16.6
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400

Table 22: *E- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.67	12.6				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Gas (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,676	40,057				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	14,585	13,536	12,232	8,044	5,478	4,146
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312

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)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-5,463

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

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)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		35.7	26	15.4	10.2	3.41	0.815
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.48	0.936	0.912	0.881	0.878	0.777
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		174	159	131	92.8	53.8	6.54
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		316	231	136	90.6	30.2	7.22
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million $2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		514	467	364	235	132	62.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		21.9	8.26	8.05	7.78	7.75	6.85
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,543	1,414	1,167	824	478	58

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		991	1,052	946	516	560	1,922
By economic sector - Construction (jobs)		10,912	11,887	28,513	27,464	25,255	28,307
By economic sector - Manufacturing (jobs)		9,584	10,666	13,541	13,061	13,632	14,754
By economic sector - Mining (jobs)		11,045	8,323	5,929	3,508	1,830	291
By economic sector - Other (jobs)		638	919	4,610	4,620	4,501	5,295
By economic sector - Pipeline (jobs)		1,559	1,323	955	630	339	95.8
By economic sector - Professional (jobs)		5,840	6,153	13,013	13,128	13,307	17,683
By economic sector - Trade (jobs)		5,584	5,247	9,333	8,905	8,472	10,108
By economic sector - Utilities (jobs)		11,946	11,665	19,949	21,900	20,894	24,307
By resource sector - Biomass (jobs)		2,407	2,458	2,123	1,229	2,120	8,609
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		1,750	216	17.8	13	10.2	0.028
By resource sector - Grid (jobs)		10,402	12,678	31,871	37,172	38,104	46,456

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		17,259	14,208	10,411	8,083	4,546	2,653
By resource sector - Nuclear (jobs)		662	651	641	631	366	0
By resource sector - Oil (jobs)		19,282	16,488	13,369	8,776	5,198	815
By resource sector - Solar (jobs)		3,358	5,454	29,858	27,425	25,806	26,641
By resource sector - Wind (jobs)		2,977	5,081	8,496	10,403	12,639	17,588
By education level - All sectors - High school diploma or less (jobs)		24,143	24,039	41,302	39,765	37,548	43,546
By education level - All sectors - Associates degree or some college (jobs)		17,436	17,336	30,446	29,920	28,458	32,710
By education level - All sectors - Bachelors degree (jobs)		13,007	12,486	19,552	18,749	17,735	20,501
By education level - All sectors - Masters or professional degree (jobs)		3,094	2,970	4,792	4,630	4,407	5,216
By education level - All sectors - Doctoral degree (jobs)		418	405	696	666	641	790
Related work experience - All sectors - None (jobs)		8,301	8,206	14,034	13,618	12,888	14,992
Related work experience - All sectors - Up to 1 year (jobs)		11,223	11,236	19,632	18,879	17,939	21,149
Related work experience - All sectors - 1 to 4 years (jobs)		21,254	20,809	34,749	33,665	31,876	36,732
Related work experience - All sectors - 4 to 10 years (jobs)		13,592	13,331	22,438	21,821	20,639	23,686
Related work experience - All sectors - Over 10 years (jobs)		3,727	3,653	5,934	5,748	5,447	6,203
On-the-Job Training - All sectors - None (jobs)		3,166	3,094	5,290	5,065	4,783	5,570
On-the-Job Training - All sectors - Up to 1 year (jobs)		38,912	38,281	63,482	61,248	58,172	67,731
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,919	11,777	20,444	19,995	18,881	21,524
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,543	3,527	6,616	6,514	6,100	6,982
On-the-Job Training - All sectors - Over 10 years (jobs)		556	556	954	908	853	956
On-Site or In-Plant Training - All sectors - None (jobs)		9,254	9,135	15,616	15,104	14,380	16,775
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		35,291	34,698	57,701	55,703	52,831	61,360
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		9,306	9,200	15,897	15,510	14,646	16,711
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,780	3,732	6,734	6,583	6,145	7,008
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		467	470	841	831	787	909
Wage income - All (million $2019)		3,264	3,224	5,381	5,274	5,034	5,874

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

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)		6.24	6.43	13.3	14.2	13.1	13.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 32: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.7	12.8				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,680	40,065				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,088	13,501	13,930	10,816	8,250	9,925

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	0	0
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	1,667	3,665	25,782	40,087	48,782	59,888
Installed renewables - Wind - Base land use assumptions (MW)	827	827	9,413	27,115	42,706	42,827	42,827
Installed renewables - Solar - Constrained land use assumptions (MW)	724	1,070	5,050	25,599	35,300	37,387	53,098
Installed renewables - Wind - Constrained land use assumptions (MW)	904	904	18,372	19,705	19,705	19,705	45,105
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		1.49	2.39	24.4	14.9	8.53	10.3
Capital invested - Wind - Base (billion $2018)		0	11.4	22	18.4	0.135	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	3,430	6,952	45,355	69,898	84,697	104,264
Wind - Base land use assumptions (GWh)	2,973	2,973	29,483	80,929	121,652	121,927	121,927
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	2,908	4,131	18,119	88,835	121,824	128,925	184,223
Wind - Constrained land use assumptions (GWh)	5,947	5,947	100,657	107,064	107,064	107,064	258,045
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

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)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		40.4	32.3	41.2	30.5	10.7	3.26
Premature deaths from air pollution - Mobile - On-Road (deaths)		448	416	315	183	84.6	35.2
Premature deaths from air pollution - Gas Stations (deaths)		58.8	53.9	40.6	24	11.7	5.62

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88	75.9	54.3	31.3	14.7	5.03
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.9	8.96	6.13	3.49	1.36	0.353
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.4	9.89	7.98	5.44	2.99	1.37
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58	52.8	41.1	26.6	14.9	7.06
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.74	4.63	3.44	2.37	1.57	1.01
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.27	2.66	2.07	1.51	0.993
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.05	0.934	0.913	0.882	0.881	0.776
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		180	171	165	140	116	86.1
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		358	286	365	271	94.9	28.9
Monetary damages from air pollution - Mobile - On-Road (million $2019)		3,979	3,697	2,802	1,624	753	313
Monetary damages from air pollution - Gas Stations (million $2019)		521	478	359	213	104	49.7
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		779	673	481	277	131	44.6
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		96.7	79.4	54.3	31	12.1	3.13
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		92.5	87.6	70.7	48.2	26.5	12.2
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		514	467	364	235	132	62.5
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		50.8	41	30.5	20.9	13.9	8.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		34.6	28.9	23.6	18.3	13.4	8.79
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		18.1	8.24	8.06	7.78	7.77	6.85

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,599	1,517	1,462	1,246	1,032	765

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		999	1,027	933	514	711	1,911
By economic sector - Construction (jobs)		10,077	10,606	11,203	12,805	14,065	16,081
By economic sector - Manufacturing (jobs)		8,773	7,982	7,686	7,706	7,210	7,259
By economic sector - Mining (jobs)		11,219	8,650	6,747	4,565	3,099	1,942
By economic sector - Other (jobs)		426	422	618	789	1,022	1,156
By economic sector - Pipeline (jobs)		1,647	1,833	1,346	1,162	970	998
By economic sector - Professional (jobs)		5,475	4,891	5,613	8,329	9,902	12,145
By economic sector - Trade (jobs)		5,356	4,572	4,505	4,892	5,152	5,627
By economic sector - Utilities (jobs)		12,071	12,189	15,085	31,633	35,973	39,178
By resource sector - Biomass (jobs)		2,412	2,363	2,112	1,234	2,809	8,096
By resource sector - CO2 (jobs)		0	2,981	0	0	255	2,194
By resource sector - Coal (jobs)		1,671	216	17.9	13.2	10.4	0
By resource sector - Grid (jobs)		9,966	9,471	16,157	20,007	24,131	29,067
By resource sector - Natural Gas (jobs)		18,420	16,302	14,912	14,251	11,918	10,231
By resource sector - Nuclear (jobs)		662	651	2,844	22,223	26,048	26,362
By resource sector - Oil (jobs)		19,278	16,571	13,779	9,722	7,155	4,914
By resource sector - Solar (jobs)		1,414	1,340	1,737	1,981	2,689	2,458
By resource sector - Wind (jobs)		2,219	2,276	2,176	2,965	3,090	2,975
By education level - All sectors - High school diploma or less (jobs)		23,197	21,848	22,441	28,738	30,916	34,702
By education level - All sectors - Associates degree or some college (jobs)		16,792	15,841	16,408	21,919	23,645	26,021
By education level - All sectors - Bachelors degree (jobs)		12,641	11,419	11,687	16,887	18,221	19,733
By education level - All sectors - Masters or professional degree (jobs)		3,010	2,707	2,823	4,250	4,649	5,089
By education level - All sectors - Doctoral degree (jobs)		403	357	377	602	674	752
Related work experience - All sectors - None (jobs)		8,017	7,540	7,747	10,131	10,923	12,200
Related work experience - All sectors - Up to 1 year (jobs)		10,725	10,005	10,347	13,694	14,840	16,776
Related work experience - All sectors - 1 to 4 years (jobs)		20,549	19,047	19,600	26,539	28,623	31,444
Related work experience - All sectors - 4 to 10 years (jobs)		13,148	12,256	12,614	17,219	18,551	20,291
Related work experience - All sectors - Over 10 years (jobs)		3,604	3,325	3,427	4,813	5,168	5,587
On-the-Job Training - All sectors - None (jobs)		3,044	2,782	2,860	4,067	4,414	4,854
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,525	34,673	35,657	48,012	51,793	57,410
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,516	10,884	11,247	15,117	16,277	17,813
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,428	3,337	3,470	4,507	4,883	5,426
On-the-Job Training - All sectors - Over 10 years (jobs)		530	496	501	693	738	794
On-Site or In-Plant Training - All sectors - None (jobs)		8,897	8,232	8,467	11,790	12,802	14,160
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		34,043	31,494	32,413	43,616	47,017	52,036

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

Item	2020	2025	2030	2035	2040	2045	2050
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,984	8,472	8,747	11,658	12,540	13,746
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,668	3,537	3,653	4,769	5,141	5,678
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		451	437	454	564	605	677
Wage income - All (million $2019)		3,168	2,981	3,119	4,362	4,785	5,334

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	952	886	773	638	516	442	411
Final energy use - Residential (PJ)	555	515	478	416	348	297	264
Final energy use - Commercial (PJ)	372	366	351	325	295	272	261
Final energy use - Industry (PJ)	602	619	627	629	639	647	652

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)		6.24	6.43	13.3	14.2	13.1	13.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	54.1	946	1,837	4,958	8,078	10,572	13,065
Vehicle stocks - LDV – All others (1000 units)	10,894	10,374	9,853	7,180	4,507	2,550	593
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,095	5,367	8,700	13,178	14,344	13,675
Public EV charging plugs - DC Fast (1000 units)	0.326		3.65		16		25.9
Public EV charging plugs - L2 (1000 units)	1.06		87.7		386		624

Table 43: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	13.7	41.4	84.2	91.7	92.1	91.9
Sales of space heating units - Electric Resistance (%)	15.4	21.4	16.1	7.17	5.54	5.47	5.69
Sales of space heating units - Gas (%)	74	56.5	36.7	5.84	0.489	0.156	0.159
Sales of space heating units - Fossil (%)	5.05	8.47	5.81	2.79	2.31	2.27	2.21
Sales of water heating units - Electric Heat Pump (%)	0	1.79	15.1	34.7	38	38.3	38.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	51.7	60	61.5	61.6	61.5
Sales of water heating units - Gas Furnace (%)	67.7	49.3	33	5.17	0.303	0	0
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.17	0.168	0.168	0.17
Sales of cooking units - Electric Resistance (%)	61.8	69.9	94.9	99.7	100	100	100
Sales of cooking units - Gas (%)	38.2	30.1	5.14	0.259	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.7	12.8				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	8.43	35.7	81.1	89	89.5	89.5
Sales of space heating units - Electric Resistance (%)	4.39	3.49	5.31	9.37	10.1	10.2	10.2
Sales of space heating units - Gas (%)	88.8	85.5	58.5	9.54	0.892	0.356	0.356
Sales of space heating units - Fossil (%)	5.44	2.58	0.487	0.021	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.454	2.53	19.6	46.2	50.8	51.1	51.1
Sales of water heating units - Electric Resistance (%)	4.26	4.67	18.3	43.9	48.4	48.7	48.7
Sales of water heating units - Gas (%)	95	92.6	61.9	9.69	0.569	0	0
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	54.2	82.9	88.6	88.9	88.9	88.9
Sales of cooking units - Gas (%)	59	45.8	17.1	11.4	11.1	11.1	11.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,680	40,065				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,334	13,080	14,653	13,647	14,668	12,939
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	2,237	11,261	20,239	27,689
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807
Installed renewables - Solar - Base land use assumptions (MW)	552	552	552	898	1,475	2,848	2,848
Installed renewables - Wind - Base land use assumptions (MW)	827	827	1,016	1,016	1,127	1,127	1,162
Installed renewables - Solar - Constrained land use assumptions (MW)	724	724	724	964	3,339	4,800	4,800
Installed renewables - Wind - Constrained land use assumptions (MW)	827	827	1,482	1,482	2,083	2,277	2,425
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		0	0	0.381	0.599	1.35	0
Capital invested - Wind - Base (billion $2018)		0	0.252	0	0.132	0	0.036
Capital invested - Solar PV - Constrained (billion $2018)		0	0	0.265	2.47	1.43	0
Capital invested - Wind - Constrained (billion $2018)		0	0.873	0	0.71	0.217	0.157

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	1,454	2,065	3,079	5,499	5,499
Wind - Base land use assumptions (GWh)	2,973	2,973	3,579	3,579	3,937	3,937	4,045
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	1,454	1,454	1,454	1,879	6,066	8,628	8,628
Wind - Constrained land use assumptions (GWh)	2,973	2,973	4,979	4,979	6,794	7,356	7,799
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)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

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)							-1,255
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,883
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-107
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-4,245
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,255
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-5,463
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-214
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-6,932
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,861
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							195
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							2,578

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							523
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,526
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							390
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,439

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)		247	0.648	0.646	0.62	0.473	0.046
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		38.3	22.1	12.3	7.99	4.07	1.32
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	459	446	402	320	220
Premature deaths from air pollution - Gas Stations (deaths)		60.1	60.6	58.5	52.5	41.8	28.9
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		88.3	80.5	71.9	61.1	47	31.3
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		11.1	10.7	10.3	8.94	6.52	4.01
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.5	10.7	10.7	9.99	8.12	5.83
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.26	5.96	5.64	5.3	4.96	4.61
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.2	56.7	54.4	49.1	40.6	30.1
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.76	5.12	4.52	3.82	3.11	2.45
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		3.9	3.51	3.12	2.74	2.37	2.02
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		2.25	0.938	0.926	0.905	0.901	0.874
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		177	155	128	107	91.1	64.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,187	5.75	5.73	5.5	4.19	0.407
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		339	196	109	70.8	36.1	11.7
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,048	4,080	3,966	3,572	2,847	1,959
Monetary damages from air pollution - Gas Stations (million $2019)		532	537	518	465	370	256

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		782	713	637	541	417	278
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		98.3	95.2	91.1	79.2	57.8	35.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		93.1	94.5	94.7	88.6	72	51.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		55.4	52.8	49.9	46.9	43.9	40.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		515	502	482	435	359	267
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		51	45.3	40	33.8	27.5	21.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		34.6	31	27.6	24.2	21	17.9
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		19.9	8.28	8.17	7.98	7.95	7.71
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,571	1,374	1,133	947	809	570

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		997	1,023	935	512	1,507	3,742
By economic sector - Construction (jobs)		9,727	10,738	15,309	14,600	18,737	21,192
By economic sector - Manufacturing (jobs)		9,369	9,845	9,630	8,115	9,334	11,811
By economic sector - Mining (jobs)		11,117	8,400	6,419	4,900	3,590	1,981
By economic sector - Other (jobs)		419	552	1,899	1,940	2,942	3,175
By economic sector - Pipeline (jobs)		1,589	1,644	1,056	873	705	711
By economic sector - Professional (jobs)		5,407	5,230	7,529	7,398	11,747	16,735
By economic sector - Trade (jobs)		5,333	4,803	6,034	5,658	7,289	8,444
By economic sector - Utilities (jobs)		11,366	11,245	12,265	12,322	15,748	19,699
By resource sector - Biomass (jobs)		2,437	2,363	2,117	1,241	6,942	17,800
By resource sector - CO2 (jobs)		0	2,708	0	0	231	1,993
By resource sector - Coal (jobs)		1,708	217	19.6	16	12.7	9.92
By resource sector - Grid (jobs)		9,010	9,595	16,318	17,115	25,709	33,331
By resource sector - Natural Gas (jobs)		17,595	13,619	10,448	8,946	6,457	4,535
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,378	17,062	15,072	13,170	10,891	6,552
By resource sector - Solar (jobs)		1,663	2,624	11,142	10,376	15,007	14,591
By resource sector - Wind (jobs)		2,872	4,641	5,316	4,823	5,727	8,067
By education level - All sectors - High school diploma or less (jobs)		22,915	22,456	25,865	23,660	30,212	37,282
By education level - All sectors - Associates degree or some college (jobs)		16,528	16,170	18,721	17,467	22,098	26,582
By education level - All sectors - Bachelors degree (jobs)		12,514	11,722	12,923	11,881	14,957	18,196
By education level - All sectors - Masters or professional degree (jobs)		2,969	2,763	3,122	2,896	3,758	4,682
By education level - All sectors - Doctoral degree (jobs)		398	369	443	414	574	748

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		7,897	7,685	8,805	8,123	10,391	12,794
Related work experience - All sectors - Up to 1 year (jobs)		10,630	10,399	12,171	11,065	14,418	18,229
Related work experience - All sectors - 1 to 4 years (jobs)		20,277	19,478	22,107	20,461	25,888	31,345
Related work experience - All sectors - 4 to 10 years (jobs)		12,955	12,496	14,179	13,162	16,547	19,905
Related work experience - All sectors - Over 10 years (jobs)		3,566	3,422	3,812	3,507	4,354	5,219
On-the-Job Training - All sectors - None (jobs)		3,013	2,874	3,326	3,044	3,907	4,795
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,143	35,744	40,529	37,165	47,512	58,768
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,312	11,036	12,673	11,822	14,779	17,552
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,329	3,306	3,953	3,749	4,740	5,599
On-the-Job Training - All sectors - Over 10 years (jobs)		528	520	593	539	660	777
On-Site or In-Plant Training - All sectors - None (jobs)		8,803	8,497	9,770	8,991	11,568	14,278
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		33,674	32,413	36,784	33,761	43,028	53,002
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,836	8,616	9,891	9,205	11,524	13,726
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,571	3,513	4,115	3,880	4,866	5,741
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		441	440	514	483	613	745
Wage income - All (million $2019)		3,119	3,027	3,453	3,237	4,132	5,074

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	954	894	812	747	696	637	566
Final energy use - Residential (PJ)	555	516	488	461	427	383	335
Final energy use - Commercial (PJ)	372	367	358	350	337	320	302
Final energy use - Industry (PJ)	602	620	630	637	652	659	663

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)		5.04	5.08	6.88	7.14	11.1	11.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	41.9	304	566	1,780	2,994	5,681	8,368
Vehicle stocks - LDV – All others (1000 units)	10,939	10,939	10,939	10,376	9,813	7,562	5,311
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	338	712	2,404	7,567	11,023
Public EV charging plugs - DC Fast (1000 units)	0.326		1.12		5.95		16.6
Public EV charging plugs - L2 (1000 units)	1.06		27		143		400

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	5.51	11.2	14.4	24.6	46.6	71.6	85.5
Sales of space heating units - Electric Resistance (%)	15.4	21.8	21.1	19.1	14.6	9.52	6.85
Sales of space heating units - Gas (%)	74	58.2	56	48.7	33.1	15.1	4.95
Sales of space heating units - Fossil (%)	5.05	8.79	8.51	7.56	5.72	3.8	2.74
Sales of water heating units - Electric Heat Pump (%)	0	0.549	2.08	6.92	17.2	28.8	35.3
Sales of water heating units - Electric Resistance (%)	32.2	48.8	49	50.1	53.4	57.7	60.3
Sales of water heating units - Gas Furnace (%)	67.7	50.5	48.8	42.8	29.2	13.3	4.31
Sales of water heating units - Other (%)	0.083	0.169	0.17	0.171	0.17	0.17	0.17
Sales of cooking units - Electric Resistance (%)	61.7	62.7	66.2	75.4	88.3	96.2	99
Sales of cooking units - Gas (%)	38.3	37.3	33.8	24.6	11.7	3.78	1.02
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.67	12.6				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	6.26	9.41	19.5	41.8	67.8	82.5
Sales of space heating units - Electric Resistance (%)	4.39	3.42	3.62	4.32	6.06	8.25	9.52
Sales of space heating units - Gas (%)	88.8	87.3	84.2	74.1	51.1	23.6	7.9
Sales of space heating units - Fossil (%)	5.44	2.99	2.75	2.06	1.03	0.337	0.088
Sales of water heating units - Electric Heat Pump (%)	0.454	1.05	3.02	9.27	22.8	38.3	47
Sales of water heating units - Electric Resistance (%)	4.26	3.81	5.35	10.5	22.3	36.6	44.8
Sales of water heating units - Gas (%)	95	94.9	91.4	80	54.7	25	8.07
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	45.8	49.8	60.5	75.4	84.5	87.7
Sales of cooking units - Gas (%)	59	54.2	50.2	39.5	24.6	15.5	12.3
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,676	40,057				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	1,455	0	0	0	0	0
Installed thermal - Natural gas (MW)	13,672	13,088	12,776	12,232	8,132	6,136	4,715
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0.179	0.179
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	1	1
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	23	65
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	2
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	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	1
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	0	0	19,240	37,955
Biomass purchases (million $2018/y)		0	0	0	0	1,897	5,611

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	24.7	72.9
Annual - BECCS (MMT)		0	0	0	0	24.7	72.9
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0	0	0	24.7	97.6
Cumulative - BECCS (MMT)		0	0	0	0	24.7	97.6
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	477	477	477	477	477
Spur (km)		0	0	0	0	932	2,589
All (km)		0	477	477	477	1,409	3,066
Cumulative investment - Trunk (million $2018)		0	1,555	1,555	1,555	1,934	1,934
Cumulative investment - Spur (million $2018)		0	0	0	0	1,080	3,054
Cumulative investment - All (million $2018)		0	1,555	1,555	1,555	3,014	4,988

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual (MMT)		0	0	0	0	0	0
Injection wells (wells)		0	0	0	0	0	0
Resource characterization, appraisal, permitting costs (million $2020)		0	0	0	0	0	0
Wells and facilities construction costs (million $2020)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362

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)							-1,772
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,589
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-96.4
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)							-4,458
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,772
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,907
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-193
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)							-6,872

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							1,674
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							175
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							3,047
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							903
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							7,832
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							351
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							166
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							129
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							9,381

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)		630	419	367	341	330	310
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		32.4	37.8	48.5	50.8	48	41.5
Premature deaths from air pollution - Mobile - On-Road (deaths)		455	465	475	489	502	516
Premature deaths from air pollution - Gas Stations (deaths)		59.9	61.2	62.2	63.8	65.2	66.5
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		87.6	80.6	74.7	70.9	68.7	66.5
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		10.7	9.16	6.55	4.04	2.01	0.911
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		10.1	10.2	10.5	10.7	10.6	10.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.54	6.52	6.47	6.4	6.32	6.21

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

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		58.7	57.6	52.8	46.7	43	42.3
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		5.91	5.59	5.13	4.61	4.26	4.08
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		4.08	4.16	4.24	4.31	4.38	4.46
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		4.75	3.29	2.65	2.49	2.38	2.21
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		178	188	191	181	179	169
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		5,585	3,709	3,254	3,020	2,928	2,745
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		287	334	430	450	426	367
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,043	4,133	4,226	4,344	4,463	4,584
Monetary damages from air pollution - Gas Stations (million $2019)		530	542	551	565	578	589
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		777	715	662	629	609	589
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		95.1	81.2	58.1	35.8	17.8	8.07
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		89.9	90.8	93	95	94.2	92.3
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		57.9	57.7	57.3	56.7	56	55
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		519	510	467	413	381	374
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		52.3	49.5	45.4	40.8	37.7	36.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		36.1	36.8	37.6	38.2	38.8	39.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		41.9	29	23.4	21.9	21	19.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,582	1,668	1,699	1,607	1,590	1,498

Table 65: *REF scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		994	988	988	978	978	981
By economic sector - Construction (jobs)		9,773	9,868	11,384	11,559	11,875	11,903
By economic sector - Manufacturing (jobs)		7,237	7,337	7,693	7,878	7,503	7,008
By economic sector - Mining (jobs)		11,767	9,602	7,983	6,443	5,365	4,218

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		343	379	488	543	573	683
By economic sector - Pipeline (jobs)		1,640	1,727	1,760	1,658	1,672	1,645
By economic sector - Professional (jobs)		5,538	4,990	5,239	5,286	5,242	5,007
By economic sector - Trade (jobs)		5,674	4,859	4,760	4,575	4,422	4,167
By economic sector - Utilities (jobs)		12,720	11,613	13,688	13,941	14,129	13,303
By resource sector - Biomass (jobs)		2,417	2,342	2,272	2,202	2,161	2,124
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		3,300	1,520	777	704	647	325
By resource sector - Grid (jobs)		11,033	9,047	13,499	13,708	13,925	13,439
By resource sector - Natural Gas (jobs)		18,156	18,705	19,033	18,526	18,454	17,161
By resource sector - Nuclear (jobs)		662	651	641	631	621	612
By resource sector - Oil (jobs)		19,437	17,227	15,483	14,057	12,987	11,451
By resource sector - Solar (jobs)			833	1,072	1,095	1,140	1,980
By resource sector - Wind (jobs)		681	1,037	1,202	1,938	1,823	1,824
By education level - All sectors - High school diploma or less (jobs)		23,075	21,421	22,737	22,366	22,015	20,977
By education level - All sectors - Associates degree or some college (jobs)		16,637	15,452	16,500	16,284	16,038	15,215
By education level - All sectors - Bachelors degree (jobs)		12,564	11,407	11,615	11,198	10,799	10,024
By education level - All sectors - Masters or professional degree (jobs)		3,008	2,718	2,766	2,664	2,570	2,385
By education level - All sectors - Doctoral degree (jobs)		402	363	363	349	337	314
Related work experience - All sectors - None (jobs)		7,966	7,392	7,831	7,700	7,575	7,193
Related work experience - All sectors - Up to 1 year (jobs)		10,619	9,811	10,348	10,168	9,970	9,502
Related work experience - All sectors - 1 to 4 years (jobs)		20,497	18,832	19,717	19,262	18,830	17,738
Related work experience - All sectors - 4 to 10 years (jobs)		13,054	12,053	12,669	12,401	12,142	11,443
Related work experience - All sectors - Over 10 years (jobs)		3,549	3,274	3,415	3,329	3,240	3,040
On-the-Job Training - All sectors - None (jobs)		3,016	2,756	2,841	2,756	2,675	2,522
On-the-Job Training - All sectors - Up to 1 year (jobs)		37,284	34,257	35,787	34,974	34,141	32,198
On-the-Job Training - All sectors - 1 to 4 years (jobs)		11,437	10,632	11,325	11,140	10,969	10,392
On-the-Job Training - All sectors - 4 to 10 years (jobs)		3,440	3,237	3,526	3,500	3,494	3,349
On-the-Job Training - All sectors - Over 10 years (jobs)		510	481	501	491	479	454
On-Site or In-Plant Training - All sectors - None (jobs)		8,768	8,083	8,436	8,245	8,043	7,591
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		33,868	31,117	32,551	31,816	31,078	29,322
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		8,925	8,289	8,815	8,667	8,527	8,079
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		3,677	3,450	3,717	3,673	3,651	3,484
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		447	423	461	461	459	439
Wage income - All (million $2019)		3,164	2,951	3,132	3,098	3,072	2,931

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	953	894	818	774	775	799	830

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	555	517	496	481	472	466	461
Final energy use - Commercial (PJ)	372	372	369	360	351	351	360
Final energy use - Industry (PJ)	602	634	654	668	689	709	731

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)		5.42	5.51	10.6	11.3	10.6	11.1

Table 68: *REF scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	4.34	15.8	16.3	17.1	17.8	18.6	19.7
Sales of space heating units - Electric Resistance (%)	15.7	20.7	20.5	20.2	19.5	18.6	17.7
Sales of space heating units - Gas (%)	74.7	55.6	55.9	55.8	55.7	55.8	55.7
Sales of space heating units - Fossil (%)	5.21	7.94	7.37	6.96	6.98	7	6.99
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	32.2	48.7	48.5	48.4	48.4	48.3	48.2
Sales of water heating units - Gas Furnace (%)	67.7	51.2	51.4	51.4	51.5	51.6	51.6
Sales of water heating units - Other (%)	0.083	0.169	0.171	0.171	0.171	0.172	0.172
Sales of cooking units - Electric Resistance (%)	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Sales of cooking units - Gas (%)	38.7	38.7	38.7	38.7	38.7	38.7	38.7
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		9.28	9.99				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	1.41	12.6	44.7	71.1	75.4	75.9	75.9
Sales of space heating units - Electric Resistance (%)	4.39	4.3	8.91	17.1	22.8	23.6	23.7
Sales of space heating units - Gas (%)	88.8	80.4	45	11.5	1.77	0.436	0.356
Sales of space heating units - Fossil (%)	5.44	2.76	1.39	0.243	0.027	0.001	0
Sales of water heating units - Electric Heat Pump (%)	0.454	0.344	0.348	0.348	0.342	0.344	0.345
Sales of water heating units - Electric Resistance (%)	4.26	3.24	3.2	3.21	3.19	3.18	3.18
Sales of water heating units - Gas (%)	95	96.2	96.3	96.3	96.3	96.3	96.3
Sales of water heating units - Other (%)	0.252	0.187	0.187	0.189	0.188	0.188	0.189
Sales of cooking units - Electric Resistance (%)	41	44.2	44.3	44.3	44.3	44.4	44.5
Sales of cooking units - Gas (%)	59	55.8	55.7	55.7	55.7	55.6	55.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		36,280	37,607				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	7,904	5,820	1,455	1,455	1,455	1,455	0
Installed thermal - Natural gas (MW)	13,672	13,364	12,776	14,044	13,055	16,912	16,758
Installed thermal - Nuclear (MW)	1,312	1,312	1,312	1,312	1,312	1,312	1,312
Installed renewables - Rooftop PV (MW)	152	228	303	401	518	653	807

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Solar - Base land use assumptions (MW)	552	552	552	552	552	552	552
Installed renewables - Wind - Base land use assumptions (MW)	821	821	821	894	1,121	1,156	1,156
Installed renewables - Wind - Constrained land use assumptions (MW)	6	6	6	6	6	6	6

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	1,454	1,454	1,454	1,454	1,454	1,454	1,454
Wind - Base land use assumptions (GWh)	2,973	2,973	2,973	3,209	3,937	4,045	4,045
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)	0.94		-7.03				-6.29
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.29		-2.32				-2.42
Business-as-usual carbon sink - Total (Mt CO2e/y)	-0.352		-9.35				-8.7

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)							-90.3
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-522
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-1,319
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-112
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,583
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-672
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-583
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-349
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-698
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,927
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-135
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,826
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-2,377
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-163
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,166
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,296

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-874
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,477
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,384
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-13,699
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-180
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,130
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-3,434
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-219
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,749
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,920
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-1,166
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,605
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-21,474
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,070
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							14.7
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							398
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							671
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							40.4
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)							96
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							38.5
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							22.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							415
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,696
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							22.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							411
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							1,211
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							60.8
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)							139
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							57.8
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							164
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							836
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							2,902
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							29.5
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							424
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							1,751
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							80.7
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)							182
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							77.1
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							131
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							686
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							3,362