Net-Zero America - Pennsylvania 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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		69.4	51.1	33.2	30.3	19.2	7.67
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.9	3.3	3.23	3.14	3.14	3.07
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		435	383	319	242	164	94
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		615	453	294	268	170	68
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million $2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		754	692	546	371	230	126

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)		226	181	129	80.9	54.3	40
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		52.1	29.1	28.5	27.7	27.7	27.1
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		3,861	3,403	2,832	2,153	1,456	835

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		375	568	326	211	97.7	657
By economic sector - Construction (jobs)		16,874	17,876	25,137	32,395	39,563	49,956
By economic sector - Manufacturing (jobs)		11,738	12,934	15,397	15,122	13,208	15,880
By economic sector - Mining (jobs)		13,345	9,256	6,636	4,454	2,850	1,740
By economic sector - Other (jobs)		883	1,157	2,917	4,991	7,450	10,794
By economic sector - Pipeline (jobs)		2,600	2,426	1,920	1,378	931	741
By economic sector - Professional (jobs)		8,378	8,290	11,351	15,244	19,237	25,675
By economic sector - Trade (jobs)		6,647	6,077	7,850	10,192	12,977	17,340
By economic sector - Utilities (jobs)		23,130	21,976	25,303	29,754	33,410	39,793
By resource sector - Biomass (jobs)		1,243	1,475	817	568	365	2,835
By resource sector - CO2 (jobs)		0	1,596	1,020	136	246	1,446
By resource sector - Coal (jobs)		5,457	2,203	1,748	1,519	1,367	1,211
By resource sector - Grid (jobs)		17,453	18,532	29,221	40,411	51,903	68,299
By resource sector - Natural Gas (jobs)		34,052	28,380	22,686	19,157	13,137	8,283
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,034
By resource sector - Oil (jobs)		11,169	9,436	7,556	5,500	4,056	2,774
By resource sector - Solar (jobs)		4,732	6,671	18,297	29,417	41,459	57,515
By resource sector - Wind (jobs)		5,437	8,450	11,735	13,335	13,549	17,180
By education level - All sectors - High school diploma or less (jobs)		34,992	33,767	40,914	48,025	54,705	68,697
By education level - All sectors - Associates degree or some college (jobs)		26,243	25,395	30,900	36,617	41,955	52,558
By education level - All sectors - Bachelors degree (jobs)		17,874	16,838	19,633	22,707	25,661	31,979
By education level - All sectors - Masters or professional degree (jobs)		4,288	4,022	4,737	5,594	6,455	8,129
By education level - All sectors - Doctoral degree (jobs)		572	537	652	797	947	1,214
Related work experience - All sectors - None (jobs)		12,012	11,602	13,989	16,507	18,904	23,786
Related work experience - All sectors - Up to 1 year (jobs)		16,102	15,581	19,139	22,673	26,027	32,975
Related work experience - All sectors - 1 to 4 years (jobs)		30,691	29,258	34,921	40,911	46,614	58,301
Related work experience - All sectors - 4 to 10 years (jobs)		19,796	18,985	22,708	26,631	30,306	37,760
Related work experience - All sectors - Over 10 years (jobs)		5,367	5,134	6,079	7,019	7,871	9,755
On-the-Job Training - All sectors - None (jobs)		4,443	4,244	5,148	6,107	7,055	8,918
On-the-Job Training - All sectors - Up to 1 year (jobs)		55,356	52,964	63,357	74,028	84,096	105,614

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)		17,859	17,209	20,771	24,501	27,988	34,841
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,515	5,361	6,608	8,001	9,346	11,671
On-the-Job Training - All sectors - Over 10 years (jobs)		796	781	951	1,104	1,238	1,534
On-Site or In-Plant Training - All sectors - None (jobs)		13,303	12,843	15,532	18,330	20,978	26,406
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		50,422	48,181	57,653	67,395	76,608	96,124
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,808	13,301	16,064	18,933	21,622	26,955
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,736	5,544	6,740	8,072	9,353	11,636
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		701	690	846	1,011	1,162	1,455
Wage income - All (million $2019)		4,838	4,669	5,619	6,664	7,688	9,713

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		181	162	132	104	81	62
Oil consumption - Cumulative (million bbls)							4,048
Oil production - Annual (million bbls)		8.39	8.42	8.41	6.66	5.42	3.6
Natural gas consumption - Annual (tcf)		1,128	951	763	574	361	251
Natural gas consumption - Cumulative (tcf)							22,977
Natural gas production - Annual (tcf)		7,475	7,066	6,154	5,204	4,126	3,205

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.8	12.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	23,592	22,975	23,637	25,286	22,365	20,256
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	4,809
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	1,009	2,921	13,557	31,631	59,894	96,038
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Solar - Constrained land use assumptions (MW)	81.2	3,242	7,508	18,931	35,187	76,526	105,204
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	7,092	46,761	46,761	46,761
Capital invested - Solar PV - Base (billion $2018)		1.23	2.29	11.7	18.8	27.7	33.5
Capital invested - Wind - Base (billion $2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Constrained (billion $2018)		0.076	2.55	12.2	15.2	34.6	27.8
Capital invested - Wind - Constrained (billion $2018)		0	0	15.8	85.7	0	0
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0.031
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)	169	1,829	5,236	23,739	54,746	102,925	164,663
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	72.1	5,753	13,458	33,323	61,312	131,716	180,658
Wind - Constrained land use assumptions (GWh)	6,912	6,912	6,912	27,090	155,738	155,738	155,738
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	30.7

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	1
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	9
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	1
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	0	9,012
Biomass purchases (million $2018/y)		0	0	0	0	0	446

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	6.84	18.6
Annual - BECCS (MMT)		0	0	0	0	0	11.5
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	32.1
Cumulative - BECCS (MMT)		0	0	0	0	0	11.5
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	515	669	669	669	669
Spur (km)		0	107	332	157	241	1,333
All (km)		0	622	1,001	826	909	2,002
Cumulative investment - Trunk (million $2018)		0	1,614	2,529	2,529	2,529	2,529
Cumulative investment - Spur (million $2018)		0	54.5	190	97.7	180	1,010
Cumulative investment - All (million $2018)		0	1,668	2,719	2,627	2,709	3,539

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140

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)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407

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)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086

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)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		66.5	42.4	18.8	8.74	2.84	1.83
Premature deaths from air pollution - Mobile - On-Road (deaths)		477	480	466	418	332	228
Premature deaths from air pollution - Gas Stations (deaths)		27.4	27.5	26.3	23.4	18.5	12.7
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		104	93.8	82.3	67.9	50.8	33.4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		73.2	68.9	64.6	55.7	41.2	25.7
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		13	12.9	12.6	11.6	9.44	6.95

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)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.5	85.6	84	77.5	65.8	51.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.7	22.8	20.2	16.8	13.9	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	6.31	5.59	4.88	4.2	3.56
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.74	3.31	3.25	3.18	3.15	3
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		433	359	272	209	167	121
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		589	376	166	77.4	25.1	16.2
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,245	4,272	4,139	3,715	2,952	2,023
Monetary damages from air pollution - Gas Stations (million $2019)		243	243	233	207	164	112
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		921	831	729	602	450	296
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		649	611	573	493	365	228
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		116	114	112	103	83.6	61.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		757	758	743	686	583	455
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		228	202	179	149	123	98.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		62.5	55.9	49.5	43.2	37.2	31.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		50.7	29.2	28.7	28	27.8	26.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		3,845	3,187	2,412	1,853	1,479	1,071

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		416	480	293	170	79.8	657
By economic sector - Construction (jobs)		16,601	17,749	22,148	27,824	40,742	52,322

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		11,939	13,098	13,614	14,024	15,923	19,817
By economic sector - Mining (jobs)		13,290	9,010	6,363	4,563	3,314	2,194
By economic sector - Other (jobs)		872	1,160	2,495	4,309	7,935	11,063
By economic sector - Pipeline (jobs)		2,598	2,439	1,815	1,291	1,062	1,066
By economic sector - Professional (jobs)		8,260	8,019	10,146	13,426	19,996	27,067
By economic sector - Trade (jobs)		6,584	6,027	7,242	9,254	13,767	18,313
By economic sector - Utilities (jobs)		22,475	21,362	22,127	24,335	31,583	41,185
By resource sector - Biomass (jobs)		1,304	1,213	773	531	340	2,743
By resource sector - CO2 (jobs)		0	2,736	1,748	234	423	2,479
By resource sector - Coal (jobs)		5,359	2,206	1,758	1,535	1,369	1,186
By resource sector - Grid (jobs)		16,280	17,415	24,121	31,833	48,733	69,408
By resource sector - Natural Gas (jobs)		33,811	26,348	19,299	15,554	12,128	8,530
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,584
By resource sector - Oil (jobs)		11,245	9,837	8,619	7,352	6,084	4,223
By resource sector - Solar (jobs)		4,929	6,954	15,269	25,489	45,295	58,542
By resource sector - Wind (jobs)		5,678	8,818	10,898	12,972	16,390	22,989
By education level - All sectors - High school diploma or less (jobs)		34,612	33,303	36,402	41,839	56,722	73,346
By education level - All sectors - Associates degree or some college (jobs)		25,914	25,017	27,379	31,696	43,285	56,033
By education level - All sectors - Bachelors degree (jobs)		17,701	16,561	17,626	20,034	26,723	34,343
By education level - All sectors - Masters or professional degree (jobs)		4,241	3,939	4,247	4,919	6,681	8,670
By education level - All sectors - Doctoral degree (jobs)		567	525	588	709	991	1,292
Related work experience - All sectors - None (jobs)		11,871	11,422	12,435	14,337	19,528	25,341
Related work experience - All sectors - Up to 1 year (jobs)		15,943	15,373	17,036	19,815	27,103	35,232
Related work experience - All sectors - 1 to 4 years (jobs)		30,344	28,800	31,139	35,719	48,269	62,280
Related work experience - All sectors - 4 to 10 years (jobs)		19,564	18,691	20,215	23,187	31,322	40,341
Related work experience - All sectors - Over 10 years (jobs)		5,312	5,058	5,416	6,139	8,178	10,489
On-the-Job Training - All sectors - None (jobs)		4,400	4,186	4,606	5,368	7,360	9,522
On-the-Job Training - All sectors - Up to 1 year (jobs)		54,788	52,170	56,525	64,804	87,420	113,095
On-the-Job Training - All sectors - 1 to 4 years (jobs)		17,630	16,945	18,424	21,203	28,804	37,112
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,426	5,269	5,839	6,850	9,512	12,297
On-the-Job Training - All sectors - Over 10 years (jobs)		790	775	848	972	1,305	1,657
On-Site or In-Plant Training - All sectors - None (jobs)		13,173	12,655	13,839	16,029	21,829	28,253
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		49,888	47,460	51,424	58,949	79,552	102,862
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,635	13,102	14,260	16,411	22,288	28,730
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,649	5,450	5,972	6,940	9,543	12,294
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		691	679	747	867	1,189	1,545
Wage income - All (million $2019)		4,779	4,590	5,005	5,799	7,921	10,355

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Commercial (PJ)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676

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)		5.07	5.09	7.06	7.31	10.1	10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	48.5	306	563	1,755	2,948	5,587	8,226
Vehicle stocks - LDV – All others (1000 units)	10,752	10,752	10,752	10,199	9,646	7,433	5,220
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	333	699	2,363	7,431	10,827
Public EV charging plugs - DC Fast (1000 units)	0.267		1.09		5.72		16
Public EV charging plugs - L2 (1000 units)	1.32		26.2		137		383

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 (%)	8.42	13.6	18	31.2	54.5	74.9	84.5
Sales of space heating units - Electric Resistance (%)	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of water heating units - Electric Heat Pump (%)	0	0.823	3.14	10.1	22.7	34.2	39.8
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Sales of water heating units - Gas Furnace (%)	58.8	42.8	40.8	34.6	22.4	10	3.56
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247
Sales of cooking units - Electric Resistance (%)	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.8	13				

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 (%)	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Sales of space heating units - Electric Resistance (%)	5.59	3.46	4.4	7.36	12.7	16.8	19
Sales of space heating units - Gas (%)	72.4	71.6	67.9	58.1	38.6	18.3	7.04
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of water heating units - Electric Heat Pump (%)	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Sales of water heating units - Electric Resistance (%)	3.49	2.59	4.34	9.88	21.2	33.5	40.1
Sales of water heating units - Gas (%)	94.2	94.7	90.2	76.4	49.4	22.1	7.82
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		59,150	64,632				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	22,806	22,038	21,553	17,222	12,762	12,729
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	7,685

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3

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)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059

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)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		61.8	43.8	26.3	18.8	6.67	1.29
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75

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)		6.31	3.3	3.23	3.14	3.14	2.91
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		423	374	287	198	104	6.12
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		548	388	233	167	59.1	11.4
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million $2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		754	692	546	371	230	126
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		226	181	129	80.9	54.3	40
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		55.7	29.1	28.5	27.7	27.7	25.7
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		3,754	3,318	2,552	1,755	920	54.4

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		376	579	326	190	89.1	652
By economic sector - Construction (jobs)		17,934	19,857	37,826	57,985	63,143	58,422
By economic sector - Manufacturing (jobs)		12,429	14,901	20,181	22,411	26,387	28,743
By economic sector - Mining (jobs)		13,268	9,064	6,129	3,836	2,148	684
By economic sector - Other (jobs)		1,145	1,727	5,983	11,238	12,900	11,506
By economic sector - Pipeline (jobs)		2,520	2,150	1,559	1,053	567	116
By economic sector - Professional (jobs)		8,764	9,425	16,896	26,623	30,762	31,568
By economic sector - Trade (jobs)		6,913	6,751	11,498	17,910	20,562	20,144
By economic sector - Utilities (jobs)		22,928	21,987	28,872	40,117	47,027	49,633
By resource sector - Biomass (jobs)		1,172	1,530	792	529	339	2,900
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		5,710	2,203	1,746	1,517	1,366	1,155
By resource sector - Grid (jobs)		17,762	20,578	39,819	65,769	85,665	96,683

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		32,838	27,453	19,833	15,472	9,104	3,956
By resource sector - Nuclear (jobs)		4,428	3,817	3,179	2,314	1,564	313
By resource sector - Oil (jobs)		11,171	9,376	7,362	5,055	3,111	228
By resource sector - Solar (jobs)		7,119	11,832	40,708	70,840	76,469	59,648
By resource sector - Wind (jobs)		6,077	9,651	15,833	19,867	25,967	36,585
By education level - All sectors - High school diploma or less (jobs)		36,094	36,337	55,057	77,238	86,388	85,105
By education level - All sectors - Associates degree or some college (jobs)		26,965	27,224	41,382	58,640	66,078	65,391
By education level - All sectors - Bachelors degree (jobs)		18,254	17,990	25,683	35,374	39,720	39,573
By education level - All sectors - Masters or professional degree (jobs)		4,376	4,302	6,250	8,804	9,938	9,951
By education level - All sectors - Doctoral degree (jobs)		589	586	899	1,307	1,462	1,448
Related work experience - All sectors - None (jobs)		12,332	12,419	18,693	26,403	29,659	29,328
Related work experience - All sectors - Up to 1 year (jobs)		16,672	16,928	26,157	36,980	41,468	40,955
Related work experience - All sectors - 1 to 4 years (jobs)		31,487	31,312	46,342	64,855	72,828	72,106
Related work experience - All sectors - 4 to 10 years (jobs)		20,287	20,283	30,092	42,148	47,295	46,809
Related work experience - All sectors - Over 10 years (jobs)		5,500	5,497	7,988	10,977	12,335	12,270
On-the-Job Training - All sectors - None (jobs)		4,579	4,594	7,008	9,932	11,100	10,862
On-the-Job Training - All sectors - Up to 1 year (jobs)		56,896	56,943	84,425	117,702	132,329	131,505
On-the-Job Training - All sectors - 1 to 4 years (jobs)		18,321	18,364	27,631	38,980	43,722	43,105
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,657	5,690	8,911	12,957	14,457	14,085
On-the-Job Training - All sectors - Over 10 years (jobs)		825	849	1,298	1,792	1,977	1,911
On-Site or In-Plant Training - All sectors - None (jobs)		13,696	13,860	20,956	29,511	33,094	32,689
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		51,816	51,754	76,778	107,127	120,410	119,541
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		14,176	14,217	21,405	30,166	33,845	33,373
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,872	5,873	9,004	12,943	14,413	14,053
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		718	735	1,129	1,615	1,823	1,812
Wage income - All (million $2019)		4,951	4,974	7,399	10,480	11,917	11,983

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.8	12.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	22,762	23,238	23,160	24,310	19,850	22,186

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	4,809	4,809	1,138	0
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	2,489	6,985	34,263	80,226	118,350	140,419
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	27,886	76,561
Installed renewables - Solar - Constrained land use assumptions (MW)	86.8	3,346	10,981	51,933	93,527	111,556	142,851
Installed renewables - Wind - Constrained land use assumptions (MW)	1,818	1,818	1,818	39,748	61,513	61,513	61,513
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		3.22	5.38	30.1	47.8	37.4	20.4
Capital invested - Wind - Base (billion $2018)		0	0	0	0	53	92.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	4,440	12,355	59,174	137,449	201,306	240,508
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	99,062	239,521
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	338	12,023	38,750	179,024	319,962	379,989	490,835
Wind - Constrained land use assumptions (GWh)	13,823	13,823	13,823	269,647	386,096	386,096	386,096
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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074

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)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		70.1	54.5	64.6	49.2	18.8	5.84
Premature deaths from air pollution - Mobile - On-Road (deaths)		469	435	329	190	86.4	33.7
Premature deaths from air pollution - Gas Stations (deaths)		26.8	24.4	18.2	10.6	5.04	2.26

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)		103	85.9	58.7	32.6	15.3	5.79
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		72	57.8	38.9	22.1	9.33	2.54
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.9	11.7	9.18	6.29	3.68	2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.2	78.2	61.7	41.9	25.9	14.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.5	20.5	14.5	9.14	6.13	4.52
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	5.89	4.76	3.69	2.68	1.75
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.5	3.3	3.23	3.14	3.14	2.91
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		443	411	391	341	283	211
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		621	483	573	436	166	51.7
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,170	3,868	2,927	1,689	768	300
Monetary damages from air pollution - Gas Stations (million $2019)		238	216	161	94.1	44.6	20
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		915	762	520	289	136	51.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		638	512	345	196	82.7	22.5
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		114	103	81.3	55.7	32.6	17.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		754	692	546	371	230	126
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		226	181	129	80.9	54.3	40
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		62.5	52.1	42.2	32.7	23.8	15.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		48.5	29.1	28.5	27.7	27.7	25.7

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)		3,937	3,648	3,469	3,027	2,510	1,870

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		402	494	284	183	92.8	661
By economic sector - Construction (jobs)		15,517	16,316	17,831	18,952	19,004	20,450
By economic sector - Manufacturing (jobs)		10,485	9,121	8,597	9,468	8,508	7,756
By economic sector - Mining (jobs)		13,413	9,710	7,599	5,568	3,985	2,696
By economic sector - Other (jobs)		658	761	986	1,273	1,425	1,758
By economic sector - Pipeline (jobs)		2,677	2,785	2,486	2,013	1,689	1,615
By economic sector - Professional (jobs)		7,665	6,966	8,264	10,491	10,580	11,523
By economic sector - Trade (jobs)		6,238	5,448	5,711	6,285	6,197	6,492
By economic sector - Utilities (jobs)		21,875	21,230	28,390	38,841	39,360	39,296
By resource sector - Biomass (jobs)		1,189	1,213	754	545	368	2,777
By resource sector - CO2 (jobs)		0	3,092	1,975	264	477	2,801
By resource sector - Coal (jobs)		5,207	2,201	1,747	1,518	1,367	1,155
By resource sector - Grid (jobs)		15,131	14,688	21,560	26,225	28,976	31,622
By resource sector - Natural Gas (jobs)		34,264	30,271	27,967	26,308	22,026	18,873
By resource sector - Nuclear (jobs)		4,428	3,817	10,488	22,379	22,780	20,394
By resource sector - Oil (jobs)		11,167	9,436	7,556	5,500	4,151	3,141
By resource sector - Solar (jobs)		3,042	3,581	3,795	4,445	4,601	5,665
By resource sector - Wind (jobs)		4,502	4,533	4,302	5,890	6,093	5,818
By education level - All sectors - High school diploma or less (jobs)		32,812	30,437	33,043	37,532	36,596	37,535
By education level - All sectors - Associates degree or some college (jobs)		24,603	22,985	25,267	29,052	28,441	28,963
By education level - All sectors - Bachelors degree (jobs)		16,915	15,269	17,093	20,622	20,059	19,981
By education level - All sectors - Masters or professional degree (jobs)		4,060	3,658	4,180	5,151	5,042	5,055
By education level - All sectors - Doctoral degree (jobs)		541	483	563	717	704	712
Related work experience - All sectors - None (jobs)		11,289	10,537	11,521	13,194	12,883	13,203
Related work experience - All sectors - Up to 1 year (jobs)		15,044	13,848	15,195	17,635	17,231	17,702
Related work experience - All sectors - 1 to 4 years (jobs)		28,902	26,548	29,222	33,977	33,146	33,539
Related work experience - All sectors - 4 to 10 years (jobs)		18,640	17,271	19,067	22,187	21,661	21,893
Related work experience - All sectors - Over 10 years (jobs)		5,056	4,628	5,141	6,080	5,921	5,908
On-the-Job Training - All sectors - None (jobs)		4,177	3,817	4,260	5,091	4,971	5,022
On-the-Job Training - All sectors - Up to 1 year (jobs)		52,026	47,602	52,316	61,017	59,453	60,314
On-the-Job Training - All sectors - 1 to 4 years (jobs)		16,794	15,717	17,308	19,902	19,474	19,764
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,188	5,002	5,503	6,176	6,082	6,286
On-the-Job Training - All sectors - Over 10 years (jobs)		745	694	759	888	861	859
On-Site or In-Plant Training - All sectors - None (jobs)		12,489	11,522	12,749	15,045	14,687	14,902
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		47,397	43,388	47,705	55,561	54,157	54,920

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)		12,978	12,115	13,316	15,290	14,953	15,184
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,409	5,176	5,688	6,412	6,292	6,461
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		657	631	688	766	752	779
Wage income - All (million $2019)		4,563	4,266	4,792	5,681	5,637	5,789

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	765	673	560	457	393	364
Final energy use - Residential (PJ)	467	427	389	337	289	255	236
Final energy use - Commercial (PJ)	388	381	368	346	323	310	307
Final energy use - Industry (PJ)	791	783	767	757	724	706	669

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)		6.13	6.27	11.6	12.4	12.4	13.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	62.6	938	1,814	4,879	7,944	10,393	12,843
Vehicle stocks - LDV – All others (1000 units)	10,709	10,197	9,685	7,058	4,431	2,507	583
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		2,057	5,276	8,545	12,946	14,088	13,433
Public EV charging plugs - DC Fast (1000 units)	0.267		3.52		15.4		24.9
Public EV charging plugs - L2 (1000 units)	1.32		84.6		370		599

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 (%)	8.42	19.7	58.8	85.6	89.5	89.7	89.7
Sales of space heating units - Electric Resistance (%)	9.49	11.8	7.94	3.83	3.14	3.17	3.29
Sales of space heating units - Gas (%)	57.9	37.3	20.7	3.68	0.918	0.75	0.749
Sales of space heating units - Fossil (%)	24.2	31.3	12.5	6.86	6.43	6.34	6.23
Sales of water heating units - Electric Heat Pump (%)	0	3.85	24.2	40.2	42.6	42.8	42.8
Sales of water heating units - Electric Resistance (%)	35.5	52.4	52.4	56.3	57.1	57.1	57.1
Sales of water heating units - Gas Furnace (%)	58.8	40.5	22.7	3.36	0.193	0	0
Sales of water heating units - Other (%)	5.73	3.25	0.692	0.122	0.097	0.097	0.098
Sales of cooking units - Electric Resistance (%)	55.4	64.9	94	99.7	100	100	100
Sales of cooking units - Gas (%)	44.6	35.1	6.01	0.303	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.8	12.5				

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Heat Pump (%)	2.56	11.7	42	73.7	78.6	79.2	79.1
Sales of space heating units - Electric Resistance (%)	5.59	4.8	13.3	19	20.2	19.9	20
Sales of space heating units - Gas (%)	72.4	68.7	41.8	7.14	1.21	0.873	0.87
Sales of space heating units - Fossil (%)	19.4	14.8	2.91	0.126	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.624	4.78	29.6	52.2	55.8	56	56
Sales of water heating units - Electric Resistance (%)	3.49	4.26	19.8	40.2	43.6	43.8	43.8
Sales of water heating units - Gas (%)	94.2	89.8	50.2	7.42	0.426	0	0
Sales of water heating units - Other (%)	1.74	1.19	0.379	0.186	0.177	0.178	0.178
Sales of cooking units - Electric Resistance (%)	18.5	33.7	75.3	83.5	83.9	84	84
Sales of cooking units - Gas (%)	81.5	66.3	24.7	16.5	16.1	16	16
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		59,163	64,630				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	19,310	18,308	20,406	21,739	21,604	20,797
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	10,513	17,904	24,102	28,132
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202
Installed renewables - Solar - Base land use assumptions (MW)	86.8	86.8	750	1,374	2,556	3,690	3,690
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Solar - Constrained land use assumptions (MW)	86.8	645	2,606	3,895	5,558	10,250	10,962
Installed renewables - Wind - Constrained land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		0	0.794	0.689	1.23	1.11	0
Capital invested - Wind - Base (billion $2018)		0	0	0	0	0	0
Capital invested - Solar PV - Constrained (billion $2018)		0.746	2.35	1.42	1.73	4.6	0.659
Capital invested - Wind - Constrained (billion $2018)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	169	1,359	2,465	4,576	6,564	6,564
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	169	1,166	4,672	6,963	9,894	18,163	19,405
Wind - Constrained land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875

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)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-304
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,086
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-47.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-1,437
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-304
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-2,059
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-95.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-2,458
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							139
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							829
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							86.6
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,055

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)							139
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							1,571
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							173
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							1,884

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)		268	0.183	0.181	0.166	0.113	0.009
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		67.6	40.3	23.3	18.1	10.4	2.85
Premature deaths from air pollution - Mobile - On-Road (deaths)		477	480	466	418	332	228
Premature deaths from air pollution - Gas Stations (deaths)		27.4	27.5	26.3	23.4	18.5	12.7
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		104	93.8	82.3	67.9	50.8	33.4
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		73.2	68.9	64.6	55.7	41.2	25.7
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		13	12.9	12.6	11.6	9.44	6.95
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		6.9	6.53	6.17	5.81	5.46	5.09
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		85.5	85.6	84	77.5	65.8	51.4
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.7	22.8	20.2	16.8	13.9	11.2
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.06	6.31	5.59	4.88	4.2	3.56
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		5.88	3.31	3.25	3.18	3.18	3.09
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		433	359	272	209	167	121
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		2,377	1.62	1.61	1.47	1.01	0.081
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		599	357	206	160	92.3	25.3
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,245	4,272	4,139	3,715	2,952	2,023
Monetary damages from air pollution - Gas Stations (million $2019)		243	243	233	207	164	112

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)		921	831	729	602	450	296
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		649	611	573	493	365	228
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		116	114	112	103	83.6	61.6
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		61.1	57.8	54.7	51.4	48.4	45.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		757	758	743	686	583	455
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		228	202	179	149	123	98.8
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		62.5	55.9	49.5	43.2	37.2	31.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		51.9	29.2	28.7	28.1	28.1	27.3
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		3,845	3,187	2,412	1,853	1,479	1,071

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		396	480	290	179	81.9	1,080
By economic sector - Construction (jobs)		16,662	17,912	21,396	23,748	31,642	46,114
By economic sector - Manufacturing (jobs)		12,067	13,255	12,501	10,264	11,584	16,295
By economic sector - Mining (jobs)		13,264	8,986	6,433	4,675	3,326	2,139
By economic sector - Other (jobs)		881	1,169	2,279	3,331	5,574	9,820
By economic sector - Pipeline (jobs)		2,570	2,440	1,853	1,336	1,054	1,035
By economic sector - Professional (jobs)		8,325	8,108	9,788	11,425	15,429	24,363
By economic sector - Trade (jobs)		6,621	6,066	7,007	7,968	10,620	16,248
By economic sector - Utilities (jobs)		22,659	21,636	22,187	22,760	27,931	36,325
By resource sector - Biomass (jobs)		1,269	1,214	773	568	373	5,124
By resource sector - CO2 (jobs)		0	2,808	1,794	240	434	2,544
By resource sector - Coal (jobs)		5,445	2,206	1,758	1,536	1,382	1,219
By resource sector - Grid (jobs)		16,688	17,869	23,886	28,360	40,902	59,710
By resource sector - Natural Gas (jobs)		33,630	26,334	19,817	16,183	12,809	8,627
By resource sector - Nuclear (jobs)		4,428	3,817	3,757	3,698	3,640	3,297
By resource sector - Oil (jobs)		11,246	9,837	8,619	7,510	6,113	4,084
By resource sector - Solar (jobs)		4,877	6,878	13,350	18,643	30,374	52,965
By resource sector - Wind (jobs)		5,862	9,090	9,980	8,949	11,216	15,849
By education level - All sectors - High school diploma or less (jobs)		34,787	33,600	35,294	36,034	45,165	64,913
By education level - All sectors - Associates degree or some college (jobs)		26,053	25,253	26,585	27,332	34,503	49,269
By education level - All sectors - Bachelors degree (jobs)		17,777	16,699	17,145	17,413	21,437	30,379
By education level - All sectors - Masters or professional degree (jobs)		4,259	3,972	4,140	4,294	5,357	7,699
By education level - All sectors - Doctoral degree (jobs)		569	529	571	615	780	1,159

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - None (jobs)		11,928	11,525	12,085	12,405	15,594	22,430
Related work experience - All sectors - Up to 1 year (jobs)		16,028	15,511	16,464	16,929	21,393	31,227
Related work experience - All sectors - 1 to 4 years (jobs)		30,493	29,053	30,270	30,955	38,627	54,997
Related work experience - All sectors - 4 to 10 years (jobs)		19,658	18,859	19,660	20,101	25,081	35,550
Related work experience - All sectors - Over 10 years (jobs)		5,338	5,103	5,257	5,298	6,546	9,215
On-the-Job Training - All sectors - None (jobs)		4,420	4,221	4,461	4,613	5,817	8,441
On-the-Job Training - All sectors - Up to 1 year (jobs)		55,063	52,631	54,824	55,867	69,689	100,040
On-the-Job Training - All sectors - 1 to 4 years (jobs)		17,717	17,100	17,927	18,388	23,074	32,637
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,451	5,318	5,707	5,996	7,638	10,849
On-the-Job Training - All sectors - Over 10 years (jobs)		794	781	817	823	1,023	1,453
On-Site or In-Plant Training - All sectors - None (jobs)		13,235	12,767	13,404	13,760	17,294	24,962
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		50,140	47,879	49,899	50,873	63,475	90,960
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		13,703	13,221	13,866	14,216	17,837	25,282
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,673	5,499	5,839	6,086	7,682	10,856
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		694	685	727	752	953	1,361
Wage income - All (million $2019)		4,802	4,630	4,877	5,054	6,374	9,153

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	817	772	705	650	607	555	495
Final energy use - Residential (PJ)	467	428	403	379	349	315	281
Final energy use - Commercial (PJ)	388	381	378	375	368	359	349
Final energy use - Industry (PJ)	791	783	769	764	735	716	676

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)		5.07	5.09	7.06	7.31	10.1	10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	48.5	306	563	1,755	2,948	5,587	8,226
Vehicle stocks - LDV – All others (1000 units)	10,752	10,752	10,752	10,199	9,646	7,433	5,220
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	333	699	2,363	7,431	10,827
Public EV charging plugs - DC Fast (1000 units)	0.267		1.09		5.72		16
Public EV charging plugs - L2 (1000 units)	1.32		26.2		137		383

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 (%)	8.42	13.6	18	31.2	54.5	74.9	84.5
Sales of space heating units - Electric Resistance (%)	9.49	12.2	11.8	10.4	7.78	5.17	3.89
Sales of space heating units - Gas (%)	57.9	39.4	37.5	31.8	20.7	9.65	3.89
Sales of space heating units - Fossil (%)	24.2	34.8	32.7	26.6	17	10.3	7.7
Sales of water heating units - Electric Heat Pump (%)	0	0.823	3.14	10.1	22.7	34.2	39.8
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.6	53.5	55.2	56.4
Sales of water heating units - Gas Furnace (%)	58.8	42.8	40.8	34.6	22.4	10	3.56
Sales of water heating units - Other (%)	5.73	3.74	3.46	2.63	1.37	0.535	0.247
Sales of cooking units - Electric Resistance (%)	55.2	56.3	60.5	71.3	86.3	95.6	98.8
Sales of cooking units - Gas (%)	44.8	43.7	39.5	28.7	13.7	4.42	1.19
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.8	13				

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 (%)	2.56	7.82	11.2	21.8	42.1	62.6	73.2
Sales of space heating units - Electric Resistance (%)	5.59	3.46	4.4	7.36	12.7	16.8	19
Sales of space heating units - Gas (%)	72.4	71.6	67.9	58.1	38.6	18.3	7.04
Sales of space heating units - Fossil (%)	19.4	17.2	16.4	12.8	6.63	2.21	0.78
Sales of water heating units - Electric Heat Pump (%)	0.624	1.34	4.16	12.7	28.8	44.1	51.9
Sales of water heating units - Electric Resistance (%)	3.49	2.59	4.34	9.88	21.2	33.5	40.1
Sales of water heating units - Gas (%)	94.2	94.7	90.2	76.4	49.4	22.1	7.82
Sales of water heating units - Other (%)	1.74	1.35	1.32	1.03	0.608	0.33	0.23
Sales of cooking units - Electric Resistance (%)	18.5	21.6	27.5	43	64.5	77.7	82.3
Sales of cooking units - Gas (%)	81.5	78.4	72.5	57	35.5	22.3	17.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		59,150	64,632				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	1,428	0	0	0	0	0
Installed thermal - Natural gas (MW)	18,464	23,686	22,962	22,478	18,448	17,482	17,148
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	7,685	7,685	7,685	6,186
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0

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

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

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	0
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	15
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	0	14,912
Biomass purchases (million $2018/y)		0	0	0	0	0	1,316

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	3.35	3.32	6.84	7.07
Annual - BECCS (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	3.35	3.32	6.84	7.07
Cumulative - All (MMT)		0	0	3.35	6.67	13.5	20.6
Cumulative - BECCS (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	3.35	6.67	13.5	20.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	515	669	669	669	669
Spur (km)		0	107	157	157	416	241
All (km)		0	622	826	826	1,084	909
Cumulative investment - Trunk (million $2018)		0	1,614	2,529	2,529	2,938	2,938
Cumulative investment - Spur (million $2018)		0	54.5	97.9	97.7	272	183
Cumulative investment - All (million $2018)		0	1,668	2,627	2,627	3,210	3,121

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875

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)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626

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)							-627
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-1,009
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-44.1
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)							-1,680
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-627
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-1,912
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-88.1
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)							-2,627

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)							253
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							768
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							80.2
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							14.8
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							58.1
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,174
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							253
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							3,594
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							160
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							14.8
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							58.1
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							4,080

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)		702	443	413	400	392	356
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		51.1	56.6	72.5	74	73	66.4
Premature deaths from air pollution - Mobile - On-Road (deaths)		476	486	495	507	520	533
Premature deaths from air pollution - Gas Stations (deaths)		27.3	27.7	28	28.5	29	29.4
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		103	95.8	91.8	90.7	90.6	89.7
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		71.1	59.9	43.4	28.4	17	10.4
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		12.7	12.6	12.7	12.9	13	13
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		7.21	7.14	7.09	7.02	6.96	6.86

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)		86.2	87.6	85.2	82.2	83.1	87.8
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		25.9	22.9	19.3	15	12.4	11
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		7.38	7.49	7.6	7.69	7.77	7.85
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		10.6	7.74	6.5	6.16	5.96	5.61
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		437	466	476	446	444	426
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		6,223	3,926	3,660	3,543	3,470	3,154
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		453	501	643	656	647	588
Monetary damages from air pollution - Mobile - On-Road (million $2019)		4,236	4,322	4,405	4,511	4,620	4,736
Monetary damages from air pollution - Gas Stations (million $2019)		242	245	248	252	256	260
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		914	849	813	803	803	795
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		630	530	385	252	150	92.1
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		113	112	113	114	115	115
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		63.8	63.3	62.8	62.1	61.6	60.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		764	776	755	728	735	778
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		229	202	171	133	109	97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		65.3	66.3	67.2	68	68.8	69.5
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		93.6	68.3	57.4	54.3	52.6	49.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		3,880	4,135	4,229	3,964	3,942	3,786

Table 65: *REF scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		386	365	363	330	330	342
By economic sector - Construction (jobs)		14,549	15,789	16,881	17,646	18,526	19,317
By economic sector - Manufacturing (jobs)		7,296	7,916	8,261	8,951	8,400	8,098
By economic sector - Mining (jobs)		15,415	12,331	10,150	8,138	6,842	5,571

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		457	634	732	879	974	1,320
By economic sector - Pipeline (jobs)		2,661	2,837	2,909	2,733	2,754	2,709
By economic sector - Professional (jobs)		7,649	7,219	7,181	7,464	7,661	7,805
By economic sector - Trade (jobs)		6,643	6,048	5,836	5,845	5,892	5,993
By economic sector - Utilities (jobs)		22,497	21,719	22,415	22,966	23,804	23,026
By resource sector - Biomass (jobs)		1,203	1,142	1,080	1,000	1,005	1,007
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		8,770	5,163	3,825	3,292	2,911	2,270
By resource sector - Grid (jobs)		16,047	15,115	16,892	18,906	20,429	21,055
By resource sector - Natural Gas (jobs)		34,463	35,595	35,901	34,675	34,389	31,807
By resource sector - Nuclear (jobs)		4,428	3,817	3,179	2,314	2,278	2,243
By resource sector - Oil (jobs)		11,327	10,030	9,039	8,351	7,863	7,308
By resource sector - Solar (jobs)			1,943	2,444	2,551	2,713	4,929
By resource sector - Wind (jobs)		1,315	2,055	2,367	3,862	3,596	3,564
By education level - All sectors - High school diploma or less (jobs)		32,507	31,362	31,386	31,555	31,703	31,414
By education level - All sectors - Associates degree or some college (jobs)		24,034	23,469	23,677	23,967	24,165	23,892
By education level - All sectors - Bachelors degree (jobs)		16,486	15,737	15,467	15,291	15,192	14,835
By education level - All sectors - Masters or professional degree (jobs)		3,994	3,789	3,711	3,661	3,648	3,571
By education level - All sectors - Doctoral degree (jobs)		532	502	486	477	475	470
Related work experience - All sectors - None (jobs)		11,065	10,775	10,837	10,925	11,006	10,891
Related work experience - All sectors - Up to 1 year (jobs)		14,801	14,213	14,148	14,209	14,233	14,134
Related work experience - All sectors - 1 to 4 years (jobs)		28,574	27,442	27,312	27,322	27,376	26,951
Related work experience - All sectors - 4 to 10 years (jobs)		18,219	17,693	17,717	17,788	17,870	17,597
Related work experience - All sectors - Over 10 years (jobs)		4,893	4,735	4,713	4,707	4,698	4,608
On-the-Job Training - All sectors - None (jobs)		4,064	3,909	3,862	3,839	3,831	3,792
On-the-Job Training - All sectors - Up to 1 year (jobs)		51,165	49,061	48,737	48,759	48,742	48,016
On-the-Job Training - All sectors - 1 to 4 years (jobs)		16,482	16,088	16,210	16,344	16,485	16,278
On-the-Job Training - All sectors - 4 to 10 years (jobs)		5,145	5,108	5,224	5,313	5,430	5,407
On-the-Job Training - All sectors - Over 10 years (jobs)		697	692	694	697	695	689
On-Site or In-Plant Training - All sectors - None (jobs)		12,072	11,714	11,682	11,710	11,723	11,584
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		46,740	44,792	44,502	44,516	44,522	43,861
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		12,750	12,418	12,495	12,593	12,690	12,535
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		5,354	5,297	5,393	5,460	5,562	5,520
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		637	637	656	673	686	682
Wage income - All (million $2019)		4,510	4,404	4,452	4,512	4,592	4,578

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	816	774	716	682	684	705	733

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	467	430	411	398	391	386	383
Final energy use - Commercial (PJ)	388	385	387	386	389	402	426
Final energy use - Industry (PJ)	792	798	821	830	852	875	887

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)		5.28	5.32	8.01	8.36	9.84	10.3

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 (%)	6.94	20.6	21.2	22	22.5	23	23.7
Sales of space heating units - Electric Resistance (%)	9.71	11.3	11.1	10.9	10.7	10.1	9.42
Sales of space heating units - Gas (%)	58.8	38.5	50	56.9	57	57	57.1
Sales of space heating units - Fossil (%)	24.6	29.7	17.7	10.2	9.79	9.79	9.79
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	35.5	52.7	52.6	52.5	52.4	52.4	52.3
Sales of water heating units - Gas Furnace (%)	58.8	43.5	43.6	43.7	43.7	43.8	43.9
Sales of water heating units - Other (%)	5.73	3.84	3.85	3.85	3.86	3.86	3.87
Sales of cooking units - Electric Resistance (%)	54.8	54.8	54.8	54.8	54.8	54.8	54.8
Sales of cooking units - Gas (%)	45.2	45.2	45.2	45.2	45.2	45.2	45.2
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		10.4	10.9				

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 (%)	2.56	12.8	39.8	61.7	65	65.6	65.5
Sales of space heating units - Electric Resistance (%)	5.59	4.04	8.87	21.3	31.9	33.3	33.6
Sales of space heating units - Gas (%)	72.4	66.4	38.4	11.1	2.19	0.955	0.868
Sales of space heating units - Fossil (%)	19.4	16.7	13	5.8	0.885	0.071	0
Sales of water heating units - Electric Heat Pump (%)	0.624	0.33	0.331	0.332	0.331	0.334	0.334
Sales of water heating units - Electric Resistance (%)	3.49	1.96	1.94	1.95	1.94	1.94	1.94
Sales of water heating units - Gas (%)	94.2	96.3	96.3	96.3	96.3	96.2	96.2
Sales of water heating units - Other (%)	1.74	1.38	1.45	1.44	1.45	1.49	1.49
Sales of cooking units - Electric Resistance (%)	18.5	19.4	19.4	19.6	19.7	19.8	19.9
Sales of cooking units - Gas (%)	81.5	80.6	80.6	80.4	80.3	80.2	80.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		58,459	60,226				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	8,722	3,013	1,428	1,428	1,428	1,428	0
Installed thermal - Natural gas (MW)	18,464	21,955	21,187	23,058	25,826	27,916	29,146
Installed thermal - Nuclear (MW)	9,532	7,685	7,685	4,809	4,809	4,809	4,809
Installed renewables - Rooftop PV (MW)	415	623	828	1,094	1,416	1,782	2,202

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)	86.8	86.8	86.8	86.8	86.8	86.8	86.8
Installed renewables - Wind - Base land use assumptions (MW)	1,619	1,619	1,619	1,619	1,619	1,619	1,619

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	169	169	169	169	169	169	169
Wind - Base land use assumptions (GWh)	6,912	6,912	6,912	6,912	6,912	6,912	6,912
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)	-32.9		-14.7				-13.1
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.61		-2.91				-3.02
Business-as-usual carbon sink - Total (Mt CO2e/y)	-34.5		-17.6				-16.2

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)							-146
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-517
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-3,371
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-224
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,978
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-392
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-93.2
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-312
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-1,306
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-8,341
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-218
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-1,811
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-6,074
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-328
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-3,957
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-757
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-140

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,217
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-2,591
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-18,092
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-291
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-3,104
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-8,777
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-440
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-5,935
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-1,121
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-186
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,122
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-27,852
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-3,875
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							23.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							395
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,715
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							81
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)							56.1
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							6.16
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							20.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							777
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							3,074
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							35.7
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							407

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							3,095
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							122
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)							81.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							9.24
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,565
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							5,463
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							47.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							420
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							4,476
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							162
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)							107
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							12.3
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							117
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							1,285
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							6,626