Net-Zero America - West Virginia 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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Contents

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)		49.9	0.05	0.05	0.046	0.033	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.77	4.84	2.81	2.2	1.21	0.446
Premature deaths from air pollution - Mobile - On-Road (deaths)		39.8	35.2	25.4	13.9	6.04	2.28
Premature deaths from air pollution - Gas Stations (deaths)		4.21	3.67	2.63	1.48	0.682	0.306
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		6.5	5.18	3.41	1.83	0.833	0.311
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.01	1.55	1	0.548	0.227	0.071
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.22	1.06	0.795	0.509	0.268	0.125
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.16	1.05	0.946	0.846	0.755	0.667
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		8.23	6.89	4.87	2.89	1.58	0.845
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.04	0.803	0.569	0.369	0.236	0.148
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.392	0.313	0.243	0.18	0.125	0.078
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		9.94	5.88	5.51	5.12	4.88	4.55
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		119	101	81.3	59.4	38.8	21.5
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		442	0.447	0.442	0.404	0.296	0.027
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		60	42.9	24.9	19.5	10.8	3.95
Monetary damages from air pollution - Mobile - On-Road (million $2019)		354	313	226	124	53.7	20.3
Monetary damages from air pollution - Gas Stations (million $2019)		37.3	32.5	23.3	13.1	6.04	2.71
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		57.6	45.9	30.2	16.2	7.38	2.76
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		17.8	13.7	8.88	4.85	2.01	0.626
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.8	9.42	7.05	4.51	2.38	1.11
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.3	9.3	8.38	7.49	6.68	5.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		72.8	61	43.1	25.6	14	7.48

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)		9.17	7.11	5.04	3.26	2.09	1.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.47	2.77	2.15	1.59	1.11	0.691
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		87.7	51.9	48.6	45.2	43.1	40.1
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,053	896	722	527	345	191

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	195
By economic sector - Construction (jobs)		3,321	3,415	5,493	8,369	9,062	9,914
By economic sector - Manufacturing (jobs)		5,890	6,329	7,587	7,259	6,011	6,897
By economic sector - Mining (jobs)		9,227	6,030	4,762	3,441	2,534	1,768
By economic sector - Other (jobs)		128	158	603	1,317	1,721	1,904
By economic sector - Pipeline (jobs)		576	498	405	305	202	170
By economic sector - Professional (jobs)		2,983	2,574	3,540	4,951	5,477	6,388
By economic sector - Trade (jobs)		3,192	2,410	2,830	3,567	3,872	4,229
By economic sector - Utilities (jobs)		4,014	3,142	4,110	5,804	5,854	7,330
By resource sector - Biomass (jobs)		0	0	0	0	0	835
By resource sector - CO2 (jobs)		0	0	0	0	0	414
By resource sector - Coal (jobs)		9,540	4,431	3,660	3,187	2,872	2,545
By resource sector - Grid (jobs)		2,090	2,376	5,190	9,051	10,168	13,343
By resource sector - Natural Gas (jobs)		7,105	5,936	4,650	3,639	2,141	1,247
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,960	6,170	5,397	3,868	2,839	1,735
By resource sector - Solar (jobs)		901	1,155	4,256	8,169	9,900	9,995
By resource sector - Wind (jobs)		2,733	4,488	6,176	7,098	6,814	8,680
By education level - All sectors - High school diploma or less (jobs)		12,828	10,517	12,551	14,930	14,744	16,211
By education level - All sectors - Associates degree or some college (jobs)		8,713	7,375	9,002	10,986	10,974	12,284
By education level - All sectors - Bachelors degree (jobs)		6,159	5,278	6,139	7,127	7,022	7,798
By education level - All sectors - Masters or professional degree (jobs)		1,435	1,220	1,435	1,717	1,731	1,939
By education level - All sectors - Doctoral degree (jobs)		194	166	201	251	262	294
Related work experience - All sectors - None (jobs)		3,977	3,355	4,063	4,935	4,928	5,485
Related work experience - All sectors - Up to 1 year (jobs)		5,963	4,915	5,939	7,129	7,095	7,840
Related work experience - All sectors - 1 to 4 years (jobs)		10,959	9,092	10,731	12,701	12,574	13,911
Related work experience - All sectors - 4 to 10 years (jobs)		6,590	5,608	6,722	8,063	8,005	8,916
Related work experience - All sectors - Over 10 years (jobs)		1,841	1,586	1,875	2,184	2,133	2,374
On-the-Job Training - All sectors - None (jobs)		1,506	1,277	1,542	1,867	1,877	2,075
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,106	16,755	19,818	23,316	23,003	25,477

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)		5,869	4,953	5,991	7,282	7,253	8,075
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,585	1,333	1,688	2,203	2,265	2,529
On-the-Job Training - All sectors - Over 10 years (jobs)		263	237	291	344	337	370
On-Site or In-Plant Training - All sectors - None (jobs)		4,450	3,827	4,648	5,611	5,600	6,240
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,350	15,221	17,980	21,170	20,892	23,120
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,639	3,902	4,704	5,687	5,653	6,280
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,686	1,426	1,769	2,257	2,298	2,557
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		204	180	228	288	291	329
Wage income - All (million $2019)		1,522	1,287	1,532	1,832	1,831	2,056

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

Item	2020	2025	2030	2035	2040	2045	2050
Oil consumption - Annual (million bbls)		31	26.8	20.4	14.4	9.6	5.68
Oil consumption - Cumulative (million bbls)							627
Oil production - Annual (million bbls)		15.1	15.1	15.1	12	9.71	6.46
Natural gas consumption - Annual (tcf)		158	133	107	80.5	50.6	35.1
Natural gas consumption - Cumulative (tcf)							3,220
Natural gas production - Annual (tcf)		2,002	1,893	1,648	1,394	1,105	859

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218

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)		0.954	0.978	1.95	2.08	1.75	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2	141	280	765	1,251	1,639	2,028
Vehicle stocks - LDV – All others (1000 units)	1,691	1,610	1,529	1,114	700	396	92
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		326	832	1,355	2,050	2,233	2,128
Public EV charging plugs - DC Fast (1000 units)	0.06		0.708		3.17		5.13
Public EV charging plugs - L2 (1000 units)	0.164		17		76.1		123

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 (%)	20.6	34.6	64.3	82.8	85.4	85.5	85.5
Sales of space heating units - Electric Resistance (%)	18.3	20.1	12	6.25	5.33	5.36	5.42
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of water heating units - Electric Heat Pump (%)	0	5.29	30.4	43.3	45	45.1	45.2
Sales of water heating units - Electric Resistance (%)	45	59.7	53.2	53.1	53.2	53.3	53.2
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.682	0.676				

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 (%)	3.31	21.4	54	79.9	84	84.2	84.2
Sales of space heating units - Electric Resistance (%)	3.22	8.3	10.8	13.4	13.9	13.9	13.9
Sales of space heating units - Gas (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.114	6.44	36.5	54	56.3	56.5	56.5
Sales of water heating units - Electric Resistance (%)	2.92	9.46	24.7	38.5	40.7	40.8	40.8
Sales of water heating units - Gas (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,826	6,488				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	1,656	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,216	1,339	1,108	1,280	537	537	537
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10	15	19.9	26.4	34.1	42.9	53.1
Installed renewables - Solar - Base land use assumptions (MW)	0	0	0	2,219	7,427	13,921	18,879
Installed renewables - Wind - Base land use assumptions (MW)	684	740	7,019	13,807	26,216	26,977	29,033
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	278	2,315	4,976	8,272	10,798
Installed renewables - Wind - Constrained land use assumptions (MW)	740	740	19,923	47,759	47,868	47,868	47,868
Capital invested - Solar PV - Base (billion $2018)		0	0	2.45	5.41	6.37	4.59
Capital invested - Wind - Base (billion $2018)		0	8.36	8.42	14.7	0.853	2.18

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	0	1.91	3.94	5.57	3.3
Capital invested - Wind - Constrained (billion $2018)		0	26.5	33.7	0.092	0	2.31
Capital invested - Biomass power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0	0	0	0
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	3,967	13,256	24,607	33,274
Wind - Base land use assumptions (GWh)	3,100	3,100	25,019	46,938	84,242	86,377	91,821
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	0	0	507	4,116	8,819	14,584	18,996
Wind - Constrained land use assumptions (GWh)	3,100	3,100	64,947	135,343	135,594	135,594	135,594
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Biomass power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu allam power plant (GWh)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	0	0	0	4
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	0	0	0	2,949
Biomass purchases (million $2018/y)		0	0	0	0	0	136

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	7.32
Annual - BECCS (MMT)		0	0	0	0	0	3.79
Annual - NGCC (MMT)		0	0	0	0	0	0
Annual - Cement and lime (MMT)		0	0	0	0	0	3.53
Cumulative - All (MMT)		0	0	0	0	0	7.32
Cumulative - BECCS (MMT)		0	0	0	0	0	3.79
Cumulative - NGCC (MMT)		0	0	0	0	0	0
Cumulative - Cement and lime (MMT)		0	0	0	0	0	3.53

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	316
All (km)		0	0	0	0	0	316
Cumulative investment - Trunk (million $2018)		0	0	0	0	0	0
Cumulative investment - Spur (million $2018)		0	0	0	0	0	223
Cumulative investment - All (million $2018)		0	0	0	0	0	223

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)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0

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)							-1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-273

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)							-10.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-284
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-518
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-21.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-539
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							182
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							19.2
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							201
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							345
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							38.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							384

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)		49.9	0.05	0.05	0.046	0.033	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.19	3.89	1.51	0.589	0.182	0.101
Premature deaths from air pollution - Mobile - On-Road (deaths)		40.4	38.6	35.7	30.5	23.1	15.1
Premature deaths from air pollution - Gas Stations (deaths)		4.3	4.1	3.75	3.19	2.41	1.58
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		6.54	5.64	4.75	3.76	2.71	1.72
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.05	1.86	1.68	1.4	0.99	0.597
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.23	1.18	1.11	0.979	0.753	0.518

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)		1.16	1.05	0.946	0.846	0.755	0.667
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		8.27	7.63	6.88	5.8	4.46	3.13
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.04	0.889	0.752	0.605	0.473	0.359
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.392	0.335	0.284	0.238	0.196	0.159
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		9.71	5.89	5.54	5.16	4.89	4.47
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		118	94.7	69.8	52.1	40.3	27.8
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		442	0.447	0.442	0.404	0.296	0.027
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		54.9	34.5	13.4	5.22	1.61	0.892
Monetary damages from air pollution - Mobile - On-Road (million $2019)		359	343	317	271	205	134
Monetary damages from air pollution - Gas Stations (million $2019)		38.1	36.3	33.2	28.2	21.3	14
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		58	50	42.1	33.3	24	15.3
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		18.1	16.5	14.9	12.4	8.77	5.29
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.9	10.4	9.87	8.67	6.67	4.59
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.3	9.3	8.38	7.49	6.68	5.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		73.2	67.5	60.9	51.3	39.5	27.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		9.21	7.87	6.66	5.35	4.19	3.18
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.47	2.97	2.52	2.1	1.73	1.41
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		85.7	52	48.9	45.6	43.1	39.4
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,049	841	619	462	358	247

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	195
By economic sector - Construction (jobs)		3,550	3,386	4,772	7,429	9,805	10,978

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Manufacturing (jobs)		6,092	6,486	6,800	7,078	7,733	9,034
By economic sector - Mining (jobs)		9,236	5,970	4,692	3,690	2,928	2,033
By economic sector - Other (jobs)		145	164	514	1,151	1,871	2,006
By economic sector - Pipeline (jobs)		575	470	359	281	225	250
By economic sector - Professional (jobs)		3,142	2,649	3,269	4,644	6,014	7,147
By economic sector - Trade (jobs)		3,347	2,436	2,689	3,433	4,288	4,711
By economic sector - Utilities (jobs)		4,478	3,149	3,373	4,883	6,053	8,136
By resource sector - Biomass (jobs)		0	0	0	0	0	806
By resource sector - CO2 (jobs)		0	0	0	0	0	710
By resource sector - Coal (jobs)		9,893	4,700	3,679	3,214	2,875	2,502
By resource sector - Grid (jobs)		2,823	2,398	4,075	7,623	10,591	14,455
By resource sector - Natural Gas (jobs)		7,063	5,457	3,945	2,939	2,030	1,509
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,976	6,254	5,621	4,939	4,248	2,701
By resource sector - Solar (jobs)		956	1,216	3,428	6,968	10,918	10,170
By resource sector - Wind (jobs)		2,855	4,684	5,723	6,905	8,255	11,638
By education level - All sectors - High school diploma or less (jobs)		13,339	10,568	11,328	13,868	16,486	18,563
By education level - All sectors - Associates degree or some college (jobs)		9,113	7,420	8,055	10,121	12,234	14,074
By education level - All sectors - Bachelors degree (jobs)		6,416	5,323	5,593	6,742	7,960	9,029
By education level - All sectors - Masters or professional degree (jobs)		1,496	1,231	1,308	1,619	1,944	2,223
By education level - All sectors - Doctoral degree (jobs)		201	168	186	239	293	334
Related work experience - All sectors - None (jobs)		4,155	3,373	3,648	4,564	5,503	6,281
Related work experience - All sectors - Up to 1 year (jobs)		6,201	4,951	5,364	6,623	7,941	8,972
Related work experience - All sectors - 1 to 4 years (jobs)		11,409	9,147	9,715	11,865	14,095	15,967
Related work experience - All sectors - 4 to 10 years (jobs)		6,882	5,642	6,052	7,494	8,965	10,249
Related work experience - All sectors - Over 10 years (jobs)		1,917	1,597	1,690	2,043	2,412	2,754
On-the-Job Training - All sectors - None (jobs)		1,570	1,286	1,396	1,742	2,107	2,375
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,926	16,876	17,950	21,814	25,882	29,326
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,129	4,974	5,367	6,717	8,075	9,244
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,666	1,333	1,496	1,995	2,470	2,847
On-the-Job Training - All sectors - Over 10 years (jobs)		274	239	261	321	383	431
On-Site or In-Plant Training - All sectors - None (jobs)		4,645	3,858	4,186	5,217	6,292	7,177
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		19,095	15,324	16,283	19,792	23,475	26,583
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,841	3,920	4,222	5,258	6,305	7,194
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,769	1,427	1,576	2,060	2,522	2,893
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		215	181	201	262	322	376
Wage income - All (million $2019)		1,586	1,294	1,384	1,710	2,051	2,362

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	143	129	118	110	100	89.1
Final energy use - Residential (PJ)	38.4	36.2	35	33.8	32.2	30.3	28.1
Final energy use - Commercial (PJ)	48.6	48.8	48.2	47.6	46.4	45.3	44.7
Final energy use - Industry (PJ)	185	197	202	207	214	216	219

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)		0.829	0.837	1.16	1.2	1.73	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	1.55	42.4	83.2	272	461	880	1,299
Vehicle stocks - LDV – All others (1000 units)	1,698	1,698	1,698	1,610	1,523	1,174	824
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	52.1	111	373	1,179	1,716
Public EV charging plugs - DC Fast (1000 units)	0.06		0.211		1.17		3.29
Public EV charging plugs - L2 (1000 units)	0.164		5.06		28.1		79

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 (%)	20.6	29.9	33.3	43.4	60.9	75.7	82.6
Sales of space heating units - Electric Resistance (%)	18.3	21.3	20.5	17.4	12.3	8.13	6.18
Sales of space heating units - Gas (%)	50.2	31.9	30	25.2	16.5	8.57	4.78
Sales of space heating units - Fossil (%)	10.8	16.9	16.2	14	10.4	7.61	6.49
Sales of water heating units - Electric Heat Pump (%)	0	1.02	3.88	12.4	26.6	38	43.1
Sales of water heating units - Electric Resistance (%)	45	61.1	60.3	58	54.9	53.5	53.2
Sales of water heating units - Gas Furnace (%)	52.2	35.8	33.7	27.7	16.7	6.76	2.07
Sales of water heating units - Other (%)	2.8	2.09	2.06	1.96	1.8	1.69	1.66
Sales of cooking units - Electric Resistance (%)	62.4	63.4	66.8	75.9	88.5	96.3	99
Sales of cooking units - Gas (%)	37.6	36.6	33.2	24.1	11.5	3.71	0.997
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.678	0.66				

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 (%)	3.31	16.5	20.2	31.4	51.9	70.8	80
Sales of space heating units - Electric Resistance (%)	3.22	7.96	8.26	9.15	10.8	12.6	13.5
Sales of space heating units - Gas (%)	89.4	70.9	67.2	56.1	35.6	16.1	6.3
Sales of space heating units - Fossil (%)	4.12	4.72	4.38	3.31	1.62	0.515	0.135
Sales of water heating units - Electric Heat Pump (%)	0.114	1.49	4.92	15.1	32.6	47.1	53.7
Sales of water heating units - Electric Resistance (%)	2.92	7.34	9.03	14.3	24.3	33.8	38.6
Sales of water heating units - Gas (%)	94.5	86.9	81.8	66.8	39.9	16.2	4.96
Sales of water heating units - Other (%)	2.43	4.23	4.21	3.78	3.24	2.87	2.74

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,823	6,480				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	2,956	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,216	1,224	1,224	815	7.5	7.5	15
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724

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)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3

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)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-273
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-10.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-284
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-518

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)							-21.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-539
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							182
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							19.2
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							201
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							345
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							38.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							384

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)		49.9	0.05	0.05	0.046	0.033	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.93	4.17	2.2	1.31	0.382	0.095
Premature deaths from air pollution - Mobile - On-Road (deaths)		39.8	35.2	25.4	13.9	6.04	2.28
Premature deaths from air pollution - Gas Stations (deaths)		4.21	3.67	2.63	1.48	0.682	0.306
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		6.5	5.18	3.41	1.83	0.833	0.311
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.01	1.55	1	0.548	0.227	0.071
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.22	1.06	0.795	0.509	0.268	0.125
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.16	1.05	0.946	0.846	0.755	0.667
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		8.23	6.89	4.87	2.89	1.58	0.845
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.04	0.803	0.569	0.369	0.236	0.148
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.392	0.313	0.243	0.18	0.125	0.078

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)		10.5	5.88	5.5	5.11	4.88	4.37
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		115	98.5	73.5	48.7	24.9	1.64
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		442	0.447	0.442	0.404	0.296	0.027
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		52.6	36.9	19.5	11.6	3.39	0.845
Monetary damages from air pollution - Mobile - On-Road (million $2019)		354	313	226	124	53.7	20.3
Monetary damages from air pollution - Gas Stations (million $2019)		37.3	32.5	23.3	13.1	6.04	2.71
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		57.6	45.9	30.2	16.2	7.38	2.76
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		17.8	13.7	8.88	4.85	2.01	0.626
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.8	9.42	7.05	4.51	2.38	1.11
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.3	9.3	8.38	7.49	6.68	5.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		72.8	61	43.1	25.6	14	7.48
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		9.17	7.11	5.04	3.26	2.09	1.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.47	2.77	2.15	1.59	1.11	0.691
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		92.8	51.9	48.6	45.1	43	38.5
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,025	874	653	432	221	14.6

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	196
By economic sector - Construction (jobs)		3,629	3,793	9,425	11,695	19,089	12,165
By economic sector - Manufacturing (jobs)		6,383	7,311	9,960	10,505	12,367	12,875
By economic sector - Mining (jobs)		9,537	5,987	4,608	3,217	2,226	1,244
By economic sector - Other (jobs)		164	216	1,426	1,894	4,086	2,032
By economic sector - Pipeline (jobs)		559	482	356	240	125	19.6
By economic sector - Professional (jobs)		3,244	2,838	5,321	6,733	10,522	8,395
By economic sector - Trade (jobs)		3,472	2,528	3,932	4,575	7,180	5,127
By economic sector - Utilities (jobs)		4,499	3,492	5,953	8,409	11,674	10,203
By resource sector - Biomass (jobs)		0	0	0	0	0	864
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		10,488	4,695	3,658	3,184	2,870	2,449
By resource sector - Grid (jobs)		2,981	2,932	9,143	14,803	22,370	19,941

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

Item	2020	2025	2030	2035	2040	2045	2050
By resource sector - Natural Gas (jobs)		6,851	5,700	4,091	2,824	1,256	253
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,960	6,158	5,253	3,536	2,182	408
By resource sector - Solar (jobs)		1,151	2,000	10,387	12,214	25,677	10,763
By resource sector - Wind (jobs)		3,056	5,163	8,450	10,706	12,913	17,579
By education level - All sectors - High school diploma or less (jobs)		13,813	11,400	17,583	20,152	28,618	21,797
By education level - All sectors - Associates degree or some college (jobs)		9,381	8,052	12,780	14,972	21,558	16,678
By education level - All sectors - Bachelors degree (jobs)		6,560	5,702	8,359	9,517	13,315	10,552
By education level - All sectors - Masters or professional degree (jobs)		1,527	1,315	1,976	2,293	3,283	2,581
By education level - All sectors - Doctoral degree (jobs)		205	179	284	333	495	380
Related work experience - All sectors - None (jobs)		4,274	3,648	5,745	6,692	9,641	7,362
Related work experience - All sectors - Up to 1 year (jobs)		6,433	5,354	8,412	9,683	13,905	10,648
Related work experience - All sectors - 1 to 4 years (jobs)		11,749	9,830	14,844	17,043	24,111	18,655
Related work experience - All sectors - 4 to 10 years (jobs)		7,062	6,089	9,397	10,892	15,492	12,042
Related work experience - All sectors - Over 10 years (jobs)		1,969	1,726	2,585	2,956	4,119	3,281
On-the-Job Training - All sectors - None (jobs)		1,614	1,387	2,189	2,523	3,678	2,770
On-the-Job Training - All sectors - Up to 1 year (jobs)		21,589	18,174	27,436	31,411	44,313	34,593
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,298	5,381	8,460	9,871	14,142	10,853
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,704	1,444	2,481	2,991	4,465	3,258
On-the-Job Training - All sectors - Over 10 years (jobs)		281	261	415	471	671	515
On-Site or In-Plant Training - All sectors - None (jobs)		4,775	4,178	6,584	7,626	10,986	8,494
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		19,704	16,495	24,888	28,500	40,217	31,309
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,980	4,237	6,623	7,698	11,003	8,441
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,807	1,540	2,557	3,046	4,486	3,300
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		220	197	330	396	576	445
Wage income - All (million $2019)		1,629	1,390	2,110	2,456	3,496	2,756

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218

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)		0.954	0.978	1.95	2.08	1.75	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2	141	280	765	1,251	1,639	2,028
Vehicle stocks - LDV – All others (1000 units)	1,691	1,610	1,529	1,114	700	396	92
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		326	832	1,355	2,050	2,233	2,128
Public EV charging plugs - DC Fast (1000 units)	0.06		0.708		3.17		5.13
Public EV charging plugs - L2 (1000 units)	0.164		17		76.1		123

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 (%)	20.6	34.6	64.3	82.8	85.4	85.5	85.5
Sales of space heating units - Electric Resistance (%)	18.3	20.1	12	6.25	5.33	5.36	5.42
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of water heating units - Electric Heat Pump (%)	0	5.29	30.4	43.3	45	45.1	45.2
Sales of water heating units - Electric Resistance (%)	45	59.7	53.2	53.1	53.2	53.3	53.2
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.682	0.676				

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 (%)	3.31	21.4	54	79.9	84	84.2	84.2
Sales of space heating units - Electric Resistance (%)	3.22	8.3	10.8	13.4	13.9	13.9	13.9
Sales of space heating units - Gas (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.114	6.44	36.5	54	56.3	56.5	56.5
Sales of water heating units - Electric Resistance (%)	2.92	9.46	24.7	38.5	40.7	40.8	40.8
Sales of water heating units - Gas (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,826	6,488				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	3,640	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,216	1,224	1,339	1,056	130	130	537

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10	15	19.9	26.4	34.1	42.9	53.1
Installed renewables - Solar - Base land use assumptions (MW)	0	79.1	262	6,872	13,078	28,498	28,498
Installed renewables - Wind - Base land use assumptions (MW)	740	740	8,957	21,914	44,905	54,159	54,198
Installed renewables - Solar - Constrained land use assumptions (MW)	0	377	916	4,435	10,762	14,839	15,021
Installed renewables - Wind - Constrained land use assumptions (MW)	840	840	27,586	47,968	47,968	47,968	63,329
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		0.106	0.219	7.29	6.45	15.1	0
Capital invested - Wind - Base (billion $2018)		0	10.9	16.1	27.2	10.4	0.041

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	145	476	12,091	22,963	49,928	49,928
Wind - Base land use assumptions (GWh)	3,100	3,100	31,342	71,772	131,323	154,153	154,241
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	0	1,379	3,378	15,726	37,677	51,985	52,648
Wind - Constrained land use assumptions (GWh)	6,201	6,201	170,493	271,188	271,188	271,188	370,654
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)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421

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)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-273
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-10.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-284
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-518
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-21.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-539
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							182
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							19.2
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							201
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							345
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							38.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							384

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)		49.9	0.05	0.05	0.046	0.033	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.99	4.83	6.84	4.94	1.73	0.506
Premature deaths from air pollution - Mobile - On-Road (deaths)		39.8	35.2	25.4	13.9	6.04	2.28
Premature deaths from air pollution - Gas Stations (deaths)		4.21	3.67	2.63	1.48	0.682	0.306

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)		6.5	5.18	3.41	1.83	0.833	0.311
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.01	1.55	1	0.548	0.227	0.071
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.22	1.06	0.795	0.509	0.268	0.125
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.16	1.05	0.946	0.846	0.755	0.667
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		8.23	6.89	4.87	2.89	1.58	0.845
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.04	0.803	0.569	0.369	0.236	0.148
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.392	0.313	0.243	0.18	0.125	0.078
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		9.36	5.88	5.51	5.12	4.88	4.37
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		121	108	98.8	82.4	65.6	46.7
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		442	0.447	0.442	0.404	0.296	0.027
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		61.9	42.7	60.6	43.8	15.3	4.49
Monetary damages from air pollution - Mobile - On-Road (million $2019)		354	313	226	124	53.7	20.3
Monetary damages from air pollution - Gas Stations (million $2019)		37.3	32.5	23.3	13.1	6.04	2.71
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		57.6	45.9	30.2	16.2	7.38	2.76
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		17.8	13.7	8.88	4.85	2.01	0.626
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.8	9.42	7.05	4.51	2.38	1.11
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.3	9.3	8.38	7.49	6.68	5.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		72.8	61	43.1	25.6	14	7.48
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		9.17	7.11	5.04	3.26	2.09	1.31
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.47	2.77	2.15	1.59	1.11	0.691
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		82.6	51.9	48.6	45.1	43.1	38.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,073	958	878	732	582	415

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	195
By economic sector - Construction (jobs)		3,371	3,100	3,266	3,696	4,340	5,968
By economic sector - Manufacturing (jobs)		5,307	4,481	4,058	4,277	4,058	4,000
By economic sector - Mining (jobs)		8,988	6,138	4,992	3,706	2,821	2,006
By economic sector - Other (jobs)		127	120	142	189	250	354
By economic sector - Pipeline (jobs)		592	536	502	439	361	372
By economic sector - Professional (jobs)		2,934	2,284	2,272	3,030	4,054	5,747
By economic sector - Trade (jobs)		3,082	2,291	2,116	2,158	2,391	2,877
By economic sector - Utilities (jobs)		4,097	2,980	3,284	7,693	13,655	22,732
By resource sector - Biomass (jobs)		0	0	0	0	0	809
By resource sector - CO2 (jobs)		0	0	0	0	0	802
By resource sector - Coal (jobs)		8,937	4,337	3,659	3,185	2,873	2,449
By resource sector - Grid (jobs)		2,094	1,699	2,791	3,998	6,024	9,905
By resource sector - Natural Gas (jobs)		7,455	6,662	6,065	5,326	4,335	3,310
By resource sector - Nuclear (jobs)		0	0	0	5,290	12,239	21,613
By resource sector - Oil (jobs)		6,959	6,170	5,397	3,868	2,910	1,983
By resource sector - Solar (jobs)		731	664	564	548	495	462
By resource sector - Wind (jobs)		2,321	2,397	2,157	2,974	3,055	2,917
By education level - All sectors - High school diploma or less (jobs)		12,400	9,385	8,809	8,884	9,291	11,064
By education level - All sectors - Associates degree or some college (jobs)		8,477	6,543	6,221	6,503	7,028	8,670
By education level - All sectors - Bachelors degree (jobs)		6,017	4,741	4,420	4,547	4,912	6,000
By education level - All sectors - Masters or professional degree (jobs)		1,411	1,109	1,040	1,097	1,227	1,549
By education level - All sectors - Doctoral degree (jobs)		192	152	143	160	190	249
Related work experience - All sectors - None (jobs)		3,873	2,999	2,844	2,929	3,132	3,829
Related work experience - All sectors - Up to 1 year (jobs)		5,748	4,333	4,047	4,158	4,425	5,333
Related work experience - All sectors - 1 to 4 years (jobs)		10,656	8,177	7,679	7,834	8,345	10,101
Related work experience - All sectors - 4 to 10 years (jobs)		6,431	5,020	4,748	4,922	5,312	6,534
Related work experience - All sectors - Over 10 years (jobs)		1,789	1,401	1,313	1,348	1,434	1,734
On-the-Job Training - All sectors - None (jobs)		1,465	1,139	1,062	1,094	1,178	1,440
On-the-Job Training - All sectors - Up to 1 year (jobs)		19,475	14,910	13,950	14,258	15,154	18,247
On-the-Job Training - All sectors - 1 to 4 years (jobs)		5,732	4,445	4,225	4,367	4,694	5,779
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,571	1,233	1,204	1,276	1,416	1,819
On-the-Job Training - All sectors - Over 10 years (jobs)		255	204	191	197	207	246
On-Site or In-Plant Training - All sectors - None (jobs)		4,326	3,377	3,174	3,320	3,599	4,428
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		17,779	13,577	12,705	12,952	13,743	16,534

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)		4,522	3,498	3,318	3,412	3,649	4,465
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,669	1,318	1,280	1,339	1,471	1,867
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		201	160	157	168	186	237
Wage income - All (million $2019)		1,485	1,162	1,108	1,146	1,241	1,530

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	141	123	101	81	68.6	63.6
Final energy use - Residential (PJ)	38.4	36.1	33.5	30.6	27.6	25.7	24.7
Final energy use - Commercial (PJ)	48.6	48.7	47.1	44.5	42	41	41.4
Final energy use - Industry (PJ)	185	197	201	206	212	214	218

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)		0.954	0.978	1.95	2.08	1.75	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	2	141	280	765	1,251	1,639	2,028
Vehicle stocks - LDV – All others (1000 units)	1,691	1,610	1,529	1,114	700	396	92
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		326	832	1,355	2,050	2,233	2,128
Public EV charging plugs - DC Fast (1000 units)	0.06		0.708		3.17		5.13
Public EV charging plugs - L2 (1000 units)	0.164		17		76.1		123

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 (%)	20.6	34.6	64.3	82.8	85.4	85.5	85.5
Sales of space heating units - Electric Resistance (%)	18.3	20.1	12	6.25	5.33	5.36	5.42
Sales of space heating units - Gas (%)	50.2	29.6	14.6	4.64	3.25	3.16	3.14
Sales of space heating units - Fossil (%)	10.8	15.7	9.07	6.34	6.05	5.96	5.93
Sales of water heating units - Electric Heat Pump (%)	0	5.29	30.4	43.3	45	45.1	45.2
Sales of water heating units - Electric Resistance (%)	45	59.7	53.2	53.1	53.2	53.3	53.2
Sales of water heating units - Gas Furnace (%)	52.2	33	14.7	1.99	0.11	0	0
Sales of water heating units - Other (%)	2.8	2.02	1.66	1.59	1.61	1.62	1.64
Sales of cooking units - Electric Resistance (%)	62.6	70.5	95	99.7	100	100	100
Sales of cooking units - Gas (%)	37.4	29.5	5.04	0.254	0	0	0
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.682	0.676				

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 (%)	3.31	21.4	54	79.9	84	84.2	84.2
Sales of space heating units - Electric Resistance (%)	3.22	8.3	10.8	13.4	13.9	13.9	13.9
Sales of space heating units - Gas (%)	89.4	66.3	34.4	6.61	2.15	1.91	1.9
Sales of space heating units - Fossil (%)	4.12	4.08	0.778	0.033	0	0	0
Sales of water heating units - Electric Heat Pump (%)	0.114	6.44	36.5	54	56.3	56.5	56.5
Sales of water heating units - Electric Resistance (%)	2.92	9.46	24.7	38.5	40.7	40.8	40.8
Sales of water heating units - Gas (%)	94.5	80.1	35.8	4.81	0.265	0	0
Sales of water heating units - Other (%)	2.43	4.02	2.96	2.7	2.7	2.7	2.7
Sales of cooking units - Electric Resistance (%)	32	46	79.9	86.5	86.9	86.9	86.9
Sales of cooking units - Gas (%)	68	54	20.1	13.5	13.1	13.1	13.1
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,826	6,488				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	972	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,216	2,013	1,141	2,178	1,949	2,301	2,301
Installed thermal - Nuclear (MW)	0	0	0	0	2,257	7,099	15,156
Installed renewables - Rooftop PV (MW)	10	15	19.9	26.4	34.1	42.9	53.1
Installed renewables - Wind - Base land use assumptions (MW)	740	1,496	4,313	4,313	4,815	4,855	4,979
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Wind - Constrained land use assumptions (MW)	740	2,348	8,454	8,454	9,820	10,260	10,930
Installed renewables - Offshore Wind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Capital invested - Wind - Base (billion $2018)		1.11	3.75	0	0.593	0.045	0.132
Capital invested - Wind - Constrained (billion $2018)		2.36	8.13	0	1.61	0.493	0.71

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Base land use assumptions (GWh)	3,100	5,923	15,857	15,857	17,577	17,724	18,139
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Constrained land use assumptions (GWh)	3,100	8,876	29,562	29,562	33,982	35,386	37,512
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)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							8.8

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 - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							3,258

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 - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415

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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-273
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-10.5
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-284
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-518
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-21.1
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-539
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							0
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							182
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							19.2
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							201
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							0

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 - Cropland measures (1000 hectares)							345
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							38.3
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							384

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)		49.9	0.05	0.05	0.046	0.033	0.003
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		6.4	3.67	1.9	1.15	0.561	0.178
Premature deaths from air pollution - Mobile - On-Road (deaths)		40.4	38.6	35.7	30.5	23.1	15.1
Premature deaths from air pollution - Gas Stations (deaths)		4.3	4.1	3.75	3.19	2.41	1.58
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		6.54	5.64	4.75	3.76	2.71	1.72
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		2.05	1.86	1.68	1.4	0.99	0.597
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.23	1.18	1.11	0.979	0.753	0.518
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.16	1.05	0.946	0.846	0.755	0.667
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (deaths)		8.27	7.63	6.88	5.8	4.46	3.13
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.04	0.889	0.752	0.605	0.473	0.359
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.392	0.335	0.284	0.238	0.196	0.159
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		9.91	5.89	5.54	5.17	4.93	4.57
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		118	94.7	69.8	52.1	40.3	27.8
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		442	0.447	0.442	0.404	0.296	0.027
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		56.7	32.5	16.8	10.2	4.97	1.57
Monetary damages from air pollution - Mobile - On-Road (million $2019)		359	343	317	271	205	134
Monetary damages from air pollution - Gas Stations (million $2019)		38.1	36.3	33.2	28.2	21.3	14
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		58	50	42.1	33.3	24	15.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		18.1	16.5	14.9	12.4	8.77	5.29
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.9	10.4	9.87	8.67	6.67	4.59
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.3	9.3	8.38	7.49	6.68	5.91
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		73.2	67.5	60.9	51.3	39.5	27.7
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		9.21	7.87	6.66	5.35	4.19	3.18
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.47	2.97	2.52	2.1	1.73	1.41
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		87.4	52	48.9	45.6	43.5	40.3
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,049	841	619	462	358	247

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	0
By economic sector - Construction (jobs)		3,455	3,406	4,522	5,859	7,199	8,815
By economic sector - Manufacturing (jobs)		6,130	6,550	6,217	5,145	5,614	7,034
By economic sector - Mining (jobs)		9,267	5,964	4,709	3,718	2,947	2,022
By economic sector - Other (jobs)		139	166	462	841	1,275	1,670
By economic sector - Pipeline (jobs)		569	468	366	292	225	244
By economic sector - Professional (jobs)		3,097	2,650	3,138	3,801	4,578	5,440
By economic sector - Trade (jobs)		3,309	2,440	2,613	2,928	3,365	3,816
By economic sector - Utilities (jobs)		4,276	3,115	3,265	3,960	4,676	6,307
By resource sector - Biomass (jobs)		0	0	0	0	0	0
By resource sector - CO2 (jobs)		0	0	0	0	0	728
By resource sector - Coal (jobs)		9,859	4,608	3,679	3,216	2,897	2,557
By resource sector - Grid (jobs)		2,535	2,436	3,815	5,757	7,929	10,919
By resource sector - Natural Gas (jobs)		6,984	5,431	4,037	3,055	2,030	1,426
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,976	6,254	5,621	4,973	4,269	2,598
By resource sector - Solar (jobs)		941	1,200	2,914	4,851	7,111	9,101
By resource sector - Wind (jobs)		2,947	4,830	5,227	4,692	5,643	8,018
By education level - All sectors - High school diploma or less (jobs)		13,221	10,596	10,817	11,290	12,670	14,960
By education level - All sectors - Associates degree or some college (jobs)		9,002	7,433	7,678	8,168	9,310	11,227
By education level - All sectors - Bachelors degree (jobs)		6,344	5,330	5,361	5,548	6,167	7,153
By education level - All sectors - Masters or professional degree (jobs)		1,477	1,231	1,258	1,339	1,505	1,749
By education level - All sectors - Doctoral degree (jobs)		199	168	179	199	227	260
Related work experience - All sectors - None (jobs)		4,105	3,379	3,483	3,703	4,206	5,026

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

Item	2020	2025	2030	2035	2040	2045	2050
Related work experience - All sectors - Up to 1 year (jobs)		6,150	4,966	5,108	5,352	6,058	7,200
Related work experience - All sectors - 1 to 4 years (jobs)		11,291	9,162	9,303	9,727	10,886	12,774
Related work experience - All sectors - 4 to 10 years (jobs)		6,798	5,651	5,786	6,104	6,878	8,160
Related work experience - All sectors - Over 10 years (jobs)		1,898	1,600	1,612	1,657	1,851	2,189
On-the-Job Training - All sectors - None (jobs)		1,553	1,289	1,332	1,414	1,607	1,898
On-the-Job Training - All sectors - Up to 1 year (jobs)		20,728	16,914	17,148	17,789	19,925	23,448
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,054	4,982	5,129	5,458	6,177	7,385
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,637	1,333	1,436	1,627	1,882	2,275
On-the-Job Training - All sectors - Over 10 years (jobs)		271	240	247	255	288	344
On-Site or In-Plant Training - All sectors - None (jobs)		4,593	3,867	3,988	4,210	4,784	5,709
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		18,914	15,358	15,563	16,159	18,088	21,275
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		4,784	3,927	4,035	4,276	4,831	5,755
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		1,740	1,427	1,515	1,688	1,932	2,311
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		212	181	192	211	244	299
Wage income - All (million $2019)		1,568	1,295	1,327	1,405	1,587	1,884

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	143	129	118	110	100	89.1
Final energy use - Residential (PJ)	38.4	36.2	35	33.8	32.2	30.3	28.1
Final energy use - Commercial (PJ)	48.6	48.8	48.2	47.6	46.4	45.3	44.7
Final energy use - Industry (PJ)	185	197	202	207	214	216	219

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)		0.829	0.837	1.16	1.2	1.73	1.83

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle stocks - LDV – EV (1000 units)	1.55	42.4	83.2	272	461	880	1,299
Vehicle stocks - LDV – All others (1000 units)	1,698	1,698	1,698	1,610	1,523	1,174	824
Light-duty vehicle capital costs vs. REF - Cumulative 5-yr (million $2018)		0	52.1	111	373	1,179	1,716
Public EV charging plugs - DC Fast (1000 units)	0.06		0.211		1.17		3.29
Public EV charging plugs - L2 (1000 units)	0.164		5.06		28.1		79

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 (%)	20.6	29.9	33.3	43.4	60.9	75.7	82.6
Sales of space heating units - Electric Resistance (%)	18.3	21.3	20.5	17.4	12.3	8.13	6.18
Sales of space heating units - Gas (%)	50.2	31.9	30	25.2	16.5	8.57	4.78
Sales of space heating units - Fossil (%)	10.8	16.9	16.2	14	10.4	7.61	6.49
Sales of water heating units - Electric Heat Pump (%)	0	1.02	3.88	12.4	26.6	38	43.1
Sales of water heating units - Electric Resistance (%)	45	61.1	60.3	58	54.9	53.5	53.2
Sales of water heating units - Gas Furnace (%)	52.2	35.8	33.7	27.7	16.7	6.76	2.07
Sales of water heating units - Other (%)	2.8	2.09	2.06	1.96	1.8	1.69	1.66
Sales of cooking units - Electric Resistance (%)	62.4	63.4	66.8	75.9	88.5	96.3	99
Sales of cooking units - Gas (%)	37.6	36.6	33.2	24.1	11.5	3.71	0.997
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.678	0.66				

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 (%)	3.31	16.5	20.2	31.4	51.9	70.8	80
Sales of space heating units - Electric Resistance (%)	3.22	7.96	8.26	9.15	10.8	12.6	13.5
Sales of space heating units - Gas (%)	89.4	70.9	67.2	56.1	35.6	16.1	6.3
Sales of space heating units - Fossil (%)	4.12	4.72	4.38	3.31	1.62	0.515	0.135
Sales of water heating units - Electric Heat Pump (%)	0.114	1.49	4.92	15.1	32.6	47.1	53.7
Sales of water heating units - Electric Resistance (%)	2.92	7.34	9.03	14.3	24.3	33.8	38.6
Sales of water heating units - Gas (%)	94.5	86.9	81.8	66.8	39.9	16.2	4.96
Sales of water heating units - Other (%)	2.43	4.23	4.21	3.78	3.24	2.87	2.74
Sales of cooking units - Electric Resistance (%)	32	36.2	40.9	53.4	71	81.7	85.5
Sales of cooking units - Gas (%)	68	63.8	59.1	46.6	29	18.3	14.5
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,823	6,480				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	3,640	0	0	0	0	0
Installed thermal - Natural gas (MW)	1,216	1,224	1,224	815	15	15	15
Installed thermal - Nuclear (MW)	0	0	0	0	0	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
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	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	0	0	0	0	0
Conversion capital investment - Cumulative 5-yr (million $2018)		0	0	0	0	0	0
Biomass purchases (million $2018/y)		0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0	0	0	0	3.53
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	0	0	0	3.53
Cumulative - All (MMT)		0	0	0	0	0	3.53
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	0	0	0	3.53

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

Item	2020	2025	2030	2035	2040	2045	2050
Trunk (km)		0	0	0	0	0	0
Spur (km)		0	0	0	0	0	30.7
All (km)		0	0	0	0	0	30.7
Cumulative investment - Trunk (million $2018)		0	0	0	0	0	0
Cumulative investment - Spur (million $2018)		0	0	0	0	0	36
Cumulative investment - All (million $2018)		0	0	0	0	0	36

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)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,675
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750

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)							8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1

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)							3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415

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)							-17
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-268
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-10.4
Carbon sink potential - Moderate deployment - Cropland to woody energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Pasture to energy crops (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-296
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-17
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-509
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-20.7
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)							-546

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)							6.53
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							179
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							18.8
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							0.058
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							110
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							314
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							6.53
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							838
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							37.7
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							0.058
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							110
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							993

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)		135	82.3	74.7	71	68.8	63.8
Premature deaths from air pollution - Fuel Comb - Electric Generation - Natural Gas (deaths)		5.33	6.23	6.87	6.6	6.8	6.09
Premature deaths from air pollution - Mobile - On-Road (deaths)		40.4	39.1	38	37	36.1	35.2
Premature deaths from air pollution - Gas Stations (deaths)		4.29	4.14	3.99	3.86	3.74	3.61
Premature deaths from air pollution - Fuel Comb - Residential - Natural Gas (deaths)		6.47	5.65	5	4.55	4.24	3.95
Premature deaths from air pollution - Fuel Comb - Residential - Oil (deaths)		1.97	1.58	1.08	0.664	0.375	0.221
Premature deaths from air pollution - Fuel Comb - Residential - Other (deaths)		1.18	1.11	1.07	1.03	0.983	0.932
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Coal (deaths)		1.22	1.15	1.09	1.02	0.962	0.899

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)		8.33	7.73	6.81	5.88	5.35	5.21
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Oil (deaths)		1.06	0.958	0.838	0.707	0.619	0.561
Premature deaths from air pollution - Fuel Comb - Comm/Institutional - Other (deaths)		0.41	0.398	0.387	0.374	0.362	0.351
Premature deaths from air pollution - Industrial Processes - Coal Mining (deaths)		16.6	11.9	9.74	8.84	8.18	7.37
Premature deaths from air pollution - Industrial Processes - Oil & Gas Production (deaths)		119	122	120	108	103	94.2
Monetary damages from air pollution - Fuel Comb - Electric Generation - Coal (million $2019)		1,200	729	662	630	609	565
Monetary damages from air pollution - Fuel Comb - Electric Generation - Natural Gas (million $2019)		47.2	55.2	60.9	58.5	60.2	53.9
Monetary damages from air pollution - Mobile - On-Road (million $2019)		359	348	338	329	321	313
Monetary damages from air pollution - Gas Stations (million $2019)		37.9	36.6	35.3	34.2	33.1	31.9
Monetary damages from air pollution - Fuel Comb - Residential - Natural Gas (million $2019)		57.3	50	44.3	40.3	37.6	35
Monetary damages from air pollution - Fuel Comb - Residential - Oil (million $2019)		17.5	14	9.56	5.88	3.32	1.96
Monetary damages from air pollution - Fuel Comb - Residential - Other (million $2019)		10.5	9.85	9.45	9.13	8.71	8.26
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Coal (million $2019)		10.8	10.2	9.62	9.05	8.51	7.96
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Natural Gas (million $2019)		73.7	68.4	60.2	52	47.3	46.1
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Oil (million $2019)		9.42	8.48	7.42	6.26	5.48	4.97
Monetary damages from air pollution - Fuel Comb - Comm/Institutional - Other (million $2019)		3.63	3.52	3.42	3.31	3.21	3.11
Monetary damages from air pollution - Industrial Processes - Coal Mining (million $2019)		147	105	86	78	72.2	65.1
Monetary damages from air pollution - Industrial Processes - Oil & Gas Production (million $2019)		1,058	1,082	1,063	957	912	837

Table 65: *REF scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		0	0	0	0	0	0
By economic sector - Construction (jobs)		3,794	3,544	3,564	3,645	3,851	3,559
By economic sector - Manufacturing (jobs)		4,346	4,251	4,227	4,466	4,107	3,727
By economic sector - Mining (jobs)		12,528	8,894	6,945	5,597	4,637	3,604

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		155	129	125	147	163	158
By economic sector - Pipeline (jobs)		589	625	640	602	606	593
By economic sector - Professional (jobs)		3,780	3,025	2,703	2,710	2,699	2,403
By economic sector - Trade (jobs)		4,540	3,335	2,850	2,632	2,475	2,087
By economic sector - Utilities (jobs)		5,450	4,365	4,151	4,158	4,381	3,687
By resource sector - Biomass (jobs)		0	0	0	0	0	0
By resource sector - CO2 (jobs)		0	0	0	0	0	0
By resource sector - Coal (jobs)		15,988	10,167	7,615	6,605	5,881	4,489
By resource sector - Grid (jobs)		4,304	2,815	2,749	2,885	3,448	2,467
By resource sector - Natural Gas (jobs)		7,247	7,523	7,588	7,071	6,866	6,690
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		6,985	6,279	5,685	5,119	4,668	3,958
By resource sector - Solar (jobs)			213	313	248	250	424
By resource sector - Wind (jobs)		658	1,170	1,253	2,029	1,805	1,789
By education level - All sectors - High school diploma or less (jobs)		15,899	12,438	11,004	10,374	9,870	8,507
By education level - All sectors - Associates degree or some college (jobs)		10,361	8,373	7,566	7,264	7,012	6,098
By education level - All sectors - Bachelors degree (jobs)		7,036	5,804	5,239	4,991	4,763	4,111
By education level - All sectors - Masters or professional degree (jobs)		1,662	1,366	1,227	1,168	1,120	967
By education level - All sectors - Doctoral degree (jobs)		225	187	167	160	155	136
Related work experience - All sectors - None (jobs)		4,746	3,834	3,461	3,310	3,191	2,771
Related work experience - All sectors - Up to 1 year (jobs)		7,341	5,721	5,038	4,755	4,505	3,876
Related work experience - All sectors - 1 to 4 years (jobs)		13,259	10,570	9,425	8,924	8,520	7,350
Related work experience - All sectors - 4 to 10 years (jobs)		7,734	6,314	5,716	5,473	5,273	4,580
Related work experience - All sectors - Over 10 years (jobs)		2,103	1,728	1,564	1,495	1,429	1,240
On-the-Job Training - All sectors - None (jobs)		1,768	1,429	1,280	1,215	1,159	1,000
On-the-Job Training - All sectors - Up to 1 year (jobs)		24,193	19,235	17,120	16,221	15,431	13,298
On-the-Job Training - All sectors - 1 to 4 years (jobs)		6,992	5,668	5,121	4,896	4,729	4,112
On-the-Job Training - All sectors - 4 to 10 years (jobs)		1,947	1,596	1,462	1,410	1,395	1,226
On-the-Job Training - All sectors - Over 10 years (jobs)		282	240	221	214	205	181
On-Site or In-Plant Training - All sectors - None (jobs)		5,142	4,202	3,796	3,642	3,492	3,035
On-Site or In-Plant Training - All sectors - Up to 1 year (jobs)		22,210	17,604	15,641	14,795	14,071	12,117
On-Site or In-Plant Training - All sectors - 1 to 4 years (jobs)		5,553	4,480	4,036	3,850	3,709	3,219
On-Site or In-Plant Training - All sectors - 4 to 10 years (jobs)		2,041	1,684	1,545	1,487	1,466	1,287
On-Site or In-Plant Training - All sectors - Over 10 years (jobs)		237	199	186	183	181	160
Wage income - All (million $2019)		1,821	1,484	1,348	1,295	1,257	1,100

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Transportation (PJ)	151	143	130	122	122	126	130

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Residential (PJ)	38.4	36.3	35.7	35.7	36	36.8	37.6
Final energy use - Commercial (PJ)	48.6	49.4	49.9	50.1	50.6	52.1	55
Final energy use - Industry (PJ)	186	200	210	215	221	226	233

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)		0.92	0.94	1.05	1.08	1.2	1.24

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 (%)	19.1	38.2	38.9	39.9	40.6	41.6	42.9
Sales of space heating units - Electric Resistance (%)	18.7	19	18.9	18.2	17.3	16.5	15
Sales of space heating units - Gas (%)	51.1	28.6	30.6	31.9	32.2	32.1	32
Sales of space heating units - Fossil (%)	11	14.2	11.6	10.1	9.89	9.86	9.99
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	45	61.3	61.3	61	60.7	60.7	60.4
Sales of water heating units - Gas Furnace (%)	52.2	36.6	36.6	36.8	37.1	37.2	37.3
Sales of water heating units - Other (%)	2.8	2.1	2.11	2.14	2.17	2.19	2.21
Sales of cooking units - Electric Resistance (%)	62.1	62.1	62.1	62.1	62.1	62.1	62.1
Sales of cooking units - Gas (%)	37.9	37.9	37.9	37.9	37.9	37.9	37.9
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.676	0.631				

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 (%)	3.31	21.2	47.1	68.4	72	72.3	72.3
Sales of space heating units - Electric Resistance (%)	3.22	8.68	12.7	19.9	24.9	25.7	25.8
Sales of space heating units - Gas (%)	89.4	65.6	36.9	10.2	2.94	1.96	1.9
Sales of space heating units - Fossil (%)	4.12	4.58	3.35	1.41	0.205	0.017	0
Sales of water heating units - Electric Heat Pump (%)	0.114	0.273	0.269	0.271	0.272	0.271	0.272
Sales of water heating units - Electric Resistance (%)	2.92	6.72	6.66	6.66	6.69	6.67	6.68
Sales of water heating units - Gas (%)	94.5	88.7	88.7	88.7	88.7	88.7	88.7
Sales of water heating units - Other (%)	2.43	4.27	4.39	4.32	4.36	4.39	4.37
Sales of cooking units - Electric Resistance (%)	32	34.3	34.3	34.3	34.4	34.3	34.3
Sales of cooking units - Gas (%)	68	65.7	65.7	65.7	65.6	65.7	65.7
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		5,743	5,973				

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed thermal - Coal (MW)	11,355	7,514	3,640	3,640	3,640	3,640	0
Installed thermal - Natural gas (MW)	1,216	1,224	1,224	1,049	537	1,753	2,679
Installed thermal - Nuclear (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	10	15	19.9	26.4	34.1	42.9	53.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Installed renewables - Wind - Base land use assumptions (MW)	740	740	2,587	3,052	4,815	4,896	5,013

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

Item	2020	2025	2030	2035	2040	2045	2050
Solar - Base land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Base land use assumptions (GWh)	3,100	3,100	9,717	11,384	17,577	17,853	18,248
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)	-5.21		-10.5				-9.4
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.21		-2.17				-2.26
Business-as-usual carbon sink - Total (Mt CO2e/y)	-6.42		-12.7				-11.7

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-53.9
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-121
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-2,454
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-30.8
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-1,480
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-69.1
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-236
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-927
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-5,372
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-80.7
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-422
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-4,421
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-45.2
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-2,961
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-133
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,675

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-1,839
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-11,577
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-108
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-724
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-6,389
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-60.6
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-4,441
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-197
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							0
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-3,114
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-17,784
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-2,750
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							8.8
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							92.1
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							1,248
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							11.2
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)							9.87
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							15.3
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							552
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							1,937
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							13.2
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							95.1
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							2,253

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 - Improve plantations (1000 hectares)							16.8
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							111
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							1,111
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							3,614
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							17.6
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							98.1
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							3,258
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							22.3
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)							18.7
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							0
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							88.5
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							912
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							4,415