Net-Zero America - south dakota state report

2021-03-18

These data underlie graphs and tables presented in the Princeton Net-Zero America study:

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Notes

- These data are all data from the study available at https://netzeroamerica.princeton.edu.
- The Net-Zero America study describes five pathways to reach net-zero emissions and one "no new policies" reference scenario. In this document, state-level results are grouped by scenario. For some scenarios, the study generated national, but not state-level results.
- Within results for a given scenario, data tables are organized into corresponding sections of the full net-zero study (e.g., Pillar 1, Pillar 2, etc.)
- For Pillar 6 (Land sinks), values shown are maximum carbon storage potentials.

Data by category and subcategory

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

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,507	2,731				
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	4.48	7.71	30.2	77.8	86.2	86.8	86.8
Sales of space heating units - Electric Resistance (%)	7.28	5.82	8.4	12	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump (%)	1.15	1.83	14.5	42	46.9	47.2	47.2
Sales of water heating units - Electric Resistance (%)	9.7	8.05	20.3	47	51.8	52.1	52.1
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

Table 2: *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)		0.836	0.87	1.6	1.72	1.54	1.62

Table 3: *E+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.5	26.9	25.1	23.7	22.9
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

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

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.653	0.813				
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.73	12	35.6	81.1	89.5	90.1	89.6
Sales of space heating units - Electric Resistance (%)	18.5	23.6	18.7	8.06	6.1	6.05	6.33
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump (%)	0	0.703	9.63	29.2	32.7	32.9	33
Sales of water heating units - Electric Resistance (%)	41.1	57.1	59.9	65.9	67	67.1	67
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

Table 5: *E+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)		244	624	1,015	1,535	1,673	1,594
Public EV charging plugs - DC Fast (1000 units)	0.054		0.519		2.31		3.75
Public EV charging plugs - L2 (1000 units)	0.074		12.5		55.8		90.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 6: *E+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
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	0.023	0	0	0	0
Capital invested - Solar PV - Base (billion $2018)		0	0	0	0	0.094	0
Capital invested - Wind - Base (billion $2018)		0.537	4.5	4.27	2.85	6.72	12.7
Capital invested - Wind - Constrained (billion $2018)		1.93	4.75	8.88	18.1	29.2	41.3
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Rooftop PV (MW)	1.38	2.45	3.13	4.18	5.55	7.15	9.05
Installed renewables - Solar - Base land use assumptions (MW)	0	0	0	0	0	113	113
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	0	0	0	90	90
Installed renewables - Wind - Base land use assumptions (MW)	2,594	2,960	6,343	9,786	12,198	18,195	30,167
Installed renewables - Wind - Constrained land use assumptions (MW)	2,594	3,489	5,770	13,384	27,469	52,840	93,514

Table 7: *E+ 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 allam power plant (GWh)	0	0	0	0	0	0	0

Table 7: *E+ scenario - PILLAR 2: Clean Electricity - Generation (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass w/ccu power plant (GWh)	0	0	26	26	26	26	26
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	0	0	0	0	0	185	185
Solar - Constrained land use assumptions (GWh)	0	0	0	0	0	146	146
Wind - Base land use assumptions (GWh)	10,866	12,231	24,637	37,043	45,634	66,984	108,855
Wind - Constrained land use assumptions (GWh)	10,866	14,150	22,381	49,476	97,419	181,317	312,996

Table 8: *E+ scenario - PILLAR 3: Clean fuels - Bioenergy*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)		0	1.37	78.9	78.9	98.7	1,354
Conversion capital investment - Cumulative 5-yr (million $2018)		0	21.3	1,107	0	283	24,538
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	2	2	3	12
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 - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	1	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	0
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	0	10
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	1	1

Table 9: *E+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.03	1.45	1.45	1.81	20.4
Annual - BECCS (MMT)		0	0.03	1.45	1.45	1.81	20.4
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0.03	1.48	2.93	4.74	25.1
Cumulative - BECCS (MMT)		0	0.03	1.48	2.93	4.74	25.1
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

Table 10: *E+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	160	637	637	851	3,475
Cumulative investment - All (million $2018)		0	82.3	1,853	1,853	1,971	3,961
Cumulative investment - Spur (million $2018)		0	82.3	191	191	309	2,299
Cumulative investment - Trunk (million $2018)		0	0	1,662	1,662	1,662	1,662
Spur (km)		0	160	302	302	516	3,140
Trunk (km)		0	0	335	335	335	335

Table 11: *E+ scenario - PILLAR 4: CCUS - CO2 storage*

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	1.1	1.76	3.61	6.02	8.39
Injection wells (wells)		0	1	5	9	14	18
Resource characterization, appraisal, permitting costs (million $2020)		44.3	133	177	177	177	177
Wells and facilities construction costs (million $2020)		0	36.9	144	256	428	531

Table 12: *E+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-7,394
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-431
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-8,980
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-3,896
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-215
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-5,266
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							6,610
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							716
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							8,024
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							3,484
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							358
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							4,540

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3
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)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
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)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4

Table 13: *E+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5
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)							175
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 14: *E+ scenario - IMPACTS - Fossil fuel industries*

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		69.2	58.4	46.8	35.2	22.2	15.4
Natural gas consumption - Cumulative (tcf)							1,410
Natural gas production - Annual (tcf)		0.526	0.497	0.433	0.366	0.29	0.226
Oil consumption - Annual (million bbls)		26	23.4	19.3	15.3	12.1	9.45
Oil consumption - Cumulative (million bbls)							589
Oil production - Annual (million bbls)		1.65	1.66	1.65	1.31	1.06	0.708

Table 15: *E+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		42.7	0.033	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019$)		12.4	6.96	3.89	3.2	1.99	0.891
Monetary damages from air pollution - Transportation (million 2019$)		37.9	34.9	26.2	14.9	6.62	2.51
Premature deaths from air pollution - Coal (deaths)		4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)		1.4	0.785	0.44	0.361	0.225	0.101
Premature deaths from air pollution - Transportation (deaths)		4.26	3.93	2.95	1.67	0.744	0.282

Table 16: *E+ scenario - IMPACTS - Jobs*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		1,821	1,822	1,879	1,056	252	1,242
By economic sector - Construction (jobs)		2,383	3,423	5,290	4,971	6,712	11,980
By economic sector - Manufacturing (jobs)		2,681	3,033	3,657	3,137	2,500	4,114
By economic sector - Mining (jobs)		502	400	311	228	204	175

Table 16: *E+ scenario - IMPACTS - Jobs (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		174	279	400	454	654	1,077
By economic sector - Pipeline (jobs)		103	89.5	303	86.8	111	497
By economic sector - Professional (jobs)		1,674	2,468	3,439	3,651	4,891	9,469
By economic sector - Trade (jobs)		1,499	1,772	2,110	2,048	2,596	4,558
By economic sector - Utilities (jobs)		2,189	2,837	4,802	4,446	6,191	11,659
By education level - All sectors - Associates degree or some college (jobs)		3,550	4,569	6,609	6,148	7,728	14,138
By education level - All sectors - Bachelors degree (jobs)		2,449	3,097	4,278	4,048	5,035	9,332
By education level - All sectors - Doctoral degree (jobs)		86.3	118	161	162	210	399
By education level - All sectors - High school diploma or less (jobs)		6,337	7,559	10,063	8,678	9,819	18,435
By education level - All sectors - Masters or professional degree (jobs)		602	780	1,081	1,042	1,319	2,465
By resource sector - Biomass (jobs)		4,261	4,146	4,254	2,536	1,006	5,600
By resource sector - CO2 (jobs)		23.5	60.7	1,988	356	750	4,100
By resource sector - Coal (jobs)		60.9	0	0	0	0	0
By resource sector - Grid (jobs)		3,464	4,769	6,848	7,761	10,845	18,517
By resource sector - Natural Gas (jobs)		804	634	560	468	448	321
By resource sector - Nuclear (jobs)		0	0	0	0	0	0
By resource sector - Oil (jobs)		1,229	1,023	789	581	431	312
By resource sector - Solar (jobs)		522	613	897	930	917	1,173
By resource sector - Wind (jobs)		2,660	4,876	6,854	7,447	9,714	14,746
Median wages - Annual - All ($2019 per job)		53,946	55,470	57,237	59,079	61,497	62,411
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)		1,850	2,369	3,417	3,160	3,963	7,256
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)		722	954	1,428	1,326	1,734	3,187
On-Site or In-Plant Training - Total jobs - None (jobs)		2,065	2,583	3,563	3,260	3,938	7,335
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)		109	138	197	178	220	405
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)		8,279	10,079	13,585	12,154	14,256	26,586
On-the-Job Training - All sectors - 1 to 4 years (jobs)		2,288	2,970	4,349	4,055	5,156	9,421
On-the-Job Training - All sectors - 4 to 10 years (jobs)		680	913	1,392	1,301	1,722	3,160
On-the-Job Training - All sectors - None (jobs)		736	900	1,202	1,085	1,287	2,390
On-the-Job Training - All sectors - Over 10 years (jobs)		117	148	206	186	221	397
On-the-Job Training - All sectors - Up to 1 year (jobs)		9,203	11,191	15,043	13,451	15,724	29,401
Related work experience - All sectors - 1 to 4 years (jobs)		4,338	5,449	7,633	7,046	8,676	16,089
Related work experience - All sectors - 4 to 10 years (jobs)		2,662	3,411	4,877	4,552	5,718	10,515
Related work experience - All sectors - None (jobs)		2,017	2,446	3,331	2,939	3,460	6,487
Related work experience - All sectors - Over 10 years (jobs)		724	918	1,291	1,204	1,482	2,700
Related work experience - All sectors - Up to 1 year (jobs)		3,284	3,898	5,058	4,337	4,774	8,978
Wage income - All (million $2019)		703	894	1,270	1,186	1,483	2,794

Table 17: *E- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,507	2,735				
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric Heat Pump (%)	4.48	6.34	7.8	12.5	23.6	37.7	45.9
Sales of space heating units - Electric Resistance (%)	7.28	5.52	5.66	6.19	7.32	8.52	9.17
Sales of space heating units - Fossil (%)	6.1	2.55	2.51	2.23	1.76	1.38	1.26
Sales of space heating units - Gas Furnace (%)	82.1	85.6	84	79.1	67.3	52.4	43.6
Sales of water heating units - Electric Heat Pump (%)	1.15	1.12	1.94	4.67	11.3	19.6	24.5
Sales of water heating units - Electric Resistance (%)	9.7	7.35	8.16	10.8	17.2	25.3	30
Sales of water heating units - Gas Furnace (%)	87.4	90.5	88.9	83.6	70.7	54.3	44.7
Sales of water heating units - Other (%)	1.76	0.994	0.977	0.938	0.876	0.841	0.828

Table 18: *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)		0.676	0.691	0.924	0.965	1.37	1.46

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.9	28.2	27.4	26.7	26
Final energy use - Industry (PJ)	163	171	174	176	179	181	183
Final energy use - Residential (PJ)	41.4	39.1	37.4	35.9	34.3	32.5	30.6
Final energy use - Transportation (PJ)	91.5	86	78.8	73.1	68.9	64	58.1

Table 20: *E- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.651	0.8				
Sales of cooking units - Electric Resistance (%)	71.4	72.1	74.7	81.6	91.2	97.2	99.2
Sales of cooking units - Gas (%)	28.6	27.9	25.3	18.4	8.76	2.83	0.76
Sales of space heating units - Electric Heat Pump (%)	6.73	10.2	11.7	16.8	28.5	42.8	50.8
Sales of space heating units - Electric Resistance (%)	18.5	23.9	23.5	22.4	19.7	16.4	14.8
Sales of space heating units - Fossil (%)	15.6	21.7	21.5	20.2	17.1	13.7	12.1
Sales of space heating units - Gas (%)	59.2	44.2	43.2	40.6	34.7	27.1	22.3
Sales of water heating units - Electric Heat Pump (%)	0	0.211	0.789	2.72	7.4	13.3	16.8
Sales of water heating units - Electric Resistance (%)	41.1	57	57.1	57.5	59	60.8	61.9
Sales of water heating units - Gas Furnace (%)	58.8	42.8	42.1	39.7	33.6	25.8	21.3
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)		0	39.1	83.1	280	883	1,285
Public EV charging plugs - DC Fast (1000 units)	0.054		0.156		0.855		2.4
Public EV charging plugs - L2 (1000 units)	0.074		3.75		20.6		57.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.87	2.23	2.11	1.7	1.11	0.578	0.246
Vehicle sales - Light-duty - EV (%)	1.53	3.89	10.2	23.2	45.4	70	86.8
Vehicle sales - Light-duty - gasoline (%)	92.9	89	82.2	70.1	49.6	27	11.8
Vehicle sales - Light-duty - hybrid (%)	3.52	4.4	5	4.71	3.68	2.26	1.13
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.389	0.344	0.27	0.196	0.111	0.051
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.111	0.098	0.072	0.04	0.018
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 22: *E- scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-7,394
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-431
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-8,980
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-3,896
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-215
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-5,266
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							6,610
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							716

Table 22: *E- scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							8,024
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							3,484
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							358
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							4,540

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3
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)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
Land impacted for carbon sink potential - Low - Increase retention of HWP (1000 hectares)							0

Table 23: *E- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5
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)							175
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 24: *E- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		42.7	0.033	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019$)		12.4	6.24	3.13	1.74	0.805	0.566
Monetary damages from air pollution - Transportation (million 2019$)		38.4	38.2	36.8	32.7	25.7	17.4
Premature deaths from air pollution - Coal (deaths)		4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)		1.4	0.705	0.353	0.196	0.091	0.064
Premature deaths from air pollution - Transportation (deaths)		4.32	4.3	4.14	3.68	2.9	1.96

Table 25: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,507	2,731				
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	4.48	7.71	30.2	77.8	86.2	86.8	86.8
Sales of space heating units - Electric Resistance (%)	7.28	5.82	8.4	12	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump (%)	1.15	1.83	14.5	42	46.9	47.2	47.2
Sales of water heating units - Electric Resistance (%)	9.7	8.05	20.3	47	51.8	52.1	52.1
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

Table 26: *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)		0.836	0.87	1.6	1.72	1.54	1.62

Table 27: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.5	26.9	25.1	23.7	22.9
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

Table 28: *E+RE+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.653	0.813				
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.73	12	35.6	81.1	89.5	90.1	89.6
Sales of space heating units - Electric Resistance (%)	18.5	23.6	18.7	8.06	6.1	6.05	6.33
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump (%)	0	0.703	9.63	29.2	32.7	32.9	33
Sales of water heating units - Electric Resistance (%)	41.1	57.1	59.9	65.9	67	67.1	67
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

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

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)		244	624	1,015	1,535	1,673	1,594
Public EV charging plugs - DC Fast (1000 units)	0.054		0.519		2.31		3.75
Public EV charging plugs - L2 (1000 units)	0.074		12.5		55.8		90.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 30: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)		0	0	0.519	0.39	0	0.205
Capital invested - Wind - Base (billion $2018)		1.96	9.01	7.52	15	42.8	106
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	0	0	0	551	990	990	1,249
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	0	923	3,037	3,037	5,310
Installed renewables - Wind - Base land use assumptions (MW)	2,594	3,333	7,095	10,464	17,508	38,712	94,427
Installed renewables - Wind - Constrained land use assumptions (MW)	5,189	7,264	14,440	32,842	98,791	197,976	238,766

Table 31: *E+RE+ scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	0	0	0	891	1,599	1,599	2,016
Solar - Constrained land use assumptions (GWh)	0	0	0	1,490	4,906	4,906	8,536
Wind - Base land use assumptions (GWh)	10,866	13,612	27,384	39,464	64,553	137,999	326,260
Wind - Constrained land use assumptions (GWh)	21,733	29,339	55,232	119,596	340,197	659,621	788,137

Table 32: *E+RE+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-7,394
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-431
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-8,980
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-3,896
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-215
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-5,266
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							6,610
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							716
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							8,024
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							3,484
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							358
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							4,540

Table 33: *E+RE+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444

Table 33: *E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3

Table 33: *E+RE+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
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)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5
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)							175

Table 33: *E+RE+ 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)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 34: *E+RE+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		42.7	0.033	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019$)		11.4	6.21	2.38	1.72	0.867	0.496
Monetary damages from air pollution - Transportation (million 2019$)		37.9	34.9	26.2	14.9	6.62	2.51
Premature deaths from air pollution - Coal (deaths)		4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)		1.29	0.701	0.268	0.194	0.098	0.056
Premature deaths from air pollution - Transportation (deaths)		4.26	3.93	2.95	1.67	0.744	0.282

Table 35: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,507	2,731				
Sales of cooking units - Electric Resistance (%)	44.8	57.1	84	89.3	89.6	89.6	89.6
Sales of cooking units - Gas (%)	55.2	42.9	16	10.7	10.4	10.4	10.4
Sales of space heating units - Electric Heat Pump (%)	4.48	7.71	30.2	77.8	86.2	86.8	86.8
Sales of space heating units - Electric Resistance (%)	7.28	5.82	8.4	12	12.7	12.7	12.7
Sales of space heating units - Fossil (%)	6.1	2.18	0.424	0.018	0	0	0
Sales of space heating units - Gas Furnace (%)	82.1	84.3	61	10.1	1.04	0.469	0.47
Sales of water heating units - Electric Heat Pump (%)	1.15	1.83	14.5	42	46.9	47.2	47.2
Sales of water heating units - Electric Resistance (%)	9.7	8.05	20.3	47	51.8	52.1	52.1
Sales of water heating units - Gas Furnace (%)	87.4	89.2	64.4	10.3	0.61	0	0
Sales of water heating units - Other (%)	1.76	0.95	0.735	0.688	0.684	0.687	0.687

Table 36: *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)		0.836	0.87	1.6	1.72	1.54	1.62

Table 37: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.5	26.9	25.1	23.7	22.9

Table 37: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Overview (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Industry (PJ)	163	170	174	174	176	178	179
Final energy use - Residential (PJ)	41.4	39	36.9	32.9	28.4	24.9	22.5
Final energy use - Transportation (PJ)	91.4	85.5	75.8	64.3	53.8	47.5	44.9

Table 38: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.653	0.813				
Sales of cooking units - Electric Resistance (%)	71.5	77.5	96.2	99.8	100	100	100
Sales of cooking units - Gas (%)	28.5	22.5	3.84	0.193	0	0	0
Sales of space heating units - Electric Heat Pump (%)	6.73	12	35.6	81.1	89.5	90.1	89.6
Sales of space heating units - Electric Resistance (%)	18.5	23.6	18.7	8.06	6.1	6.05	6.33
Sales of space heating units - Fossil (%)	15.6	21.1	15.1	5.2	3.21	2.91	3.1
Sales of space heating units - Gas (%)	59.2	43.3	30.6	5.66	1.24	0.955	0.922
Sales of water heating units - Electric Heat Pump (%)	0	0.703	9.63	29.2	32.7	32.9	33
Sales of water heating units - Electric Resistance (%)	41.1	57.1	59.9	65.9	67	67.1	67
Sales of water heating units - Gas Furnace (%)	58.8	42.1	30.5	4.89	0.289	0	0
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

Table 39: *E+RE- scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)		244	624	1,015	1,535	1,673	1,594
Public EV charging plugs - DC Fast (1000 units)	0.054		0.519		2.31		3.75
Public EV charging plugs - L2 (1000 units)	0.074		12.5		55.8		90.3
Vehicle sales - Heavy-duty - diesel (%)	97.2	92.1	67	23.3	4.22	0.628	0
Vehicle sales - Heavy-duty - EV (%)	0.588	3.81	19	45.6	57.4	59.6	60
Vehicle sales - Heavy-duty - gasoline (%)	0.227	0.227	0.176	0.066	0.013	0.002	0
Vehicle sales - Heavy-duty - hybrid (%)	0.082	0.09	0.077	0.031	0.007	0.001	0
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.392	2.54	12.7	30.4	38.2	39.7	40
Vehicle sales - Heavy-duty - other (%)	1.5	1.23	1.07	0.568	0.163	0.038	0
Vehicle sales - Light-duty - diesel (%)	1.86	2.08	1.38	0.446	0.08	0.013	0
Vehicle sales - Light-duty - EV (%)	2.89	12.1	41.5	79.8	96.1	99.3	100
Vehicle sales - Light-duty - gasoline (%)	91.6	81.6	53.9	18.5	3.55	0.598	0
Vehicle sales - Light-duty - hybrid (%)	3.42	3.82	2.86	1.1	0.261	0.055	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.357	0.228	0.072	0.014	0.002	0
Vehicle sales - Light-duty - other (%)	0.116	0.112	0.076	0.027	0.005	0.001	0
Vehicle sales - Medium-duty - diesel (%)	64.7	59.7	42.3	14.4	2.59	0.384	0
Vehicle sales - Medium-duty - EV (%)	0.784	5.07	25.3	60.8	76.5	79.5	80
Vehicle sales - Medium-duty - gasoline (%)	33.7	33.3	25.5	9.32	1.77	0.277	0
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.402	0.341	0.14	0.03	0.005	0
Vehicle sales - Medium-duty - hydrogen FC (%)	0.196	1.27	6.33	15.2	19.1	19.9	20
Vehicle sales - Medium-duty - other (%)	0.253	0.255	0.205	0.083	0.019	0.004	0

Table 40: *E+RE- scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
Capital invested - Solar PV - Base (billion $2018)		0	0	0	0	0.075	0
Capital invested - Wind - Base (billion $2018)		0	1.36	3.83	2.22	1.94	0.034
Capital invested - Wind - Constrained (billion $2018)		0.574	1.01	3.01	5	6.14	0.24
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Solar - Base land use assumptions (MW)	0	0	0	0	0	90	90
Installed renewables - Solar - Constrained land use assumptions (MW)	0	0	0	0	0	0	0
Installed renewables - Wind - Base land use assumptions (MW)	2,594	2,594	3,613	6,703	8,586	10,312	10,343
Installed renewables - Wind - Constrained land use assumptions (MW)	2,594	2,985	3,745	6,173	10,407	15,879	16,106

Table 41: *E+RE- scenario - PILLAR 2: Clean Electricity - Generation*

Item	2020	2025	2030	2035	2040	2045	2050
OffshoreWind - Base land use assumptions (GWh)	0	0	0	0	0	0	0
OffshoreWind - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Solar - Base land use assumptions (GWh)	0	0	0	0	0	146	146
Solar - Constrained land use assumptions (GWh)	0	0	0	0	0	0	0
Wind - Base land use assumptions (GWh)	10,866	10,866	14,642	25,959	32,751	38,916	39,030
Wind - Constrained land use assumptions (GWh)	10,866	12,309	15,073	23,841	39,056	57,935	58,698

Table 42: *E+RE- scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-7,394
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-431
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-8,980
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,155
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-3,896
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-215
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-5,266
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							699

Table 42: *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)							6,610
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							716
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							8,024
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							699
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							3,484
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							358
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							4,540

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3
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)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7

Table 43: *E+RE- scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
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)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5
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)							175
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 44: *E+RE- scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		42.7	0.033	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019$)		12.6	6.82	7.01	6.05	2.7	1.01
Monetary damages from air pollution - Transportation (million 2019$)		37.9	34.9	26.2	14.9	6.62	2.51
Premature deaths from air pollution - Coal (deaths)		4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)		1.42	0.77	0.791	0.683	0.305	0.114
Premature deaths from air pollution - Transportation (deaths)		4.26	3.93	2.95	1.67	0.744	0.282

Table 45: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,507	2,735				
Sales of cooking units - Electric Resistance (%)	44.8	49.3	53.1	63	76.9	85.5	88.5
Sales of cooking units - Gas (%)	55.2	50.7	46.9	37	23.1	14.5	11.5
Sales of space heating units - Electric Heat Pump (%)	4.48	6.34	7.8	12.5	23.6	37.7	45.9
Sales of space heating units - Electric Resistance (%)	7.28	5.52	5.66	6.19	7.32	8.52	9.17
Sales of space heating units - Fossil (%)	6.1	2.55	2.51	2.23	1.76	1.38	1.26
Sales of space heating units - Gas Furnace (%)	82.1	85.6	84	79.1	67.3	52.4	43.6
Sales of water heating units - Electric Heat Pump (%)	1.15	1.12	1.94	4.67	11.3	19.6	24.5
Sales of water heating units - Electric Resistance (%)	9.7	7.35	8.16	10.8	17.2	25.3	30
Sales of water heating units - Gas Furnace (%)	87.4	90.5	88.9	83.6	70.7	54.3	44.7
Sales of water heating units - Other (%)	1.76	0.994	0.977	0.938	0.876	0.841	0.828

Table 46: *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)		0.676	0.691	0.924	0.965	1.37	1.46

Table 47: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	29.7	28.9	28.2	27.4	26.7	26
Final energy use - Industry (PJ)	163	171	174	176	179	181	183
Final energy use - Residential (PJ)	41.4	39.1	37.4	35.9	34.3	32.5	30.6
Final energy use - Transportation (PJ)	91.5	86	78.8	73.1	68.9	64	58.1

Table 48: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.651	0.8				
Sales of cooking units - Electric Resistance (%)	71.4	72.1	74.7	81.6	91.2	97.2	99.2
Sales of cooking units - Gas (%)	28.6	27.9	25.3	18.4	8.76	2.83	0.76
Sales of space heating units - Electric Heat Pump (%)	6.73	10.2	11.7	16.8	28.5	42.8	50.8
Sales of space heating units - Electric Resistance (%)	18.5	23.9	23.5	22.4	19.7	16.4	14.8
Sales of space heating units - Fossil (%)	15.6	21.7	21.5	20.2	17.1	13.7	12.1
Sales of space heating units - Gas (%)	59.2	44.2	43.2	40.6	34.7	27.1	22.3
Sales of water heating units - Electric Heat Pump (%)	0	0.211	0.789	2.72	7.4	13.3	16.8
Sales of water heating units - Electric Resistance (%)	41.1	57	57.1	57.5	59	60.8	61.9
Sales of water heating units - Gas Furnace (%)	58.8	42.8	42.1	39.7	33.6	25.8	21.3
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.033

Table 49: *E-B+ scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Light-duty vehicle capital costs - Cumulative 5-yr (million $2018)		0	39.1	83.1	280	883	1,285
Public EV charging plugs - DC Fast (1000 units)	0.054		0.156		0.855		2.4
Public EV charging plugs - L2 (1000 units)	0.074		3.75		20.6		57.9
Vehicle sales - Heavy-duty - diesel (%)	97.4	96	91.3	79.8	58.2	32.1	13.7
Vehicle sales - Heavy-duty - EV (%)	0.498	1.45	4.11	10.8	23.6	39.5	51
Vehicle sales - Heavy-duty - gasoline (%)	0.228	0.236	0.239	0.225	0.179	0.109	0.051
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.094	0.104	0.107	0.092	0.06	0.03
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.332	0.969	2.74	7.17	15.7	26.3	34
Vehicle sales - Heavy-duty - other (%)	1.5	1.28	1.46	1.95	2.25	1.96	1.14
Vehicle sales - Light-duty - diesel (%)	1.87	2.23	2.11	1.7	1.11	0.578	0.246
Vehicle sales - Light-duty - EV (%)	1.53	3.89	10.2	23.2	45.4	70	86.8
Vehicle sales - Light-duty - gasoline (%)	92.9	89	82.2	70.1	49.6	27	11.8
Vehicle sales - Light-duty - hybrid (%)	3.52	4.4	5	4.71	3.68	2.26	1.13
Vehicle sales - Light-duty - hydrogen FC (%)	0.114	0.389	0.344	0.27	0.196	0.111	0.051
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.111	0.098	0.072	0.04	0.018
Vehicle sales - Medium-duty - diesel (%)	64.8	62.2	57.7	49.4	35.6	19.6	8.37
Vehicle sales - Medium-duty - EV (%)	0.664	1.94	5.49	14.3	31.4	52.6	68
Vehicle sales - Medium-duty - gasoline (%)	33.8	34.7	34.7	31.9	24.4	14.2	6.33
Vehicle sales - Medium-duty - hybrid (%)	0.363	0.418	0.464	0.478	0.414	0.275	0.141
Vehicle sales - Medium-duty - hydrogen FC (%)	0.166	0.485	1.37	3.58	7.86	13.2	17
Vehicle sales - Medium-duty - other (%)	0.253	0.266	0.279	0.286	0.258	0.184	0.102

Table 50: *E-B+ scenario - PILLAR 2: Clean Electricity - Generating capacity*

Item	2020	2025	2030	2035	2040	2045	2050
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	0.03	0	0	0	0

Table 51: *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 allam power plant (GWh)	0	0	0	0	0	0	0
Biomass w/ccu power plant (GWh)	0	0	34	34	34	34	34

Table 52: *E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy*

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)		0	2.19	190	243	1,415	1,991
Conversion capital investment - Cumulative 5-yr (million $2018)		0	28	2,268	651	14,187	7,387
Number of facilities - Allam power w ccu (quantity)	0	0	0	0	0	0	0
Number of facilities - Beccs hydrogen (quantity)	0	0	0	3	4	19	19
Number of facilities - Diesel (quantity)	0	0	0	0	0	0	0
Number of facilities - Diesel ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Power (quantity)	0	0	0	0	0	0	0
Number of facilities - Power ccu (quantity)	0	0	1	1	1	1	1
Number of facilities - Pyrolysis (quantity)	0	0	0	0	0	0	8

Table 52: *E-B+ scenario - PILLAR 3: Clean fuels - Bioenergy (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	0	0	1	1
Number of facilities - Sng (quantity)	0	0	0	0	0	0	0
Number of facilities - Sng ccu (quantity)	0	0	1	1	1	2	2

Table 53: *E-B+ scenario - PILLAR 4: CCUS - CO2 capture*

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.03	2.95	3.79	22	22.3
Annual - BECCS (MMT)		0	0.03	2.95	3.79	22	22.3
Annual - Cement and lime (MMT)		0	0	0	0	0	0
Annual - NGCC (MMT)		0	0	0	0	0	0
Cumulative - All (MMT)		0	0.03	2.98	6.77	28.8	51.1
Cumulative - BECCS (MMT)		0	0.03	2.98	6.77	28.8	51.1
Cumulative - Cement and lime (MMT)		0	0	0	0	0	0
Cumulative - NGCC (MMT)		0	0	0	0	0	0

Table 54: *E-B+ scenario - PILLAR 4: CCUS - CO2 pipelines*

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	125	707	845	2,492	2,422
Cumulative investment - All (million $2018)		0	64	2,061	2,139	3,632	3,611
Cumulative investment - Spur (million $2018)		0	64	295	373	1,866	1,845
Cumulative investment - Trunk (million $2018)		0	0	1,766	1,766	1,766	1,766
Spur (km)		0	125	372	511	2,157	2,087
Trunk (km)		0	0	335	335	335	335

Table 55: *E-B+ scenario - PILLAR 4: CCUS - CO2 storage*

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	1.85	6.42	13.1	18.7	19.2
Injection wells (wells)		0	3	12	22	37	46
Resource characterization, appraisal, permitting costs (million $2020)		44.3	204	319	319	319	319
Wells and facilities construction costs (million $2020)		0	95.8	373	666	1,113	1,382

Table 56: *E-B+ scenario - PILLAR 6: Land sinks - Agriculture*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,508
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-7,051
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 - Permanent conservation cover (1000 tCO2e/y)							-406
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-8,966

Table 56: *E-B+ scenario - PILLAR 6: Land sinks - Agriculture (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							-1,508
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-3,715
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 - Permanent conservation cover (1000 tCO2e/y)							-203
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-5,426
Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares)							1,080
Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares)							15,438
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							16.4
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							84.8
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							676
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							17,295
Land impacted for carbon sink - Moderate deployment - Corn-ethanol to energy grasses (1000 hectares)							1,080
Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares)							3,295
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							16.4
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							84.8
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							338
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							4,814

Table 57: *E-B+ scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771

Table 57: *E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104

Table 57: *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)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3
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)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
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)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5

Table 57: *E-B+ scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							175
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 58: *E-B+ scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		42.7	0.033	0.033	0.024	0.015	0
Monetary damages from air pollution - Natural Gas (million 2019$)		12	5.69	3.56	2.53	1.31	0.584
Monetary damages from air pollution - Transportation (million 2019$)		38.4	38.2	36.8	32.7	25.7	17.4
Premature deaths from air pollution - Coal (deaths)		4.82	0.004	0.004	0.003	0.002	0
Premature deaths from air pollution - Natural Gas (deaths)		1.35	0.642	0.401	0.286	0.148	0.066
Premature deaths from air pollution - Transportation (deaths)		4.32	4.3	4.14	3.68	2.9	1.96

Table 59: *REF scenario - PILLAR 1: Efficiency/Electrification - Commercial*

Item	2020	2025	2030	2035	2040	2045	2050
Commercial HVAC investment in 2020s - Cumulative 5-yr (million $2018)		2,478	2,548				
Sales of cooking units - Electric Resistance (%)	44.8	47.8	47.9	47.8	47.9	47.9	48
Sales of cooking units - Gas (%)	55.2	52.2	52.1	52.2	52.1	52.1	52
Sales of space heating units - Electric Heat Pump (%)	4.48	13.1	44.5	70.3	74.5	75	75
Sales of space heating units - Electric Resistance (%)	7.28	6.37	10.8	18.4	23.7	24.5	24.5
Sales of space heating units - Fossil (%)	6.1	2.47	1.92	0.869	0.131	0.011	0
Sales of space heating units - Gas Furnace (%)	82.1	78.1	42.8	10.4	1.7	0.533	0.471
Sales of water heating units - Electric Heat Pump (%)	1.15	0.821	0.819	0.82	0.818	0.815	0.812
Sales of water heating units - Electric Resistance (%)	9.7	7.06	7.08	7.05	7.05	7.05	7.05
Sales of water heating units - Gas Furnace (%)	87.4	91.1	91.1	91.1	91.1	91.1	91.1
Sales of water heating units - Other (%)	1.76	0.999	0.996	0.994	0.992	0.996	0.997

Table 60: *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)		0.688	0.705	0.782	0.806	0.832	0.856

Table 61: *REF scenario - PILLAR 1: Efficiency/Electrification - Overview*

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	30.2	30.3	30.4	30.1	29.9	30.1	31
Final energy use - Industry (PJ)	163	172	176	178	183	186	191
Final energy use - Residential (PJ)	41.4	39.2	38.1	37.3	36.9	36.9	36.9
Final energy use - Transportation (PJ)	91.4	86.1	79.4	75.5	75.4	77.5	80.1

Table 62: *REF scenario - PILLAR 1: Efficiency/Electrification - Residential*

Item	2020	2025	2030	2035	2040	2045	2050
Residential HVAC investment in 2020s vs. REF - Cumulative 5-yr (billion $2018)		0.63	0.659				
Sales of cooking units - Electric Resistance (%)	71.1	71.1	71.1	71.1	71.1	71.1	71.1
Sales of cooking units - Gas (%)	28.9	28.9	28.9	28.9	28.9	28.9	28.9
Sales of space heating units - Electric Heat Pump (%)	5.86	14.1	14.5	15	15.7	16.5	17.4
Sales of space heating units - Electric Resistance (%)	18.7	23	22.7	22.5	21.9	21.1	20.3
Sales of space heating units - Fossil (%)	15.7	20.1	19.3	18.7	18.3	18	18.2
Sales of space heating units - Gas (%)	59.7	42.8	43.5	43.8	44.2	44.4	44
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	41.1	56.9	56.9	56.7	56.6	56.6	56.5
Sales of water heating units - Gas Furnace (%)	58.8	43.1	43.1	43.3	43.4	43.4	43.5
Sales of water heating units - Other (%)	0.032	0.033	0.033	0.033	0.033	0.033	0.034

Table 63: *REF scenario - PILLAR 1: Efficiency/Electrification - Transportation*

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Heavy-duty - diesel (%)	98.1	98.2	97.9	97	95.6	93.5	91.6
Vehicle sales - Heavy-duty - EV (%)	0	0	0	0	0	0	0
Vehicle sales - Heavy-duty - gasoline (%)	0.229	0.242	0.257	0.274	0.294	0.317	0.343
Vehicle sales - Heavy-duty - hybrid (%)	0.083	0.096	0.112	0.13	0.15	0.174	0.202
Vehicle sales - Heavy-duty - hydrogen FC (%)	0.119	0.138	0.16	0.186	0.216	0.25	0.29
Vehicle sales - Heavy-duty - other (%)	1.51	1.31	1.57	2.37	3.69	5.71	7.57
Vehicle sales - Light-duty - diesel (%)	1.86	2.23	2.24	2.08	1.89	1.76	1.68
Vehicle sales - Light-duty - EV (%)	2.54	4.29	4.93	5.97	7.34	8.69	9.8
Vehicle sales - Light-duty - gasoline (%)	91.9	88.6	87	85.6	83.8	81.8	80.1
Vehicle sales - Light-duty - hybrid (%)	3.43	4.34	5.33	5.92	6.55	7.26	7.93
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.388	0.364	0.328	0.328	0.332	0.343
Vehicle sales - Light-duty - other (%)	0.116	0.12	0.117	0.118	0.118	0.118	0.121
Vehicle sales - Medium-duty - diesel (%)	65.2	63.5	61.6	59.6	58	56.5	55.2
Vehicle sales - Medium-duty - EV (%)	0.027	0.105	0.329	0.671	0.895	0.973	0.993
Vehicle sales - Medium-duty - gasoline (%)	34	35.5	37	38.5	39.7	40.8	41.7
Vehicle sales - Medium-duty - hybrid (%)	0.365	0.427	0.496	0.577	0.674	0.793	0.929
Vehicle sales - Medium-duty - hydrogen FC (%)	0.175	0.208	0.242	0.285	0.339	0.409	0.487
Vehicle sales - Medium-duty - other (%)	0.255	0.271	0.298	0.345	0.42	0.528	0.671

Table 64: *REF scenario - PILLAR 6: Land sinks - Forests*

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - High - Accelerate regeneration (1000 tCO2e/y)							-378
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-14,326
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-771
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-301
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-41.4
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-444
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,415
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-4,571
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-4,746
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-658
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-190
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-4,315
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-129
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-115
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-21.1
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-148
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-845
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-2,286
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-360
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-222
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-284
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-9,320
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-450
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-208
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-30.9
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-296
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,630
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-3,429
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-2,553
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-440

Table 64: *REF scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							61.9
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							104
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							153
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							15.3
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)							229
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							302
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							135
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							218
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							1,219
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							31
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							98
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							58.7
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							7.63
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)							121
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							151
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							23.4
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							132
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							622
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							46.4

Table 64: *REF scenario - PILLAR 6: Land sinks - Forests (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							101
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							106
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							11.5
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)							175
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							227
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							169
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							266
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							1,102

Table 65: *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)	-2.82		0.391				0.112
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-0.121		-0.251				-0.264
Business-as-usual carbon sink - Total (Mt CO2e/y)	-2.94		0.14				-0.152

Table 66: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		131	63.7	40.8	32	27.8	26.8
Monetary damages from air pollution - Natural Gas (million 2019$)		13.9	13	13.6	9.39	7.66	6.66
Monetary damages from air pollution - Transportation (million 2019$)		38.5	38.8	39.2	39.8	40.4	41
Premature deaths from air pollution - Coal (deaths)		14.8	7.2	4.6	3.61	3.14	3.02
Premature deaths from air pollution - Natural Gas (deaths)		1.57	1.46	1.54	1.06	0.865	0.751
Premature deaths from air pollution - Transportation (deaths)		4.33	4.37	4.41	4.48	4.54	4.61