Net-Zero America - california 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)		120,478	131,958				
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas Furnace (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635

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)		27.7	36.5				
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83

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)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452
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 (%)	1.18	1.49	1.11	0.353	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.15	19	52	84	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	87.8	73.7	43	14.3	3	0.581	0
Vehicle sales - Light-duty - hybrid (%)	5.63	5.42	3.61	1.3	0.323	0.072	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.108	0.318	0.174	0.052	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.085	0.08	0.049	0.017	0.003	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	0.007	0.811	0	0.169	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.073	0.003	0.003	0.022
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	0.556	0.001	0	0	0
Capital invested - Offshore Wind - Base (billion $2018)		0.292	0	0	0.987	1.09	7.32
Capital invested - Offshore Wind - Constrained (billion $2018)		0.153	0	0.119	0.769	1.26	6.35
Capital invested - Solar PV - Base (billion $2018)		4.1	10.5	19.8	29.2	38.6	39.9
Capital invested - Solar PV - Constrained (billion $2018)		13.6	9.2	26.8	27.8	30.2	38.8
Capital invested - Wind - Base (billion $2018)		0	0	0	0.06	0.103	0
Capital invested - Wind - Constrained (billion $2018)		0.068	0	0.657	1.24	0.43	0.3
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	76.3	76.3	76.3	563	1,229	6,753
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	76.3	76.3	76.3	563	1,229	6,753
Installed renewables - Rooftop PV (MW)	10,012	15,483	20,658	26,842	34,107	42,472	52,234
Installed renewables - Solar - Base land use assumptions (MW)	27,682	31,271	41,520	62,501	95,382	141,409	191,884
Installed renewables - Solar - Constrained land use assumptions (MW)	26,547	28,482	37,106	59,388	100,979	136,923	189,743
Installed renewables - Wind - Base land use assumptions (MW)	7,083	7,083	7,083	7,083	7,123	7,193	7,193
Installed renewables - Wind - Constrained land use assumptions (MW)	7,217	7,252	7,252	7,903	8,613	8,866	10,363

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass power plant (GWh)	0	13.5	1,606	1,606	1,952	1,952	1,952
Biomass w/ccu allam power plant (GWh)	0	0	0	72.5	75.5	78.9	101
Biomass w/ccu power plant (GWh)	0	0	624	625	625	625	625
OffshoreWind - Base land use assumptions (GWh)	0	418	418	418	3,109	6,763	37,067
OffshoreWind - Constrained land use assumptions (GWh)	0	418	418	418	3,109	6,763	37,067
Solar - Base land use assumptions (GWh)	66,975	74,628	96,427	139,989	204,029	291,499	388,310
Solar - Constrained land use assumptions (GWh)	64,339	68,428	86,888	131,184	210,139	277,511	377,239
Wind - Base land use assumptions (GWh)	28,124	28,124	28,124	28,124	28,259	28,498	28,498
Wind - Constrained land use assumptions (GWh)	28,240	28,364	28,364	30,135	31,893	32,448	35,314

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)		8.07	113	386	525	652	722
Conversion capital investment - Cumulative 5-yr (million $2018)		7.67	1,415	7,867	3,886	3,650	2,020
Number of facilities - Allam power w ccu (quantity)	0	0	0	4	5	6	7
Number of facilities - Beccs hydrogen (quantity)	0	0	0	8	14	18	21
Number of facilities - Diesel (quantity)	0	0	0	1	1	1	1
Number of facilities - Diesel ccu (quantity)	0	0	0	4	6	7	8
Number of facilities - Power (quantity)	0	1	1	1	2	2	2
Number of facilities - Power ccu (quantity)	0	0	4	6	6	6	6
Number of facilities - Pyrolysis (quantity)	0	0	0	1	1	1	1
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	4	6	7	8
Number of facilities - Sng (quantity)	0	1	1	1	1	1	1
Number of facilities - Sng ccu (quantity)	0	0	4	4	4	4	4

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	0.75	26.1	37.5	49.8	57.6
Annual - BECCS (MMT)		0	0.62	10.6	15.3	20	22.5
Annual - Cement and lime (MMT)		0	0	6.71	9.95	13.7	14.1
Annual - NGCC (MMT)		0	0.13	8.85	12.3	16.2	21
Cumulative - All (MMT)		0	0.75	26.9	64.4	114	172
Cumulative - BECCS (MMT)		0	0.62	11.2	26.5	46.5	69
Cumulative - Cement and lime (MMT)		0	0	6.71	16.7	30.4	44.5
Cumulative - NGCC (MMT)		0	0.13	8.98	21.3	37.4	58.4

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	2,083	4,688	5,992	6,553	7,748
Cumulative investment - All (million $2018)		0	5,343	7,698	8,531	8,996	9,769
Cumulative investment - Spur (million $2018)		0	423	2,013	2,845	3,310	4,083
Cumulative investment - Trunk (million $2018)		0	4,920	5,686	5,686	5,686	5,686
Spur (km)		0	798	3,159	4,463	5,023	6,219
Trunk (km)		0	1,285	1,529	1,529	1,529	1,529

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	28.2	41.6	53.4	80.1
Injection wells (wells)		0	0	62	92	122	174
Resource characterization, appraisal, permitting costs (million $2020)		250	900	1,370	1,370	1,370	1,370
Wells and facilities construction costs (million $2020)		0	0	1,860	2,760	3,660	5,220

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)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,082
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
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)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887
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)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962

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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240

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)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460

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)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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

Item	2020	2025	2030	2035	2040	2045	2050
Natural gas consumption - Annual (tcf)		1,654	1,394	1,118	842	530	367
Natural gas consumption - Cumulative (tcf)							33,681
Natural gas production - Annual (tcf)		236	223	194	164	130	101
Oil consumption - Annual (million bbls)		546	474	371	277	202	142
Oil consumption - Cumulative (million bbls)							11,511
Oil production - Annual (million bbls)		222	223	223	177	143	95.5

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		251	0.33	0.328	0.172	0.099	0
Monetary damages from air pollution - Natural Gas (million 2019$)		2,148	1,204	1,078	930	524	234
Monetary damages from air pollution - Transportation (million 2019$)		31,487	29,710	22,808	13,295	6,015	2,235
Premature deaths from air pollution - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Natural Gas (deaths)		242	136	122	105	59.2	26.4
Premature deaths from air pollution - Transportation (deaths)		3,541	3,341	2,565	1,495	676	251

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Agriculture (jobs)		807	1,386	1,883	1,859	1,653	1,456
By economic sector - Construction (jobs)		58,143	61,482	76,374	88,452	98,058	134,483
By economic sector - Manufacturing (jobs)		45,728	65,320	80,973	73,649	64,840	72,019
By economic sector - Mining (jobs)		32,912	26,356	20,984	13,552	9,002	5,320

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

Item	2020	2025	2030	2035	2040	2045	2050
By economic sector - Other (jobs)		7,993	9,224	12,621	16,586	20,593	33,114
By economic sector - Pipeline (jobs)		2,738	3,005	2,338	1,855	1,425	1,184
By economic sector - Professional (jobs)		27,553	28,474	35,760	40,983	46,258	64,799
By economic sector - Trade (jobs)		23,488	23,021	26,403	29,088	32,630	46,719
By economic sector - Utilities (jobs)		32,003	34,620	51,426	61,771	69,870	89,340
By education level - All sectors - Associates degree or some college (jobs)		70,243	77,778	96,475	103,858	110,069	144,679
By education level - All sectors - Bachelors degree (jobs)		50,531	53,560	63,482	65,655	68,043	87,443
By education level - All sectors - Doctoral degree (jobs)		1,724	1,739	2,039	2,180	2,344	3,146
By education level - All sectors - High school diploma or less (jobs)		96,899	107,379	131,958	140,501	147,387	191,596
By education level - All sectors - Masters or professional degree (jobs)		11,968	12,431	14,808	15,603	16,484	21,570
By resource sector - Biomass (jobs)		2,736	3,641	5,139	5,465	6,045	6,279
By resource sector - CO2 (jobs)		127	5,222	3,730	3,209	3,425	4,510
By resource sector - Coal (jobs)		21.8	7.3	0	0	0	0
By resource sector - Grid (jobs)		43,985	50,184	87,779	109,695	127,593	169,013
By resource sector - Natural Gas (jobs)		24,459	18,978	17,499	16,093	13,996	11,074
By resource sector - Nuclear (jobs)		691	0	0	0	0	0
By resource sector - Oil (jobs)		74,368	64,969	55,609	40,007	29,393	18,443
By resource sector - Solar (jobs)		68,196	77,935	106,739	126,628	145,178	216,773
By resource sector - Wind (jobs)		16,781	31,953	32,267	26,700	18,699	22,341
Median wages - Annual - All ($2019 per job)		69,497	69,307	70,110	71,266	72,596	73,492
On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs)		37,209	40,698	50,024	53,579	56,579	73,861
On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs)		14,870	15,777	19,442	21,444	23,178	30,715
On-Site or In-Plant Training - Total jobs - None (jobs)		37,707	41,275	50,239	53,265	55,918	73,204
On-Site or In-Plant Training - Total jobs - Over 10 years (jobs)		1,828	2,029	2,555	2,796	2,995	3,942
On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs)		139,752	153,108	186,502	196,711	205,658	266,711
On-the-Job Training - All sectors - 1 to 4 years (jobs)		47,534	51,906	63,890	68,631	72,629	94,966
On-the-Job Training - All sectors - 4 to 10 years (jobs)		14,161	15,087	18,811	21,043	22,953	30,703
On-the-Job Training - All sectors - None (jobs)		12,946	13,902	16,732	17,755	18,731	24,717
On-the-Job Training - All sectors - Over 10 years (jobs)		2,389	2,670	3,210	3,335	3,424	4,419
On-the-Job Training - All sectors - Up to 1 year (jobs)		154,335	169,324	206,119	217,032	226,592	293,629
Related work experience - All sectors - 1 to 4 years (jobs)		84,169	91,353	111,035	117,537	123,350	160,232
Related work experience - All sectors - 4 to 10 years (jobs)		53,830	58,408	71,122	75,508	79,360	103,194
Related work experience - All sectors - None (jobs)		32,643	35,839	44,108	47,296	50,040	65,548
Related work experience - All sectors - Over 10 years (jobs)		14,741	16,179	19,619	20,444	21,152	27,138
Related work experience - All sectors - Up to 1 year (jobs)		45,982	51,108	62,878	67,011	70,425	92,321
Wage income - All (million $2019)		16,081	17,529	21,650	23,364	25,001	32,962

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)		120,137	130,140				
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Sales of space heating units - Electric Heat Pump (%)	1.74	13	17.8	31.6	53.4	68.7	74.5
Sales of space heating units - Electric Resistance (%)	11.4	13.3	14	15.8	18.8	21.2	22.2
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	86.9	73.7	68.3	52.6	27.8	10.2	3.31
Sales of water heating units - Electric Heat Pump (%)	0.63	2.65	7.89	23	46.1	61.3	66.6
Sales of water heating units - Electric Resistance (%)	2.03	3.16	5.36	11.7	21.4	27.8	30.1
Sales of water heating units - Gas Furnace (%)	96.8	93.6	86.1	64.7	31.8	10.2	2.7
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		9.31	9.32	16.2	17	25.6	27.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	800	806	802	788	770	759
Final energy use - Industry (PJ)	1,021	1,058	1,081	1,146	1,217	1,253	1,293
Final energy use - Residential (PJ)	878	825	766	706	626	537	459
Final energy use - Transportation (PJ)	3,060	2,970	2,767	2,590	2,445	2,267	2,054

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)		27.5	36.2				
Sales of cooking units - Electric Resistance (%)	39.8	41.4	46.9	61.4	81.6	94.1	98.4
Sales of cooking units - Gas (%)	60.2	58.6	53.1	38.6	18.4	5.94	1.6
Sales of space heating units - Electric Heat Pump (%)	5.99	14.3	19.7	35.3	59.2	74.8	80.3
Sales of space heating units - Electric Resistance (%)	16.4	25.3	24.3	21.5	17.3	14.5	13.6
Sales of space heating units - Fossil (%)	3.33	6.29	6.05	5.3	4.13	3.36	3.07
Sales of space heating units - Gas (%)	74.3	54.1	50	38	19.4	7.29	3.04
Sales of water heating units - Electric Heat Pump (%)	0	1.93	7.42	23.2	47.5	63.3	68.9
Sales of water heating units - Electric Resistance (%)	17.5	32.1	31.6	30.2	28.2	26.9	26.5
Sales of water heating units - Gas Furnace (%)	79.8	63.2	58.2	43.8	21.5	6.93	1.83
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.8	2.81	2.83

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	1,128	1,859	6,771	19,756	29,318
Public EV charging plugs - DC Fast (1000 units)	4.35		5.46		15.8		38.7
Public EV charging plugs - L2 (1000 units)	21.5		131		380		930
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 (%)	1.19	1.67	1.99	1.57	0.974	0.494	0.213
Vehicle sales - Light-duty - EV (%)	2.32	5.65	13.7	28.9	51.7	74.1	88.4
Vehicle sales - Light-duty - gasoline (%)	90.4	85.6	76.6	62.8	42.5	22.7	10.1
Vehicle sales - Light-duty - hybrid (%)	5.86	6.61	7.25	6.42	4.63	2.63	1.24
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.369	0.305	0.225	0.155	0.085	0.04
Vehicle sales - Light-duty - other (%)	0.087	0.09	0.08	0.069	0.049	0.026	0.012
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)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,082
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
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)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8

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)							3,887
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)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962

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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813

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)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		251	0.33	0.328	0.172	0.099	0
Monetary damages from air pollution - Natural Gas (million 2019$)		2,037	1,010	587	227	70.7	31.3
Monetary damages from air pollution - Transportation (million 2019$)		32,107	32,984	32,552	29,690	23,875	16,465
Premature deaths from air pollution - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Natural Gas (deaths)		230	114	66.3	25.6	7.98	3.54
Premature deaths from air pollution - Transportation (deaths)		3,611	3,710	3,661	3,339	2,685	1,852

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)		120,478	131,958				
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas Furnace (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635

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)		27.7	36.5				
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83

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)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452
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 (%)	1.18	1.49	1.11	0.353	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.15	19	52	84	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	87.8	73.7	43	14.3	3	0.581	0
Vehicle sales - Light-duty - hybrid (%)	5.63	5.42	3.61	1.3	0.323	0.072	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.108	0.318	0.174	0.052	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.085	0.08	0.049	0.017	0.003	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 - Offshore Wind - Base (billion $2018)		0.292	0	0	1.57	9.82	13.5
Capital invested - Solar PV - Base (billion $2018)		13.7	13.4	28.6	46.9	44.6	58.4
Capital invested - Wind - Base (billion $2018)		0	0	0.063	0.24	0.154	0.11
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	76.3	76.3	76.3	852	6,847	17,034
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	79.8	79.8	175	1,796	12,529	34,826
Installed renewables - Solar - Base land use assumptions (MW)	27,682	39,652	52,780	83,157	135,954	189,133	262,972
Installed renewables - Solar - Constrained land use assumptions (MW)	55,364	72,449	100,842	159,295	283,562	396,211	524,506
Installed renewables - Wind - Base land use assumptions (MW)	7,083	7,083	7,083	7,123	7,279	7,385	7,465
Installed renewables - Wind - Constrained land use assumptions (MW)	14,434	14,505	14,610	16,859	18,576	20,725	26,310

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	418	418	418	4,696	37,533	86,533
OffshoreWind - Constrained land use assumptions (GWh)	0	438	438	953	9,850	64,792	175,138
Solar - Base land use assumptions (GWh)	66,975	92,334	119,520	180,379	282,184	383,350	523,234
Solar - Constrained land use assumptions (GWh)	133,950	170,119	229,275	341,268	574,837	786,552	1,025,722
Wind - Base land use assumptions (GWh)	28,124	28,124	28,124	28,259	28,777	29,112	29,351

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

Item	2020	2025	2030	2035	2040	2045	2050
Wind - Constrained land use assumptions (GWh)	56,479	56,727	57,022	62,932	66,635	70,629	82,299

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)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,082
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
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)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887
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)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962

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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255

Table 33: *E+RE+ 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)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711

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 - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360

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 - Increase retention of HWP (1000 hectares)							0
Land impacted for carbon sink potential - Mid - Increase trees outside forests (1000 hectares)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		251	0.33	0.328	0.172	0.099	0
Monetary damages from air pollution - Natural Gas (million 2019$)		1,498	1,137	581	320	121	25.6
Monetary damages from air pollution - Transportation (million 2019$)		31,487	29,710	22,808	13,295	6,015	2,235
Premature deaths from air pollution - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Natural Gas (deaths)		169	128	65.5	36.1	13.7	2.89
Premature deaths from air pollution - Transportation (deaths)		3,541	3,341	2,565	1,495	676	251

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)		120,478	131,958				
Sales of cooking units - Electric Resistance (%)	27.5	41.7	78.2	85.4	85.8	85.8	85.8
Sales of cooking units - Gas (%)	72.5	58.3	21.8	14.6	14.2	14.2	14.2
Sales of space heating units - Electric Heat Pump (%)	1.74	20.9	62.9	75.6	76.7	76.7	76.7
Sales of space heating units - Electric Resistance (%)	11.4	14.3	19.6	22.2	22.6	22.6	22.6
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	86.9	64.8	17.5	2.29	0.731	0.685	0.683
Sales of water heating units - Electric Heat Pump (%)	0.63	11.5	57.5	68	68.5	68.5	68.5
Sales of water heating units - Electric Resistance (%)	2.03	6.87	26.2	30.7	30.9	30.9	30.9
Sales of water heating units - Gas Furnace (%)	96.8	81	15.7	0.718	0.005	0	0
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		12.6	13	29.3	31.6	24.6	25.8

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	798	775	732	700	692	702
Final energy use - Industry (PJ)	1,021	1,057	1,074	1,125	1,184	1,218	1,259
Final energy use - Residential (PJ)	878	820	708	579	478	418	385
Final energy use - Transportation (PJ)	3,056	2,945	2,657	2,291	1,958	1,742	1,635

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)		27.7	36.5				
Sales of cooking units - Electric Resistance (%)	40	52.8	91.9	99.6	100	100	100
Sales of cooking units - Gas (%)	60	47.2	8.07	0.406	0	0	0
Sales of space heating units - Electric Heat Pump (%)	5.99	23.4	70.8	81.7	82.3	82.2	82.2
Sales of space heating units - Electric Resistance (%)	16.4	23.7	15.2	13.3	13.2	13.3	13.4
Sales of space heating units - Fossil (%)	3.33	5.85	3.58	3.05	3	2.95	2.91
Sales of space heating units - Gas (%)	74.3	47	10.3	1.95	1.53	1.52	1.52
Sales of water heating units - Electric Heat Pump (%)	0	11.2	59.4	70.3	70.8	70.8	70.8
Sales of water heating units - Electric Resistance (%)	17.5	31.3	27.2	26.4	26.4	26.4	26.4
Sales of water heating units - Gas Furnace (%)	79.8	54.8	10.6	0.486	0.003	0	0
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.79	2.8	2.82	2.83

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)		5,550	15,540	23,053	35,766	38,007	36,736
Public EV charging plugs - DC Fast (1000 units)	4.35		11.9		38.9		60.4
Public EV charging plugs - L2 (1000 units)	21.5		285		934		1,452
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 (%)	1.18	1.49	1.11	0.353	0.069	0.013	0
Vehicle sales - Light-duty - EV (%)	5.15	19	52	84	96.6	99.3	100
Vehicle sales - Light-duty - gasoline (%)	87.8	73.7	43	14.3	3	0.581	0
Vehicle sales - Light-duty - hybrid (%)	5.63	5.42	3.61	1.3	0.323	0.072	0
Vehicle sales - Light-duty - hydrogen FC (%)	0.108	0.318	0.174	0.052	0.011	0.002	0
Vehicle sales - Light-duty - other (%)	0.085	0.08	0.049	0.017	0.003	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

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

Item	2020	2025	2030	2035	2040	2045	2050
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 - Offshore Wind - Base (billion $2018)		0.292	0	0	0	0.588	0.429
Capital invested - Offshore Wind - Constrained (billion $2018)		0.153	0	0	0.097	0.622	0.374
Capital invested - Solar PV - Base (billion $2018)		11.9	7.32	6.33	16.7	12.1	21.6
Capital invested - Solar PV - Constrained (billion $2018)		11.2	9.7	10.7	14.1	12.5	21
Capital invested - Wind - Base (billion $2018)		0	0	0	0	0	0.054
Capital invested - Wind - Constrained (billion $2018)		0	0.062	0	0.347	0.265	1.01
Installed renewables - OffshoreWind - Base land use assumptions (MW)	0	76.3	76.3	76.3	76.3	435	760
Installed renewables - OffshoreWind - Constrained land use assumptions (MW)	0	39.9	39.9	39.9	87.6	468	750
Installed renewables - Solar - Base land use assumptions (MW)	32,006	42,401	49,556	56,280	75,133	89,612	116,934
Installed renewables - Solar - Constrained land use assumptions (MW)	33,114	42,924	52,406	63,769	79,643	94,519	121,035
Installed renewables - Wind - Base land use assumptions (MW)	7,005	7,005	7,005	7,005	7,005	7,005	7,044
Installed renewables - Wind - Constrained land use assumptions (MW)	7,089	7,089	7,124	7,124	7,350	7,531	8,263

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	418	418	418	418	2,400	4,197
OffshoreWind - Constrained land use assumptions (GWh)	0	219	219	219	477	2,558	4,106
Solar - Base land use assumptions (GWh)	76,176	98,009	113,175	127,060	164,853	192,978	245,329
Solar - Constrained land use assumptions (GWh)	78,455	99,044	118,573	141,109	171,332	199,522	249,459
Wind - Base land use assumptions (GWh)	27,863	27,863	27,863	27,863	27,863	27,863	27,998
Wind - Constrained land use assumptions (GWh)	27,871	27,871	27,995	27,995	28,624	29,123	31,003

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)							0
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,082

Table 42: *E+RE- 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)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
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)							3,813
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							3,887
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)							1,925
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,962

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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9

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 - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		251	0.33	0.328	0.172	0.099	0
Monetary damages from air pollution - Natural Gas (million 2019$)		2,098	678	1,028	1,343	674	172
Monetary damages from air pollution - Transportation (million 2019$)		31,487	29,710	22,808	13,295	6,015	2,235
Premature deaths from air pollution - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Natural Gas (deaths)		237	76.6	116	152	76.1	19.5
Premature deaths from air pollution - Transportation (deaths)		3,541	3,341	2,565	1,495	676	251

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)		120,137	130,140				
Sales of cooking units - Electric Resistance (%)	27.5	31	36.1	49.7	68.6	80.2	84.3
Sales of cooking units - Gas (%)	72.5	69	63.9	50.3	31.4	19.8	15.7
Sales of space heating units - Electric Heat Pump (%)	1.74	13	17.8	31.6	53.4	68.7	74.5
Sales of space heating units - Electric Resistance (%)	11.4	13.3	14	15.8	18.8	21.2	22.2
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0
Sales of space heating units - Gas Furnace (%)	86.9	73.7	68.3	52.6	27.8	10.2	3.31
Sales of water heating units - Electric Heat Pump (%)	0.63	2.65	7.89	23	46.1	61.3	66.6
Sales of water heating units - Electric Resistance (%)	2.03	3.16	5.36	11.7	21.4	27.8	30.1
Sales of water heating units - Gas Furnace (%)	96.8	93.6	86.1	64.7	31.8	10.2	2.7
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		9.31	9.32	16.2	17	25.6	27.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	800	806	802	788	770	759
Final energy use - Industry (PJ)	1,021	1,058	1,081	1,146	1,217	1,253	1,293
Final energy use - Residential (PJ)	878	825	766	706	626	537	459
Final energy use - Transportation (PJ)	3,060	2,970	2,767	2,590	2,445	2,267	2,054

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)		27.5	36.2				
Sales of cooking units - Electric Resistance (%)	39.8	41.4	46.9	61.4	81.6	94.1	98.4
Sales of cooking units - Gas (%)	60.2	58.6	53.1	38.6	18.4	5.94	1.6
Sales of space heating units - Electric Heat Pump (%)	5.99	14.3	19.7	35.3	59.2	74.8	80.3

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Electric Resistance (%)	16.4	25.3	24.3	21.5	17.3	14.5	13.6
Sales of space heating units - Fossil (%)	3.33	6.29	6.05	5.3	4.13	3.36	3.07
Sales of space heating units - Gas (%)	74.3	54.1	50	38	19.4	7.29	3.04
Sales of water heating units - Electric Heat Pump (%)	0	1.93	7.42	23.2	47.5	63.3	68.9
Sales of water heating units - Electric Resistance (%)	17.5	32.1	31.6	30.2	28.2	26.9	26.5
Sales of water heating units - Gas Furnace (%)	79.8	63.2	58.2	43.8	21.5	6.93	1.83
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.8	2.81	2.83

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	1,128	1,859	6,771	19,756	29,318
Public EV charging plugs - DC Fast (1000 units)	4.35		5.46		15.8		38.7
Public EV charging plugs - L2 (1000 units)	21.5		131		380		930
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 (%)	1.19	1.67	1.99	1.57	0.974	0.494	0.213
Vehicle sales - Light-duty - EV (%)	2.32	5.65	13.7	28.9	51.7	74.1	88.4
Vehicle sales - Light-duty - gasoline (%)	90.4	85.6	76.6	62.8	42.5	22.7	10.1
Vehicle sales - Light-duty - hybrid (%)	5.86	6.61	7.25	6.42	4.63	2.63	1.24
Vehicle sales - Light-duty - hydrogen FC (%)	0.112	0.369	0.305	0.225	0.155	0.085	0.04
Vehicle sales - Light-duty - other (%)	0.087	0.09	0.08	0.069	0.049	0.026	0.012
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	0.012	0.833	0	0	0	0
Capital invested - Biomass w/ccu allam power plant (billion $2018)	0	0	0	0.105	0.017	0.003	0.03
Capital invested - Biomass w/ccu power plant (billion $2018)	0	0	1.31	0.033	0.129	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	22.5	1,658	1,658	1,658	1,658	1,658
Biomass w/ccu allam power plant (GWh)	0	0	0	105	122	125	155
Biomass w/ccu power plant (GWh)	0	0	1,475	1,512	1,657	1,657	1,657

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

Item	2020	2025	2030	2035	2040	2045	2050
Biomass purchases (million $2018/year)		9.04	119	484	687	752	768
Conversion capital investment - Cumulative 5-yr (million $2018)		12.9	2,135	12,011	6,685	2,104	577
Number of facilities - Allam power w ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Beccs hydrogen (quantity)	0	0	0	12	18	20	21
Number of facilities - Diesel (quantity)	0	0	0	2	2	2	2
Number of facilities - Diesel ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Power (quantity)	0	2	2	2	2	2	2
Number of facilities - Power ccu (quantity)	0	0	4	6	7	7	7
Number of facilities - Pyrolysis (quantity)	0	0	0	2	2	2	2
Number of facilities - Pyrolysis ccu (quantity)	0	0	0	4	5	6	6
Number of facilities - Sng (quantity)	0	2	2	2	2	2	2
Number of facilities - Sng ccu (quantity)	0	0	4	4	4	4	4

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

Item	2020	2025	2030	2035	2040	2045	2050
Annual - All (MMT)		0	1.48	30.2	45	54.6	61
Annual - BECCS (MMT)		0	1.47	16.7	25.2	27.9	28.5
Annual - Cement and lime (MMT)		0	0	6.71	9.95	13.7	14.1
Annual - NGCC (MMT)		0	0.01	6.82	9.85	13	18.3
Cumulative - All (MMT)		0	1.48	31.7	76.7	131	192
Cumulative - BECCS (MMT)		0	1.47	18.1	43.4	71.3	99.8
Cumulative - Cement and lime (MMT)		0	0	6.71	16.7	30.4	44.5
Cumulative - NGCC (MMT)		0	0.01	6.83	16.7	29.6	47.9

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

Item	2020	2025	2030	2035	2040	2045	2050
All (km)		0	2,057	5,127	6,088	6,545	7,397
Cumulative investment - All (million $2018)		0	5,343	7,995	8,768	9,111	9,664
Cumulative investment - Spur (million $2018)		0	423	2,309	3,082	3,425	3,978
Cumulative investment - Trunk (million $2018)		0	4,920	5,686	5,686	5,686	5,686
Spur (km)		0	772	3,598	4,559	5,016	5,868
Trunk (km)		0	1,285	1,529	1,529	1,529	1,529

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

Item	2020	2025	2030	2035	2040	2045	2050
CO2 storage (MMT)		0	0	34.2	57	61.1	75.2
Injection wells (wells)		0	0	66	96	128	182
Resource characterization, appraisal, permitting costs (million $2020)		250	918	1,410	1,410	1,410	1,410
Wells and facilities construction costs (million $2020)		0	0	1,946	2,887	3,828	5,460

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)							0

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y)							-4,034
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)							-47.2
Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y)							-4,081
Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y)							0
Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y)							-2,030
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)							-23.6
Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y)							-2,054
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)							9,415
Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares)							0.125
Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares)							10.6
Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares)							73.8
Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares)							9,499
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)							1,925
Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares)							0.126
Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares)							10.6

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares)							36.9
Land impacted for carbon sink - Moderate deployment - Total (1000 hectares)							1,973

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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572

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 - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		251	0.33	0.328	0.172	0.099	0
Monetary damages from air pollution - Natural Gas (million 2019$)		1,910	936	610	452	254	180
Monetary damages from air pollution - Transportation (million 2019$)		32,107	32,984	32,552	29,690	23,875	16,465
Premature deaths from air pollution - Coal (deaths)		28.3	0.037	0.037	0.019	0.011	0
Premature deaths from air pollution - Natural Gas (deaths)		216	106	68.8	51.1	28.6	20.3
Premature deaths from air pollution - Transportation (deaths)		3,611	3,710	3,661	3,339	2,685	1,852

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)		119,229	123,203				
Sales of cooking units - Electric Resistance (%)	27.5	29	29	29	29	28.9	28.9
Sales of cooking units - Gas (%)	72.5	71	71	71	71	71.1	71.1
Sales of space heating units - Electric Heat Pump (%)	1.74	24.2	61.6	69.2	69.7	69.7	69.6
Sales of space heating units - Electric Resistance (%)	11.4	15.3	21.9	26.1	29.1	29.6	29.7
Sales of space heating units - Fossil (%)	0	0	0	0	0	0	0

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

Item	2020	2025	2030	2035	2040	2045	2050
Sales of space heating units - Gas Furnace (%)	86.9	60.6	16.5	4.65	1.21	0.731	0.683
Sales of water heating units - Electric Heat Pump (%)	0.63	0.808	0.81	0.813	0.819	0.823	0.824
Sales of water heating units - Electric Resistance (%)	2.03	2.38	2.39	2.4	2.4	2.4	2.41
Sales of water heating units - Gas Furnace (%)	96.8	96.2	96.2	96.2	96.2	96.1	96.1
Sales of water heating units - Other (%)	0.501	0.619	0.623	0.624	0.623	0.624	0.625

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)		11.4	11.7	20.7	22	18.4	19.1

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

Item	2020	2025	2030	2035	2040	2045	2050
Final energy use - Commercial (PJ)	793	809	826	837	860	902	960
Final energy use - Industry (PJ)	1,021	1,088	1,143	1,208	1,279	1,368	1,470
Final energy use - Residential (PJ)	878	827	784	756	740	729	719
Final energy use - Transportation (PJ)	3,057	2,998	2,847	2,765	2,800	2,893	3,001

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)		26.2	28.8				
Sales of cooking units - Electric Resistance (%)	39.3	39.3	39.3	39.3	39.3	39.3	39.3
Sales of cooking units - Gas (%)	60.7	60.7	60.7	60.7	60.7	60.7	60.7
Sales of space heating units - Electric Heat Pump (%)	4.04	25.4	26.3	27.8	29.1	30.6	32.8
Sales of space heating units - Electric Resistance (%)	16.9	22.7	22.3	21.7	21	19.5	17.3
Sales of space heating units - Fossil (%)	3.38	4.97	5	5	4.95	4.95	4.96
Sales of space heating units - Gas (%)	75.7	46.9	46.4	45.5	45	44.9	44.9
Sales of water heating units - Electric Heat Pump (%)	0	0	0	0	0	0	0
Sales of water heating units - Electric Resistance (%)	17.5	32.2	32.2	32.2	32.2	32.1	32.1
Sales of water heating units - Gas Furnace (%)	79.8	65	65	65	65.1	65.1	65.1
Sales of water heating units - Other (%)	2.7	2.75	2.76	2.78	2.79	2.81	2.82

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 (%)	1.18	1.65	2.12	1.98	1.77	1.65	1.57
Vehicle sales - Light-duty - EV (%)	4.79	7.2	8.03	9.95	12	13.5	14.8
Vehicle sales - Light-duty - gasoline (%)	88.2	84.3	81.7	79.4	77.1	75.3	73.9
Vehicle sales - Light-duty - hybrid (%)	5.65	6.45	7.76	8.29	8.76	9.15	9.38

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

Item	2020	2025	2030	2035	2040	2045	2050
Vehicle sales - Light-duty - hydrogen FC (%)	0.109	0.363	0.325	0.284	0.278	0.277	0.286
Vehicle sales - Light-duty - other (%)	0.085	0.089	0.085	0.086	0.085	0.084	0.085
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)							-3,748
Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y)							-43,341
Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y)							-5,255
Carbon sink potential - High - Extend rotation length (1000 tCO2e/y)							-13,545
Carbon sink potential - High - Improve plantations (1000 tCO2e/y)							-1,299
Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y)							-6,568
Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y)							-2,022
Carbon sink potential - High - Reforest cropland (1000 tCO2e/y)							-288
Carbon sink potential - High - Reforest pasture (1000 tCO2e/y)							-2,778
Carbon sink potential - High - Restore productivity (1000 tCO2e/y)							-7,838
Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y)							-1,878
Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y)							-14,511
Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y)							-876
Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y)							-5,203
Carbon sink potential - Low - Improve plantations (1000 tCO2e/y)							-661
Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y)							-2,189
Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y)							-708
Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y)							-144
Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y)							-210
Carbon sink potential - Low - Restore productivity (1000 tCO2e/y)							-2,642
Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y)							-2,813
Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y)							-28,914
Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y)							-3,065

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

Item	2020	2025	2030	2035	2040	2045	2050
Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y)							-9,374
Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y)							-968
Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y)							-4,379
Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y)							-1,365
Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y)							-216
Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y)							-1,494
Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y)							-5,240
Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares)							613
Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares)							711
Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares)							6,907
Land impacted for carbon sink potential - High - Improve plantations (1000 hectares)							479
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)							192
Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares)							19
Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares)							78.9
Land impacted for carbon sink potential - High - Restore productivity (1000 hectares)							2,598
Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares)							11,598
Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares)							307
Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares)							668
Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares)							2,646
Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares)							239
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)							101

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

Item	2020	2025	2030	2035	2040	2045	2050
Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares)							9.51
Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares)							13.7
Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares)							1,572
Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares)							5,556
Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares)							460
Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares)							690
Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares)							4,777
Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares)							360
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)							147
Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares)							14.3
Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares)							98.9
Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares)							3,166
Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares)							9,712

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)	-13.7		-7.63				-6.35
Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y)	-1.79		-3				-3.16
Business-as-usual carbon sink - Total (Mt CO2e/y)	-15.5		-10.6				-9.51

Table 66: *REF scenario - IMPACTS - Health*

Item	2020	2025	2030	2035	2040	2045	2050
Monetary damages from air pollution - Coal (million 2019$)		436	229	117	86.4	79.4	75
Monetary damages from air pollution - Natural Gas (million 2019$)		1,786	1,197	1,492	1,695	1,893	1,768
Monetary damages from air pollution - Transportation (million 2019$)		32,012	33,340	34,643	36,132	37,595	39,009
Premature deaths from air pollution - Coal (deaths)		49.2	25.9	13.3	9.76	8.97	8.47
Premature deaths from air pollution - Natural Gas (deaths)		202	135	168	191	214	200

Table 66: *REF scenario - IMPACTS - Health (continued)*

Item	2020	2025	2030	2035	2040	2045	2050
Premature deaths from air pollution - Transportation (deaths)		3,600	3,750	3,896	4,064	4,228	4,387