# Net-Zero America - washington state report

2021-03-05

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) | 0 | 22,776 | 24,705 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 15.7 | 39.9 | 56.5 | 59 | 59.1 | 59.1 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 17.1 | 34.2 | 39.6 | 40.2 | 40.2 | 40.2 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of space heating units - Gas Furnace (%) | 79 | 67.2 | 25.9 | 3.88 | 0.83 | 0.698 | 0.698 |
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 9.5 | 48.6 | 62.9 | 64.3 | 64.4 | 64.4 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 6.18 | 24.2 | 33.6 | 34.9 | 34.9 | 34.9 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 83.7 | 26.6 | 2.84 | 0.138 | 0 | 0 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 3.77 | 3.88 | 6.5 | 6.9 | 5.9 | 6.14 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 162 | 160 | 153 | 146 | 145 | 146 |
| Final energy use - Industry (PJ) | 342 | 354 | 359 | 361 | 368 | 377 | 387 |
| Final energy use - Residential (PJ) | 246 | 227 | 199 | 170 | 144 | 128 | 117 |
| Final energy use - Transportation (PJ) | 656 | 650 | 592 | 519 | 454 | 412 | 391 |

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 | 4.12 | 4.1 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.6 | 76.8 | 96 | 99.8 | 100 | 100 | 100 |
| Sales of cooking units - Gas (%) | 29.4 | 23.2 | 3.96 | 0.2 | 0 | 0 | 0 |
| Sales of space heating units - Electric Heat Pump (%) | 14 | 25.2 | 47.6 | 59.1 | 60.7 | 60.7 | 60.6 |
| Sales of space heating units - Electric Resistance (%) | 35.6 | 41 | 35.5 | 30.7 | 30 | 30.2 | 30.3 |
| Sales of space heating units - Fossil (%) | 8.89 | 13.2 | 9.93 | 8.85 | 8.62 | 8.41 | 8.39 |
| Sales of space heating units - Gas (%) | 41.5 | 20.6 | 6.9 | 1.33 | 0.7 | 0.659 | 0.662 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 6.87 | 37.5 | 47.6 | 48.6 | 48.6 | 48.6 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 59.1 | 48.2 | 46.1 | 46.1 | 46.1 | 46.1 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 28.5 | 9.06 | 0.967 | 0.047 | 0 | 0 |
| Sales of water heating units - Other (%) | 6.95 | 5.52 | 5.27 | 5.27 | 5.28 | 5.27 | 5.28 |

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) | 0 | 1,331 | 3,547 | 5,529 | 8,462 | 9,115 | 8,742 |
| Public EV charging plugs - DC Fast (1000 units) | 0.551 | 0 | 2.62 | 0 | 9.97 | 0 | 15.8 |
| Public EV charging plugs - L2 (1000 units) | 2.37 | 0 | 63.1 | 0 | 240 | 0 | 381 |
| 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 (%) | 1.51 | 1.78 | 1.24 | 0.397 | 0.074 | 0.013 | 0 |
| Vehicle sales - Light-duty - EV (%) | 4.05 | 15.6 | 47.1 | 82.1 | 96.4 | 99.3 | 100 |
| Vehicle sales - Light-duty - gasoline (%) | 89.7 | 77.5 | 48.1 | 16.3 | 3.26 | 0.589 | 0 |
| Vehicle sales - Light-duty - hybrid (%) | 4.56 | 4.64 | 3.26 | 1.21 | 0.294 | 0.065 | 0 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.11 | 0.337 | 0.2 | 0.062 | 0.012 | 0.002 | 0 |
| Vehicle sales - Light-duty - other (%) | 0.1 | 0.096 | 0.062 | 0.022 | 0.004 | 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 | 0.003 | 0.249 | 0 | 0 | 0 | 0 |
| Capital invested - Biomass w/ccu allam power plant (billion $2018) | 0 | 0 | 0 | 0 | 0 | 0.008 | 0.044 |
| Capital invested - Biomass w/ccu power plant (billion $2018) | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.172 |
| Capital invested - Solar PV - Base (billion $2018) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital invested - Solar PV - Constrained (billion $2018) | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 |
| Capital invested - Wind - Base (billion $2018) | 0 | 0 | 0.826 | 0.787 | 0.706 | 0.738 | 0.057 |
| Capital invested - Wind - Constrained (billion $2018) | 0 | 0 | 2.11 | 3.35 | 11.6 | 9.51 | 1.16 |
| Installed (cumulative) - OffshoreWind - Base land use assumptions (MW) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Installed (cumulative) - Rooftop PV (MW) | 1,788 | 2,755 | 3,680 | 4,796 | 6,121 | 7,666 | 9,495 |
| Installed (cumulative) - Solar - Base land use assumptions (MW) | 695 | 695 | 695 | 695 | 695 | 695 | 695 |
| Installed (cumulative) - Wind - Base land use assumptions (MW) | 3,388 | 3,388 | 3,866 | 4,354 | 4,813 | 5,320 | 5,361 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Biomass power plant (GWh) | 0 | 6.64 | 495 | 495 | 495 | 495 | 495 |
| Biomass w/ccu allam power plant (GWh) | 0 | 0 | 0 | 0 | 0 | 7.51 | 51.1 |
| Biomass w/ccu power plant (GWh) | 0 | 0 | 0 | 0 | 0 | 22.3 | 216 |
| Solar - Base land use assumptions (GWh) | 1,419 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar - Constrained land use assumptions (GWh) | 1,371 | 0 | 0 | 0 | 0 | 0 | 0 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Wind - Base land use assumptions (GWh) | 11,561 | 0 | 1,656 | 1,570 | 1,428 | 1,567 | 124 |
| Wind - Constrained land use assumptions (GWh) | 11,682 | 0 | 4,128 | 5,915 | 21,482 | 16,579 | 2,952 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Biomass purchases (million $2018/year) | 0 | 49.2 | 148 | 149 | 149 | 200 | 644 |
| Conversion capital investment - Cumulative 5-yr (million $2018) | 0 | 3.83 | 277 | 22.3 | 0 | 927 | 8,114 |
| Number of facilities - Allam power w ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Number of facilities - Beccs hydrogen (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| Number of facilities - Diesel (quantity) | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Number of facilities - Diesel ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Number of facilities - Power (quantity) | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of facilities - Power ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Number of facilities - Pyrolysis (quantity) | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Number of facilities - Pyrolysis ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| Number of facilities - Sng (quantity) | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of facilities - Sng ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Annual - All (MMT) | | 0 | 0 | 3.35 | 3.32 | 4.6 | 15 |
| Annual - BECCS (MMT) | | 0 | 0 | 0 | 0 | 1.17 | 11.5 |
| Annual - Cement and lime (MMT) | | 0 | 0 | 3.35 | 3.32 | 3.42 | 3.53 |
| Annual - NGCC (MMT) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Cumulative - All (MMT) | | 0 | 0 | 3.35 | 6.67 | 11.3 | 26.3 |
| Cumulative - BECCS (MMT) | | 0 | 0 | 0 | 0 | 1.17 | 12.7 |
| Cumulative - Cement and lime (MMT) | | 0 | 0 | 3.35 | 6.67 | 10.1 | 13.6 |
| 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 | 0 | 776 | 776 | 1,019 | 2,201 |
| Cumulative investment - All (million $2018) | | 0 | 0 | 1,802 | 1,801 | 1,948 | 2,738 |
| Cumulative investment - Spur (million $2018) | | 0 | 0 | 99.8 | 99.3 | 246 | 1,036 |
| Cumulative investment - Trunk (million $2018) | | 0 | 0 | 1,702 | 1,702 | 1,702 | 1,702 |
| Spur (km) | | 0 | 0 | 101 | 101 | 344 | 1,526 |
| Trunk (km) | | 0 | 0 | 675 | 675 | 675 | 675 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| CO2 storage (MMT) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Injection wells (wells) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Resource characterization, appraisal, permitting costs (million $2020) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Wells and facilities construction costs (million $2020) | | 0 | 0 | 0 | 0 | 0 | 0 |

Table 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) | | | | | | | -1,981 |
| Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -147 |
| Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y) | | | | | | | -2,129 |
| Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y) | | | | | | | 0 |
| Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,027 |
| Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -73.6 |
| Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y) | | | | | | | -1,101 |
| 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) | | | | | | | 2,798 |
| Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) | | | | | | | 235 |
| Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) | | | | | | | 3,033 |
| 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) | | | | | | | 1,458 |
| Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) | | | | | | | 117 |
| Land impacted for carbon sink - Moderate deployment - Total (1000 hectares) | | | | | | | 1,575 |

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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |

Table 13: *E+ 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) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |

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 - Increase retention of HWP (1000 hectares) | | | | | | | 0 |
| Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |
| Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |
| Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares) | | | | | | | 752 |
| 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) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |
| Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |

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 - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Natural gas consumption - Annual (tcf) | | 238 | 201 | 161 | 121 | 76.3 | 52.9 |
| Natural gas consumption - Cumulative (tcf) | | 0 | 0 | 0 | 0 | 0 | 4,854 |
| Natural gas production - Annual (tcf) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Oil consumption - Annual (million bbls) | | 135 | 119 | 96.2 | 74.7 | 57.8 | 41.8 |
| Oil consumption - Cumulative (million bbls) | | 0 | 0 | 0 | 0 | 0 | 2,955 |
| Oil production - Annual (million bbls) | | 0 | 0 | 0 | 0 | 0 | 0 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 63.6 | 0.07 | 0.07 | 0.053 | 0.033 | 0 |
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 59.3 | 35.2 | 31.1 | 30.1 | 25.2 | 20.2 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,113 | 1,077 | 847 | 507 | 238 | 95 |
| Premature deaths from air pollution - Coal (deaths) | | 7.18 | 0.008 | 0.008 | 0.006 | 0.004 | 0 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 6.69 | 3.97 | 3.51 | 3.4 | 2.84 | 2.28 |
| Premature deaths from air pollution - Transportation (deaths) | | 125 | 121 | 95.3 | 57 | 26.7 | 10.7 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| By economic sector - Agriculture (jobs) | | 125 | 364 | 389 | 329 | 334 | 783 |
| By economic sector - Construction (jobs) | | 8,570 | 8,392 | 10,289 | 10,284 | 9,831 | 13,352 |
| By economic sector - Manufacturing (jobs) | | 4,850 | 7,540 | 9,472 | 8,742 | 7,531 | 8,676 |
| By economic sector - Mining (jobs) | | 2,249 | 1,645 | 1,105 | 712 | 448 | 269 |
| By economic sector - Other (jobs) | | 1,146 | 1,192 | 1,469 | 1,726 | 1,924 | 3,451 |
| By economic sector - Pipeline (jobs) | | 418 | 361 | 502 | 229 | 169 | 210 |
| By economic sector - Professional (jobs) | | 3,915 | 4,130 | 4,718 | 5,032 | 5,150 | 7,796 |
| By economic sector - Trade (jobs) | | 3,140 | 2,993 | 3,186 | 3,344 | 3,411 | 5,119 |
| By economic sector - Utilities (jobs) | | 4,450 | 5,095 | 7,657 | 7,723 | 6,900 | 7,084 |
| By education level - All sectors - Associates degree or some college (jobs) | | 8,906 | 9,838 | 12,304 | 12,151 | 11,388 | 14,823 |
| By education level - All sectors - Bachelors degree (jobs) | | 6,016 | 6,502 | 7,700 | 7,523 | 7,058 | 9,267 |
| By education level - All sectors - Doctoral degree (jobs) | | 217 | 223 | 250 | 252 | 249 | 361 |
| By education level - All sectors - High school diploma or less (jobs) | | 12,287 | 13,619 | 16,728 | 16,401 | 15,290 | 19,982 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| By education level - All sectors - Masters or professional degree (jobs) | | 1,437 | 1,531 | 1,805 | 1,794 | 1,711 | 2,305 |
| By resource sector - Biomass (jobs) | | 537 | 1,003 | 1,107 | 989 | 1,216 | 3,342 |
| By resource sector - CO2 (jobs) | | 0 | 0 | 1,741 | 53.5 | 90 | 814 |
| By resource sector - Coal (jobs) | | 98.8 | 0 | 0 | 0 | 0 | 0 |
| By resource sector - Grid (jobs) | | 5,671 | 7,561 | 11,493 | 14,009 | 12,552 | 11,879 |
| By resource sector - Natural Gas (jobs) | | 2,549 | 2,064 | 2,014 | 1,796 | 1,380 | 1,366 |
| By resource sector - Nuclear (jobs) | | 606 | 596 | 346 | 0.015 | 0.019 | 0.038 |
| By resource sector - Oil (jobs) | | 6,006 | 4,868 | 3,624 | 2,612 | 1,888 | 1,284 |
| By resource sector - Solar (jobs) | | 9,420 | 9,518 | 12,164 | 13,095 | 14,032 | 23,686 |
| By resource sector - Wind (jobs) | | 3,976 | 6,104 | 6,298 | 5,567 | 4,538 | 4,367 |
| Median wages - Annual - All ($2019 per job) | | 68,136 | 68,415 | 69,492 | 70,588 | 71,567 | 71,977 |
| On-Site or In-Plant Training - Total jobs - 1 to 4 years (jobs) | | 4,656 | 5,087 | 6,322 | 6,221 | 5,810 | 7,507 |
| On-Site or In-Plant Training - Total jobs - 4 to 10 years (jobs) | | 1,923 | 2,005 | 2,514 | 2,489 | 2,347 | 3,065 |
| On-Site or In-Plant Training - Total jobs - None (jobs) | | 4,750 | 5,226 | 6,339 | 6,219 | 5,850 | 7,782 |
| On-Site or In-Plant Training - Total jobs - Over 10 years (jobs) | | 235 | 259 | 331 | 329 | 309 | 398 |
| On-Site or In-Plant Training - Total jobs - Up to 1 year (jobs) | | 17,299 | 19,136 | 23,281 | 22,863 | 21,380 | 27,987 |
| On-the-Job Training - All sectors - 1 to 4 years (jobs) | | 5,969 | 6,503 | 8,110 | 7,982 | 7,458 | 9,623 |
| On-the-Job Training - All sectors - 4 to 10 years (jobs) | | 1,871 | 1,950 | 2,470 | 2,458 | 2,326 | 3,050 |
| On-the-Job Training - All sectors - None (jobs) | | 1,632 | 1,753 | 2,087 | 2,054 | 1,945 | 2,628 |
| On-the-Job Training - All sectors - Over 10 years (jobs) | | 300 | 331 | 401 | 386 | 358 | 469 |
| On-the-Job Training - All sectors - Up to 1 year (jobs) | | 19,093 | 21,176 | 25,719 | 25,241 | 23,610 | 30,969 |
| Related work experience - All sectors - 1 to 4 years (jobs) | | 10,375 | 11,351 | 13,836 | 13,598 | 12,729 | 16,616 |
| Related work experience - All sectors - 4 to 10 years (jobs) | | 6,683 | 7,277 | 8,931 | 8,767 | 8,201 | 10,645 |
| Related work experience - All sectors - None (jobs) | | 4,124 | 4,537 | 5,603 | 5,519 | 5,179 | 6,817 |
| Related work experience - All sectors - Over 10 years (jobs) | | 1,784 | 1,983 | 2,424 | 2,366 | 2,195 | 2,807 |
| Related work experience - All sectors - Up to 1 year (jobs) | | 5,897 | 6,565 | 7,993 | 7,871 | 7,393 | 9,853 |
| Wage income - All (million $2019) | | 1,967 | 2,170 | 2,696 | 2,691 | 2,555 | 3,365 |

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) | 0 | 22,723 | 24,348 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 11.9 | 14.6 | 22.8 | 37.2 | 49.8 | 55.8 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 13.9 | 15.8 | 21.6 | 30.6 | 36.8 | 39.3 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of space heating units - Gas Furnace (%) | 79 | 74.3 | 69.5 | 55.6 | 32.2 | 13.3 | 4.9 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 2.39 | 6.84 | 19.8 | 40.6 | 55.7 | 61.7 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 3.14 | 5.18 | 11.2 | 21.3 | 29.5 | 33.1 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 93.8 | 87.3 | 68.4 | 37.5 | 14.2 | 4.65 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 2.95 | 2.96 | 4.08 | 4.22 | 5.76 | 6.07 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 163 | 165 | 166 | 164 | 162 | 160 |
| Final energy use - Industry (PJ) | 342 | 355 | 361 | 367 | 376 | 385 | 395 |
| Final energy use - Residential (PJ) | 246 | 227 | 207 | 188 | 169 | 150 | 133 |
| Final energy use - Transportation (PJ) | 657 | 654 | 611 | 573 | 544 | 510 | 470 |

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 | 4.1 | 4.04 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.4 | 71.2 | 73.9 | 81.1 | 91 | 97.1 | 99.2 |
| Sales of cooking units - Gas (%) | 29.6 | 28.8 | 26.1 | 18.9 | 9.03 | 2.91 | 0.784 |
| Sales of space heating units - Electric Heat Pump (%) | 14 | 21.3 | 23.9 | 31.4 | 44.1 | 54.1 | 58.4 |
| Sales of space heating units - Electric Resistance (%) | 35.6 | 41.8 | 41.1 | 39.2 | 35.8 | 32.7 | 31 |
| Sales of space heating units - Fossil (%) | 8.89 | 13.8 | 13.5 | 12.4 | 10.6 | 9.24 | 8.81 |
| Sales of space heating units - Gas (%) | 41.5 | 23 | 21.5 | 17 | 9.58 | 4.03 | 1.76 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 1.23 | 4.71 | 14.8 | 30.9 | 42.3 | 46.7 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 61.3 | 60 | 56.4 | 51 | 47.6 | 46.5 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 31.9 | 29.8 | 23.3 | 12.8 | 4.87 | 1.59 |
| Sales of water heating units - Other (%) | 6.95 | 5.56 | 5.52 | 5.49 | 5.39 | 5.31 | 5.28 |

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 | 0 | 239 | 450 | 1,569 | 4,778 | 7,016 |
| Public EV charging plugs - DC Fast (1000 units) | 0.551 | 0 | 1.02 | 0 | 3.86 | 0 | 10.1 |
| Public EV charging plugs - L2 (1000 units) | 2.37 | 0 | 24.5 | 0 | 92.8 | 0 | 244 |
| 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 (%) | 1.52 | 1.94 | 2.05 | 1.63 | 1.04 | 0.532 | 0.228 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Vehicle sales - Light-duty - EV (%) | 1.94 | 4.79 | 12.1 | 26.2 | 48.8 | 72.3 | 87.7 |
| Vehicle sales - Light-duty - gasoline (%) | 91.6 | 87.3 | 79.3 | 66.2 | 45.8 | 24.6 | 10.9 |
| Vehicle sales - Light-duty - hybrid (%) | 4.73 | 5.52 | 6.19 | 5.61 | 4.19 | 2.46 | 1.19 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.113 | 0.379 | 0.324 | 0.246 | 0.174 | 0.096 | 0.045 |
| Vehicle sales - Light-duty - other (%) | 0.101 | 0.105 | 0.095 | 0.083 | 0.059 | 0.033 | 0.015 |
| 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) | | | | | | | -1,981 |
| Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -147 |
| Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y) | | | | | | | -2,129 |
| Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y) | | | | | | | 0 |
| Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,027 |
| Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -73.6 |
| Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y) | | | | | | | -1,101 |
| 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) | | | | | | | 2,798 |
| Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) | | | | | | | 235 |
| Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) | | | | | | | 3,033 |
| 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) | | | | | | | 1,458 |
| Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) | | | | | | | 117 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Land impacted for carbon sink - Moderate deployment - Total (1000 hectares) | | | | | | | 1,575 |

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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |
| Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |
| 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) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |
| Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |
| Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares) | | | | | | | 752 |
| 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) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |

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 - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |
| Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 63.6 | 0.07 | 0.07 | 0.053 | 0.033 | 0 |
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 62.4 | 33.3 | 23 | 17.6 | 14.2 | 14.7 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,133 | 1,189 | 1,198 | 1,115 | 917 | 648 |
| Premature deaths from air pollution - Coal (deaths) | | 7.18 | 0.008 | 0.008 | 0.006 | 0.004 | 0 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 7.04 | 3.76 | 2.59 | 1.98 | 1.6 | 1.65 |
| Premature deaths from air pollution - Transportation (deaths) | | 127 | 134 | 135 | 125 | 103 | 72.9 |

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) | 0 | 22,776 | 24,705 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 15.7 | 39.9 | 56.5 | 59 | 59.1 | 59.1 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 17.1 | 34.2 | 39.6 | 40.2 | 40.2 | 40.2 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Sales of space heating units - Gas Furnace (%) | 79 | 67.2 | 25.9 | 3.88 | 0.83 | 0.698 | 0.698 |
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 9.5 | 48.6 | 62.9 | 64.3 | 64.4 | 64.4 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 6.18 | 24.2 | 33.6 | 34.9 | 34.9 | 34.9 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 83.7 | 26.6 | 2.84 | 0.138 | 0 | 0 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 3.77 | 3.88 | 6.5 | 6.9 | 5.9 | 6.14 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 162 | 160 | 153 | 146 | 145 | 146 |
| Final energy use - Industry (PJ) | 342 | 354 | 359 | 361 | 368 | 377 | 387 |
| Final energy use - Residential (PJ) | 246 | 227 | 199 | 170 | 144 | 128 | 117 |
| Final energy use - Transportation (PJ) | 656 | 650 | 592 | 519 | 454 | 412 | 391 |

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 | 4.12 | 4.1 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.6 | 76.8 | 96 | 99.8 | 100 | 100 | 100 |
| Sales of cooking units - Gas (%) | 29.4 | 23.2 | 3.96 | 0.2 | 0 | 0 | 0 |
| Sales of space heating units - Electric Heat Pump (%) | 14 | 25.2 | 47.6 | 59.1 | 60.7 | 60.7 | 60.6 |
| Sales of space heating units - Electric Resistance (%) | 35.6 | 41 | 35.5 | 30.7 | 30 | 30.2 | 30.3 |
| Sales of space heating units - Fossil (%) | 8.89 | 13.2 | 9.93 | 8.85 | 8.62 | 8.41 | 8.39 |
| Sales of space heating units - Gas (%) | 41.5 | 20.6 | 6.9 | 1.33 | 0.7 | 0.659 | 0.662 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 6.87 | 37.5 | 47.6 | 48.6 | 48.6 | 48.6 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 59.1 | 48.2 | 46.1 | 46.1 | 46.1 | 46.1 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 28.5 | 9.06 | 0.967 | 0.047 | 0 | 0 |
| Sales of water heating units - Other (%) | 6.95 | 5.52 | 5.27 | 5.27 | 5.28 | 5.27 | 5.28 |

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) | 0 | 1,331 | 3,547 | 5,529 | 8,462 | 9,115 | 8,742 |
| Public EV charging plugs - DC Fast (1000 units) | 0.551 | 0 | 2.62 | 0 | 9.97 | 0 | 15.8 |
| Public EV charging plugs - L2 (1000 units) | 2.37 | 0 | 63.1 | 0 | 240 | 0 | 381 |
| 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 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Vehicle sales - Heavy-duty - other (%) | 1.5 | 1.23 | 1.07 | 0.568 | 0.163 | 0.038 | 0 |
| Vehicle sales - Light-duty - diesel (%) | 1.51 | 1.78 | 1.24 | 0.397 | 0.074 | 0.013 | 0 |
| Vehicle sales - Light-duty - EV (%) | 4.05 | 15.6 | 47.1 | 82.1 | 96.4 | 99.3 | 100 |
| Vehicle sales - Light-duty - gasoline (%) | 89.7 | 77.5 | 48.1 | 16.3 | 3.26 | 0.589 | 0 |
| Vehicle sales - Light-duty - hybrid (%) | 4.56 | 4.64 | 3.26 | 1.21 | 0.294 | 0.065 | 0 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.11 | 0.337 | 0.2 | 0.062 | 0.012 | 0.002 | 0 |
| Vehicle sales - Light-duty - other (%) | 0.1 | 0.096 | 0.062 | 0.022 | 0.004 | 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 | 0 | 0 | 0 | 6.65 |
| Capital invested - Wind - Base (billion $2018) | 0 | 0 | 0.898 | 1.32 | 2.71 | 4.51 | 10.6 |
| Installed (cumulative) - OffshoreWind - Base land use assumptions (MW) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Installed (cumulative) - Solar - Base land use assumptions (MW) | 79.7 | 79.7 | 79.7 | 79.7 | 79.7 | 79.7 | 79.7 |
| Installed (cumulative) - Wind - Base land use assumptions (MW) | 3,388 | 3,388 | 3,907 | 4,728 | 6,492 | 9,583 | 17,262 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Solar - Base land use assumptions (GWh) | 1,419 | | 0 | 0 | 0 | 0 | 14,097 |
| Solar - Constrained land use assumptions (GWh) | 1,419 | | 0 | 0 | 0 | 0 | 22,754 |
| Wind - Base land use assumptions (GWh) | 11,561 | | 1,795 | 2,598 | 5,362 | 9,058 | 21,690 |
| Wind - Constrained land use assumptions (GWh) | 11,817 | | 4,125 | 23,540 | 43,847 | 72,415 | 80,287 |

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) | | | | | | | -1,981 |
| Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -147 |
| Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y) | | | | | | | -2,129 |
| Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y) | | | | | | | 0 |
| Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,027 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -73.6 |
| Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y) | | | | | | | -1,101 |
| 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) | | | | | | | 2,798 |
| Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) | | | | | | | 235 |
| Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) | | | | | | | 3,033 |
| 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) | | | | | | | 1,458 |
| Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) | | | | | | | 117 |
| Land impacted for carbon sink - Moderate deployment - Total (1000 hectares) | | | | | | | 1,575 |

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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |
| Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |
| 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) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |

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 - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |
| Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares) | | | | | | | 752 |
| 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) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |
| Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |
| Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 63.6 | 0.07 | 0.07 | 0.053 | 0.033 | 0 |

Table 34: *E+RE+ scenario - IMPACTS - Health (continued)*

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 55.2 | 26.2 | 16.9 | 15.4 | 13 | 4.18 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,113 | 1,077 | 847 | 507 | 238 | 95 |
| Premature deaths from air pollution - Coal (deaths) | | 7.18 | 0.008 | 0.008 | 0.006 | 0.004 | 0 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 6.23 | 2.96 | 1.9 | 1.73 | 1.47 | 0.472 |
| Premature deaths from air pollution - Transportation (deaths) | | 125 | 121 | 95.3 | 57 | 26.7 | 10.7 |

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) | 0 | 22,776 | 24,705 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 15.7 | 39.9 | 56.5 | 59 | 59.1 | 59.1 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 17.1 | 34.2 | 39.6 | 40.2 | 40.2 | 40.2 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of space heating units - Gas Furnace (%) | 79 | 67.2 | 25.9 | 3.88 | 0.83 | 0.698 | 0.698 |
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 9.5 | 48.6 | 62.9 | 64.3 | 64.4 | 64.4 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 6.18 | 24.2 | 33.6 | 34.9 | 34.9 | 34.9 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 83.7 | 26.6 | 2.84 | 0.138 | 0 | 0 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 3.77 | 3.88 | 6.5 | 6.9 | 5.9 | 6.14 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 162 | 160 | 153 | 146 | 145 | 146 |
| Final energy use - Industry (PJ) | 342 | 354 | 359 | 361 | 368 | 377 | 387 |
| Final energy use - Residential (PJ) | 246 | 227 | 199 | 170 | 144 | 128 | 117 |
| Final energy use - Transportation (PJ) | 656 | 650 | 592 | 519 | 454 | 412 | 391 |

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 | 4.12 | 4.1 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.6 | 76.8 | 96 | 99.8 | 100 | 100 | 100 |
| Sales of cooking units - Gas (%) | 29.4 | 23.2 | 3.96 | 0.2 | 0 | 0 | 0 |
| Sales of space heating units - Electric Heat Pump (%) | 14 | 25.2 | 47.6 | 59.1 | 60.7 | 60.7 | 60.6 |
| Sales of space heating units - Electric Resistance (%) | 35.6 | 41 | 35.5 | 30.7 | 30 | 30.2 | 30.3 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Sales of space heating units - Fossil (%) | 8.89 | 13.2 | 9.93 | 8.85 | 8.62 | 8.41 | 8.39 |
| Sales of space heating units - Gas (%) | 41.5 | 20.6 | 6.9 | 1.33 | 0.7 | 0.659 | 0.662 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 6.87 | 37.5 | 47.6 | 48.6 | 48.6 | 48.6 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 59.1 | 48.2 | 46.1 | 46.1 | 46.1 | 46.1 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 28.5 | 9.06 | 0.967 | 0.047 | 0 | 0 |
| Sales of water heating units - Other (%) | 6.95 | 5.52 | 5.27 | 5.27 | 5.28 | 5.27 | 5.28 |

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) | 0 | 1,331 | 3,547 | 5,529 | 8,462 | 9,115 | 8,742 |
| Public EV charging plugs - DC Fast (1000 units) | 0.551 | 0 | 2.62 | 0 | 9.97 | 0 | 15.8 |
| Public EV charging plugs - L2 (1000 units) | 2.37 | 0 | 63.1 | 0 | 240 | 0 | 381 |
| 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 (%) | 1.51 | 1.78 | 1.24 | 0.397 | 0.074 | 0.013 | 0 |
| Vehicle sales - Light-duty - EV (%) | 4.05 | 15.6 | 47.1 | 82.1 | 96.4 | 99.3 | 100 |
| Vehicle sales - Light-duty - gasoline (%) | 89.7 | 77.5 | 48.1 | 16.3 | 3.26 | 0.589 | 0 |
| Vehicle sales - Light-duty - hybrid (%) | 4.56 | 4.64 | 3.26 | 1.21 | 0.294 | 0.065 | 0 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.11 | 0.337 | 0.2 | 0.062 | 0.012 | 0.002 | 0 |
| Vehicle sales - Light-duty - other (%) | 0.1 | 0.096 | 0.062 | 0.022 | 0.004 | 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 | 0.377 | 0 |
| Capital invested - Solar PV - Constrained (billion $2018) | | 0.437 | 0 | 0 | 1.54 | 0.688 | 0 |
| Capital invested - Wind - Base (billion $2018) | | 0.134 | 0.485 | 0.205 | 0.75 | 0.37 | 0 |
| Capital invested - Wind - Constrained (billion $2018) | | 0.094 | 1.29 | 0.695 | 3.43 | 5.19 | 0 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Solar - Base land use assumptions (GWh) | 1,419 | 0 | 0 | 0 | 0 | 759 | |
| Solar - Constrained land use assumptions (GWh) | 2,487 | 644 | 0 | 0 | 2,917 | 1,365 | |
| Wind - Base land use assumptions (GWh) | 11,561 | 256 | 977 | 423 | 1,570 | 789 | |
| Wind - Constrained land use assumptions (GWh) | 11,817 | 176 | 2,470 | 1,347 | 6,655 | 10,251 | |

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) | | | | | | | -1,981 |
| Carbon sink potential - Aggressive deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -147 |
| Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y) | | | | | | | -2,129 |
| Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y) | | | | | | | 0 |
| Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,027 |
| Carbon sink potential - Moderate deployment - Permanent conservation cover (1000 tCO2e/y) | | | | | | | -73.6 |
| Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y) | | | | | | | -1,101 |
| 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) | | | | | | | 2,798 |
| Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) | | | | | | | 235 |
| Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) | | | | | | | 3,033 |
| 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) | | | | | | | 1,458 |
| Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) | | | | | | | 117 |
| Land impacted for carbon sink - Moderate deployment - Total (1000 hectares) | | | | | | | 1,575 |

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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |

Table 43: *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) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |

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 - Increase retention of HWP (1000 hectares) | | | | | | | 0 |
| Land impacted for carbon sink potential - High - Increase trees outside forests (1000 hectares) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |
| Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |
| Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares) | | | | | | | 752 |
| 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) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |
| Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |

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 - Mid - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 63.6 | 0.07 | 0.07 | 0.053 | 0.033 | 0 |
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 57.8 | 27.7 | 32.8 | 38.7 | 24.2 | 11.4 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,113 | 1,077 | 847 | 507 | 238 | 95 |
| Premature deaths from air pollution - Coal (deaths) | | 7.18 | 0.008 | 0.008 | 0.006 | 0.004 | 0 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 6.53 | 3.13 | 3.7 | 4.37 | 2.73 | 1.29 |
| Premature deaths from air pollution - Transportation (deaths) | | 125 | 121 | 95.3 | 57 | 26.7 | 10.7 |

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) | 0 | 22,723 | 24,348 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 11.9 | 14.6 | 22.8 | 37.2 | 49.8 | 55.8 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 13.9 | 15.8 | 21.6 | 30.6 | 36.8 | 39.3 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of space heating units - Gas Furnace (%) | 79 | 74.3 | 69.5 | 55.6 | 32.2 | 13.3 | 4.9 |
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 2.39 | 6.84 | 19.8 | 40.6 | 55.7 | 61.7 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 3.14 | 5.18 | 11.2 | 21.3 | 29.5 | 33.1 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 93.8 | 87.3 | 68.4 | 37.5 | 14.2 | 4.65 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 2.95 | 2.96 | 4.08 | 4.22 | 5.76 | 6.07 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 163 | 165 | 166 | 164 | 162 | 160 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Industry (PJ) | 342 | 355 | 361 | 367 | 376 | 385 | 395 |
| Final energy use - Residential (PJ) | 246 | 227 | 207 | 188 | 169 | 150 | 133 |
| Final energy use - Transportation (PJ) | 657 | 654 | 611 | 573 | 544 | 510 | 470 |

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 | 4.1 | 4.04 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.4 | 71.2 | 73.9 | 81.1 | 91 | 97.1 | 99.2 |
| Sales of cooking units - Gas (%) | 29.6 | 28.8 | 26.1 | 18.9 | 9.03 | 2.91 | 0.784 |
| Sales of space heating units - Electric Heat Pump (%) | 14 | 21.3 | 23.9 | 31.4 | 44.1 | 54.1 | 58.4 |
| Sales of space heating units - Electric Resistance (%) | 35.6 | 41.8 | 41.1 | 39.2 | 35.8 | 32.7 | 31 |
| Sales of space heating units - Fossil (%) | 8.89 | 13.8 | 13.5 | 12.4 | 10.6 | 9.24 | 8.81 |
| Sales of space heating units - Gas (%) | 41.5 | 23 | 21.5 | 17 | 9.58 | 4.03 | 1.76 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 1.23 | 4.71 | 14.8 | 30.9 | 42.3 | 46.7 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 61.3 | 60 | 56.4 | 51 | 47.6 | 46.5 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 31.9 | 29.8 | 23.3 | 12.8 | 4.87 | 1.59 |
| Sales of water heating units - Other (%) | 6.95 | 5.56 | 5.52 | 5.49 | 5.39 | 5.31 | 5.28 |

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 | 0 | 239 | 450 | 1,569 | 4,778 | 7,016 |
| Public EV charging plugs - DC Fast (1000 units) | 0.551 | 0 | 1.02 | 0 | 3.86 | 0 | 10.1 |
| Public EV charging plugs - L2 (1000 units) | 2.37 | 0 | 24.5 | 0 | 92.8 | 0 | 244 |
| 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 (%) | 1.52 | 1.94 | 2.05 | 1.63 | 1.04 | 0.532 | 0.228 |
| Vehicle sales - Light-duty - EV (%) | 1.94 | 4.79 | 12.1 | 26.2 | 48.8 | 72.3 | 87.7 |
| Vehicle sales - Light-duty - gasoline (%) | 91.6 | 87.3 | 79.3 | 66.2 | 45.8 | 24.6 | 10.9 |
| Vehicle sales - Light-duty - hybrid (%) | 4.73 | 5.52 | 6.19 | 5.61 | 4.19 | 2.46 | 1.19 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.113 | 0.379 | 0.324 | 0.246 | 0.174 | 0.096 | 0.045 |
| Vehicle sales - Light-duty - other (%) | 0.101 | 0.105 | 0.095 | 0.083 | 0.059 | 0.033 | 0.015 |
| 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 | 0.004 | 0.227 | 0 | 0 | 0 | 0 |
| Capital invested - Biomass w/ccu allam power plant (billion $2018) | 0 | 0 | 0 | 0 | 0.008 | 0 | 0 |
| Capital invested - Biomass w/ccu power plant (billion $2018) | 0 | 0 | 0 | 0 | 0.063 | 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 | 7.38 | 452 | 452 | 452 | 452 | 452 |
| Biomass w/ccu allam power plant (GWh) | 0 | 0 | 0 | 0 | 8.4 | 8.4 | 8.4 |
| Biomass w/ccu power plant (GWh) | 0 | 0 | 0 | 0 | 70.4 | 70.4 | 70.4 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Biomass purchases (million $2018/year) | 0 | 63.7 | 192 | 194 | 290 | 684 | 729 |
| Conversion capital investment - Cumulative 5-yr (million $2018) | 0 | 4.26 | 253 | 26.4 | 1,350 | 5,424 | 624 |
| Number of facilities - Allam power w ccu (quantity) | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Number of facilities - Beccs hydrogen (quantity) | 0 | 0 | 0 | 0 | 1 | 6 | 7 |
| Number of facilities - Diesel (quantity) | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Number of facilities - Diesel ccu (quantity) | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Number of facilities - Power (quantity) | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of facilities - Power ccu (quantity) | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Number of facilities - Pyrolysis (quantity) | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Number of facilities - Pyrolysis ccu (quantity) | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Number of facilities - Sng (quantity) | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of facilities - Sng ccu (quantity) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Annual - All (MMT) | | 0 | 0 | 3.35 | 5.03 | 12.1 | 13 |
| Annual - BECCS (MMT) | | 0 | 0 | 0 | 1.71 | 8.69 | 9.49 |
| Annual - Cement and lime (MMT) | | 0 | 0 | 3.35 | 3.32 | 3.42 | 3.53 |
| Annual - NGCC (MMT) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Cumulative - All (MMT) | | 0 | 0 | 3.35 | 8.38 | 20.5 | 33.5 |
| Cumulative - BECCS (MMT) | | 0 | 0 | 0 | 1.71 | 10.4 | 19.9 |
| Cumulative - Cement and lime (MMT) | | 0 | 0 | 3.35 | 6.67 | 10.1 | 13.6 |
| 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 | 0 | 776 | 984 | 1,486 | 1,688 |
| Cumulative investment - All (million $2018) | | 0 | 0 | 1,800 | 1,935 | 2,313 | 2,443 |
| Cumulative investment - Spur (million $2018) | | 0 | 0 | 98.6 | 233 | 611 | 741 |
| Cumulative investment - Trunk (million $2018) | | 0 | 0 | 1,702 | 1,702 | 1,702 | 1,702 |
| Spur (km) | | 0 | 0 | 101 | 309 | 811 | 1,013 |
| Trunk (km) | | 0 | 0 | 675 | 675 | 675 | 675 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| CO2 storage (MMT) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Injection wells (wells) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Resource characterization, appraisal, permitting costs (million $2020) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Wells and facilities construction costs (million $2020) | | 0 | 0 | 0 | 0 | 0 | 0 |

Table 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) | | | | | | | -0.035 |
| Carbon sink potential - Aggressive deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,981 |
| 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) | | | | | | | -147 |
| Carbon sink potential - Aggressive deployment - Total (1000 tCO2e/y) | | | | | | | -2,129 |
| Carbon sink potential - Moderate deployment - Corn-ethanol to energy grasses (1000 tCO2e/y) | | | | | | | -0.035 |
| Carbon sink potential - Moderate deployment - Cropland measures (1000 tCO2e/y) | | | | | | | -1,027 |
| 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) | | | | | | | -73.6 |
| Carbon sink potential - Moderate deployment - Total (1000 tCO2e/y) | | | | | | | -1,101 |
| Land impacted for carbon sink - Aggressive deployment - Corn-ethanol to energy grasses (1000 hectares) | | | | | | | 0.062 |
| Land impacted for carbon sink - Aggressive deployment - Cropland measures (1000 hectares) | | | | | | | 6,909 |
| Land impacted for carbon sink - Aggressive deployment - Cropland to woody energy crops (1000 hectares) | | | | | | | 0.016 |
| Land impacted for carbon sink - Aggressive deployment - Pasture to energy crops (1000 hectares) | | | | | | | 2.81 |
| Land impacted for carbon sink - Aggressive deployment - Permanent conservation cover (1000 hectares) | | | | | | | 235 |
| Land impacted for carbon sink - Aggressive deployment - Total (1000 hectares) | | | | | | | 7,146 |

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 - Corn-ethanol to energy grasses (1000 hectares) | | | | | | | 0.062 |
| Land impacted for carbon sink - Moderate deployment - Cropland measures (1000 hectares) | | | | | | | 1,458 |
| Land impacted for carbon sink - Moderate deployment - Cropland to woody energy crops (1000 hectares) | | | | | | | 0.016 |
| Land impacted for carbon sink - Moderate deployment - Pasture to energy crops (1000 hectares) | | | | | | | 2.81 |
| Land impacted for carbon sink - Moderate deployment - Permanent conservation cover (1000 hectares) | | | | | | | 117 |
| Land impacted for carbon sink - Moderate deployment - Total (1000 hectares) | | | | | | | 1,578 |

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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |
| Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |
| 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) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |
| Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |
| Land impacted for carbon sink potential - Low - Improve plantations (1000 hectares) | | | | | | | 752 |

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 - Increase retention of HWP (1000 hectares) | | | | | | | 0 |
| Land impacted for carbon sink potential - Low - Increase trees outside forests (1000 hectares) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |
| Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |
| Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 63.6 | 0.07 | 0.07 | 0.053 | 0.033 | 0 |
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 60.3 | 31.8 | 24.2 | 23.1 | 19.6 | 17.4 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,133 | 1,189 | 1,198 | 1,115 | 917 | 648 |
| Premature deaths from air pollution - Coal (deaths) | | 7.18 | 0.008 | 0.008 | 0.006 | 0.004 | 0 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 6.81 | 3.58 | 2.73 | 2.6 | 2.21 | 1.96 |
| Premature deaths from air pollution - Transportation (deaths) | | 127 | 134 | 135 | 125 | 103 | 72.9 |

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) | 0 | 22,575 | 23,159 | 0 | 0 | 0 | 0 |
| 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 (%) | 2.72 | 21.4 | 53.8 | 64.1 | 65.2 | 65.3 | 65.3 |
| Sales of space heating units - Electric Resistance (%) | 18.3 | 16.1 | 25.2 | 30.3 | 33.5 | 33.9 | 34 |
| Sales of space heating units - Fossil (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of space heating units - Gas Furnace (%) | 79 | 62.5 | 21 | 5.54 | 1.3 | 0.744 | 0.697 |
| Sales of water heating units - Electric Heat Pump (%) | 1.12 | 0.821 | 0.82 | 0.824 | 0.831 | 0.834 | 0.834 |
| Sales of water heating units - Electric Resistance (%) | 3.42 | 2.42 | 2.42 | 2.44 | 2.44 | 2.44 | 2.44 |
| Sales of water heating units - Gas Furnace (%) | 94.6 | 96.1 | 96.1 | 96.1 | 96.1 | 96.1 | 96.1 |
| Sales of water heating units - Other (%) | 0.885 | 0.628 | 0.63 | 0.632 | 0.632 | 0.63 | 0.631 |

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) | | 3.38 | 3.44 | 3.99 | 4.11 | 3.95 | 4.04 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Final energy use - Commercial (PJ) | 160 | 165 | 169 | 173 | 178 | 188 | 201 |
| Final energy use - Industry (PJ) | 342 | 367 | 387 | 404 | 428 | 457 | 490 |
| Final energy use - Residential (PJ) | 246 | 227 | 210 | 196 | 186 | 179 | 172 |
| Final energy use - Transportation (PJ) | 656 | 659 | 625 | 605 | 608 | 624 | 642 |

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 | 4.1 | 3.83 | 0 | 0 | 0 | 0 |
| Sales of cooking units - Electric Resistance (%) | 70.2 | 70.2 | 70.2 | 70.2 | 70.2 | 70.2 | 70.2 |
| Sales of cooking units - Gas (%) | 29.8 | 29.8 | 29.8 | 29.8 | 29.8 | 29.8 | 29.8 |
| Sales of space heating units - Electric Heat Pump (%) | 12.4 | 29.8 | 30.5 | 31.7 | 33.2 | 35.3 | 38.5 |
| Sales of space heating units - Electric Resistance (%) | 36.2 | 36.9 | 36.4 | 35.6 | 34.5 | 32.5 | 29.2 |
| Sales of space heating units - Fossil (%) | 9.05 | 12.7 | 11.5 | 10.8 | 10.6 | 10.5 | 10.6 |
| Sales of space heating units - Gas (%) | 42.3 | 20.7 | 21.6 | 21.9 | 21.7 | 21.7 | 21.7 |
| Sales of water heating units - Electric Heat Pump (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales of water heating units - Electric Resistance (%) | 45.5 | 61.7 | 61.7 | 61.6 | 61.6 | 61.6 | 61.6 |
| Sales of water heating units - Gas Furnace (%) | 47.5 | 32.7 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| Sales of water heating units - Other (%) | 6.95 | 5.57 | 5.55 | 5.6 | 5.61 | 5.61 | 5.61 |

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 (%) | 1.51 | 1.93 | 2.18 | 2.03 | 1.82 | 1.7 | 1.62 |
| Vehicle sales - Light-duty - EV (%) | 3.7 | 5.77 | 6.57 | 8.08 | 9.83 | 11.3 | 12.5 |
| Vehicle sales - Light-duty - gasoline (%) | 90 | 86.4 | 84.2 | 82.3 | 80.2 | 78.3 | 76.7 |
| Vehicle sales - Light-duty - hybrid (%) | 4.57 | 5.41 | 6.62 | 7.18 | 7.74 | 8.3 | 8.72 |
| Vehicle sales - Light-duty - hydrogen FC (%) | 0.111 | 0.375 | 0.343 | 0.304 | 0.301 | 0.301 | 0.312 |
| Vehicle sales - Light-duty - other (%) | 0.1 | 0.104 | 0.1 | 0.101 | 0.1 | 0.099 | 0.101 |
| 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) | | | | | | | -2,170 |
| Carbon sink potential - High - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -71,521 |
| Carbon sink potential - High - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,904 |
| Carbon sink potential - High - Extend rotation length (1000 tCO2e/y) | | | | | | | -9,494 |
| Carbon sink potential - High - Improve plantations (1000 tCO2e/y) | | | | | | | -4,080 |
| Carbon sink potential - High - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -29,790 |
| Carbon sink potential - High - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -1,078 |
| Carbon sink potential - High - Reforest cropland (1000 tCO2e/y) | | | | | | | -14,981 |
| Carbon sink potential - High - Reforest pasture (1000 tCO2e/y) | | | | | | | -2,477 |
| Carbon sink potential - High - Restore productivity (1000 tCO2e/y) | | | | | | | -5,545 |
| Carbon sink potential - Low - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,087 |
| Carbon sink potential - Low - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -26,982 |
| Carbon sink potential - Low - Avoid deforestation (1000 tCO2e/y) | | | | | | | -317 |
| Carbon sink potential - Low - Extend rotation length (1000 tCO2e/y) | | | | | | | -3,647 |
| Carbon sink potential - Low - Improve plantations (1000 tCO2e/y) | | | | | | | -2,076 |
| Carbon sink potential - Low - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -9,930 |
| Carbon sink potential - Low - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -377 |
| Carbon sink potential - Low - Reforest cropland (1000 tCO2e/y) | | | | | | | -7,491 |

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

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Carbon sink potential - Low - Reforest pasture (1000 tCO2e/y) | | | | | | | -188 |
| Carbon sink potential - Low - Restore productivity (1000 tCO2e/y) | | | | | | | -1,869 |
| Carbon sink potential - Mid - Accelerate regeneration (1000 tCO2e/y) | | | | | | | -1,629 |
| Carbon sink potential - Mid - All (not counting overlap) (1000 tCO2e/y) | | | | | | | -49,216 |
| Carbon sink potential - Mid - Avoid deforestation (1000 tCO2e/y) | | | | | | | -1,111 |
| Carbon sink potential - Mid - Extend rotation length (1000 tCO2e/y) | | | | | | | -6,570 |
| Carbon sink potential - Mid - Improve plantations (1000 tCO2e/y) | | | | | | | -3,042 |
| Carbon sink potential - Mid - Increase retention of HWP (1000 tCO2e/y) | | | | | | | -19,860 |
| Carbon sink potential - Mid - Increase trees outside forests (1000 tCO2e/y) | | | | | | | -728 |
| Carbon sink potential - Mid - Reforest cropland (1000 tCO2e/y) | | | | | | | -11,236 |
| Carbon sink potential - Mid - Reforest pasture (1000 tCO2e/y) | | | | | | | -1,332 |
| Carbon sink potential - Mid - Restore productivity (1000 tCO2e/y) | | | | | | | -3,707 |
| Land impacted for carbon sink potential - High - Accelerate regeneration (1000 hectares) | | | | | | | 355 |
| Land impacted for carbon sink potential - High - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 258 |
| Land impacted for carbon sink potential - High - Extend rotation length (1000 hectares) | | | | | | | 4,841 |
| Land impacted for carbon sink potential - High - Improve plantations (1000 hectares) | | | | | | | 1,503 |
| 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) | | | | | | | 102 |
| Land impacted for carbon sink potential - High - Reforest cropland (1000 hectares) | | | | | | | 990 |
| Land impacted for carbon sink potential - High - Reforest pasture (1000 hectares) | | | | | | | 70.4 |
| Land impacted for carbon sink potential - High - Restore productivity (1000 hectares) | | | | | | | 1,838 |
| Land impacted for carbon sink potential - High - Total impacted (over 30 years) (1000 hectares) | | | | | | | 9,959 |
| Land impacted for carbon sink potential - Low - Accelerate regeneration (1000 hectares) | | | | | | | 178 |
| Land impacted for carbon sink potential - Low - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 242 |
| Land impacted for carbon sink potential - Low - Extend rotation length (1000 hectares) | | | | | | | 1,855 |

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 - Improve plantations (1000 hectares) | | | | | | | 752 |
| 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) | | | | | | | 53.9 |
| Land impacted for carbon sink potential - Low - Reforest cropland (1000 hectares) | | | | | | | 495 |
| Land impacted for carbon sink potential - Low - Reforest pasture (1000 hectares) | | | | | | | 12.2 |
| Land impacted for carbon sink potential - Low - Restore productivity (1000 hectares) | | | | | | | 1,112 |
| Land impacted for carbon sink potential - Low - Total impacted (over 30 years) (1000 hectares) | | | | | | | 4,699 |
| Land impacted for carbon sink potential - Mid - Accelerate regeneration (1000 hectares) | | | | | | | 266 |
| Land impacted for carbon sink potential - Mid - Avoid deforestation (over 30 years) (1000 hectares) | | | | | | | 250 |
| Land impacted for carbon sink potential - Mid - Extend rotation length (1000 hectares) | | | | | | | 3,348 |
| Land impacted for carbon sink potential - Mid - Improve plantations (1000 hectares) | | | | | | | 1,131 |
| 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) | | | | | | | 78.2 |
| Land impacted for carbon sink potential - Mid - Reforest cropland (1000 hectares) | | | | | | | 743 |
| Land impacted for carbon sink potential - Mid - Reforest pasture (1000 hectares) | | | | | | | 88.2 |
| Land impacted for carbon sink potential - Mid - Restore productivity (1000 hectares) | | | | | | | 2,240 |
| Land impacted for carbon sink potential - Mid - Total impacted (over 30 years) (1000 hectares) | | | | | | | 8,144 |

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) | -27.2 | | -5.37 | | | | -4.47 |
| Business-as-usual carbon sink - Retained in Hardwood Products (Mt CO2e/y) | -8.11 | | -13.6 | | | | -14.3 |
| Business-as-usual carbon sink - Total (Mt CO2e/y) | -35.3 | | -19 | | | | -18.8 |

Table 66: *REF scenario - IMPACTS - Health*

| Item | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Monetary damages from air pollution - Coal (million 2019$) | | 271 | 195 | 35.8 | 28.1 | 25.7 | 24.2 |
| Monetary damages from air pollution - Natural Gas (million 2019$) | | 72.7 | 72 | 75.4 | 61 | 55.4 | 57.5 |
| Monetary damages from air pollution - Transportation (million 2019$) | | 1,130 | 1,203 | 1,275 | 1,353 | 1,434 | 1,517 |
| Premature deaths from air pollution - Coal (deaths) | | 30.6 | 22 | 4.05 | 3.18 | 2.91 | 2.73 |
| Premature deaths from air pollution - Natural Gas (deaths) | | 8.21 | 8.13 | 8.52 | 6.89 | 6.26 | 6.49 |
| Premature deaths from air pollution - Transportation (deaths) | | 127 | 135 | 143 | 152 | 161 | 171 |