

# Index

**This chapter should be cited as:**

IPCC, 2022: Index. In IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.026

Note: \* indicates the term also appears in the Glossary and n indicates a footnote. Italicised page numbers denote tables, figures, associated captions and boxed material. Bold page numbers indicate entire chapter spans.

**1.5°C pathway\*** 14–25, 15–16, 21–23, 26–27, 44, 174–175, 175, 274, 298–299, 332, 424–426, 435, 1585, 1585, 1871  
 carbon lock-in and stranded assets 28, 188, 697, 698  
 co-benefits and trade-offs 376, 1741–1742  
 emissions gap 14, 14  
 energy system scenarios 436–437, 615, 625–626, 685–700, 685–692, 694–695, 698, 699, 703  
 fossil fuels use and phase-out 267, 438, 625–626, 698–700  
 high renewable accelerated pathways 436–437  
 industry sector 1199–1200, 1200  
 investment and finance 158–159, 300, 1550  
 land occupation and mitigation 1297, 1298  
 mitigation costs 156, 703  
 and net zero 174, 324, 325–327, 328, 329, 337  
 remaining carbon budget 6–7, 174, 188, 319, 349  
 sectoral strategies 337  
 technology cost and deployment 1658, 1658–1659  
 see also long-term goal compatible mitigation pathways

**1.5°C scenarios** 433–435, 1742, 1743, 1873

**2°C pathways** 14–25, 14, 15–16, 21–23, 26–27, 174–175, 175, 274, 298–300, 332, 351, 424–426, 435, 1585, 1585  
 carbon budgets 174, 1874  
 co-benefits and trade-offs 377, 1741–1742  
 energy system scenarios 436, 615, 625–626, 685–700, 685–692, 694–695, 698, 699, 703  
 fossil fuel use and phase-out 267, 438, 625–626, 698–700  
 industry sector 1199–1200, 1200  
 land occupation and mitigation 1297, 1298  
 mitigation costs 156, 703  
 and net zero 174, 324, 325–327, 328, 329, 337  
 sectoral strategies 337  
 technology cost and deployment 1658, 1658–1659  
 see also long-term goal compatible mitigation pathways

**2°C Scenario (2DS)** 1201, 1202, 1203

**2°C scenarios** 32, 193, 431, 433, 698–700, 1201, 1202, 1203, 1742, 1743, 1873

**2030 Agenda for Sustainable Development**  
 155, 1455–1456, 1485, 1486, 1498, 1732–1733, 1738–1739

## A

**absolute decoupling** 242, 243, 243, 244, 274, 452, 513

**absorptive capacity** 1676, 1685

**accelerating mitigation** 40, 45, 153–154, 411–413, 414, 415–447, 477, 1409–1411, 1412, 1694  
 behaviour and lifestyle changes 412, 440, 460, 463–464, 505  
 cross-sector and economy-wide system change 1359, 1406–1411  
 demand-side measures 512  
 enabling conditions 412–413, 414, 459–464, 460, 1359, 1407  
 equity and just transitions 189, 472–474, 474, 475, 517–518, 1407  
 impact on development objectives 411, 442–446  
 international cooperation 356–358, 471, 1410  
 obstacles 411, 446–447, 446, 447  
 pathways 356–358, 357, 435–442, 436–437, 476  
 policies 412–413, 444, 460, 461  
 policy integration 461, 464–468, 471, 1359, 1394  
 public support 1358  
 risks and uncertainties 471–472  
 and shifting development pathways 414–415, 459–468, 471–472  
 societal perspective 517–518, 1358  
 unsuitable 'structures' 446, 447

**accelerating transition** 45, 185, 255, 256–259, 562–564, 565, 1772

**accelerating transition in sustainable development context** 147, 1727–1772  
 adaptation and mitigation 1756–1759, 1771  
 AFOLU sector 1749–1751, 1770–1771  
 barriers 1729, 1730–1731, 1764–1770, 1771  
 cities, infrastructure and transport 1755–1756, 1770  
 cross-sectoral transitions 1749–1764, 1770  
 digitalisation 1730, 1759–1761  
 enabling conditions 1729, 1730–1731, 1764–1770, 1771  
 factors influencing transitions 1729, 1734–1738, 1770  
 FAQs 1772  
 governance 1729, 1735–1736, 1767–1768, 1772  
 industry 1754–1755  
 institutional factors 1735–1736, 1767–1768, 1772  
 international cooperation 1732–1734, 1735, 1736  
 just transition 1729, 1730, 1731, 1745–1749, 1768–1769  
 pathways and scenarios 1739–1742  
 policy coherence and integration 1731, 1733, 1736, 1758, 1759, 1769  
 political economy 1735–1736, 1743, 1748, 1768, 1770  
 renewable energy penetration and fossil fuel phase-out 1742–1749, 1743, 1771  
 short-term and long-term transitions 1738–1739  
 stranded assets 1730, 1744–1745, 1747, 1771  
 synergies and trade-offs 1729–1730, 1749–1751, 1753–1754, 1755, 1756, 1757–1758, 1759–1760, 1761–1764, 1762, 1770–1771  
 systems-level perspective 1737–1738, 1770  
 transition process 1748–1749  
 water-energy-food nexus 1751–1754, 1758, 1759, 1760–1761

**acceptability of policy or system change\*** 382, 556, 702–703, 1658  
 carbon taxes 466, 507  
 CDR methods 1277, 1279  
 fossil fuels 648  
 nuclear power 640–641  
 renewable energy 633, 637, 639, 646, 649

**access**  
 to finance 1321, 1549, 1550  
 to food 1279–1280  
 to modern energy services\* 9, 622–623, 623–624, 1000–1001, 1001  
 for clean cooking 517, 548, 559, 623, 623, 1003–1004, 1603–1604  
 electrification co-benefits 705, 1001, 1003–1004  
 and emissions 218, 254–255  
 energy security 1005  
 inequity 516–521  
 to services 514, 515, 516–517, 517–518  
 to technology and infrastructure services 517–518  
 see also energy access\*

**action research** 1737

**active travel/transport** 908, 909, 926, 1052

**activism** 165, 506, 525, 556–557, 1374–1375, 1375, 1508–1509, 1765  
 see also climate litigation

**adaptation\*** 40–43, 525–527, 1207  
 adaptive management 1406  
 buildings 956, 996–998  
 capacity building 1686  
 finance/financing needs 915–916, 1550, 1554, 1555, 1573–1574  
 international cooperation 1404–1405, 1474, 1686  
 and just transitions 1747  
 and mitigation 1359, 1400–1405, 1402, 1403–1404  
 AFOLU sector 753–754, 830  
 and bioeconomy 1307–1311  
 development pathways 468–471  
 sustainable development context 1401–1403, 1756–1759, 1771  
 National Adaptation Plans (NAPs) 1401, 1574  
 Paris Agreement 1474  
 synergies and trade-offs 1400–1403, 1401, 1729, 1756–1759  
 technology and innovation 1686, 1699  
 transport sector 1057

- urban adaptation and mitigation 876–877, 877–880, 1758–1759, 1771
- adaptation gap** 426, 1574
- adaptation pathways\*** 469, 1407
- adaptive capacity\*** 42, 468–471, 828–829, 876, 998, 1302, 1686, 1729, 1757
- additionality\*** 813, 820–821
- adverse side-effects\***
- AFOLU sector 770, 779, 780, 781, 800, 803, 827, 829, 831, 1743
  - for biodiversity and ecosystem services 827–828, 829
  - bioenergy and BECCS 800, 831
  - cross-sectoral perspective 1311–1313
  - food system mitigation 803, 1286–1287
  - land degradation 827–828
  - mining and deforestation 770
  - policy evaluation for 1383–1384, 1383
  - of renewable energy 1743
  - of shift to sustainable healthy diets 803
  - of soil carbon management 789
- aerosol masking** 159n
- aerosols\***
- emissions 24, 159, 221, 232–233
  - stratospheric aerosol interventions (SAI) 1489, 1490, 1491–1492, 1494
  - see also particulate matter (PM)\*; short-lived climate forcers (SLCFs)\*
- afforestation\*** 272, 323, 471, 751, 766, 767, 780–781, 825–826
- afforestation/reforestation (A/R)** 766, 780–781, 1264, 1265, 1273–1274, 1276, 1277, 1300–1302
- Afghanistan** 1741
- Africa** 1823, 1824
- accelerated mitigation pathways 435
  - adaptation and mitigation synergies 1401
  - AFOLU 453, 768, 806–807, 806, 820, 822, 828, 828–829
  - emissions 252–253, 253, 254, 756, 759, 759, 765, 765, 766
  - mitigation potential 777, 778, 780, 781, 782, 783, 784, 810–811, 810, 816
  - air pollution 442
  - buildings energy demand 970, 971, 973, 973
  - buildings mitigation potential 989, 991
  - climate change impacts on energy supply 668
  - climate laws 1361
  - climate-related economic losses 1594
  - climate-smart agriculture (CSA) 828, 828–829
  - climate-smart villages (CSV) 795
  - cooking energy/technology 548
  - development pathways 453, 453–454
  - electromobility 1113
  - emissions 218, 335
  - AFOLU 252–253, 253, 254, 756, 759, 759, 765, 765, 766
  - buildings sector 250, 964, 965, 966, 968, 978
  - consumption-based 241, 242
  - embodied in trade 244
  - energy sector 248, 620, 621, 622, 685, 686
  - industry sector 249
  - timing of net zero 324
  - transport sector 252, 1053, 1055, 1056, 1099, 1100, 1101
  - trends and drivers 233, 234–235, 236, 238, 246
  - urban 885, 885, 886
  - emissions and land dynamics 806–807
  - energy access 548, 568, 623
  - energy investment needs 1571, 1571, 1603–1604
  - energy systems 626, 668, 685, 686, 690, 691, 1505
  - energy use trends 623
  - fire regimes 770
  - forest and forestry 767, 770, 816, 820, 1503
  - fossil fuels 626, 1746
  - geologic CO<sub>2</sub> storage potential 641
  - grassland area 784
  - infrastructure development 769
  - investment and finance flows 1562, 1563, 1577, 1606, 1746
  - investment needs 1571, 1571, 1602, 1603–1604
  - land-based emissions/removals 806
  - land cover change 807
  - land use 767, 768, 784
  - local capital markets 1606
  - mining and deforestation 770
  - mitigation potential 777, 778, 780, 781, 782, 783, 784, 810–811, 810, 816, 989, 991
  - pathways and scenarios 685, 686, 690, 691, 806–807, 806, 888, 888, 889, 891, 892
  - per capita floor area 969, 970
  - population 313, 883
  - rare metals for batteries 1744
  - REDD+ 1503
  - regreening the Sahel 820
  - renewable energy projects 1505
  - rice cultivation 771
  - services for well-being 514, 515
  - technology transfer 1502, 1685
  - transport demand 1101–1103, 1102
  - transport modal trends 1104, 1113
  - urban informal economy 870
  - urban land expansion 768, 863, 883, 883, 888, 888, 889
  - urban population 883
  - urbanisation 768, 868, 888, 888, 889, 891, 892
  - voluntary offsets 814
  - see also *specific countries*
- aggregated approaches** 180–182
- agriculture and farming methods** 788–796, 796–799
- agroecological approaches 796–798, 1285, 1300, 1310, 1697–1698
  - cellular agriculture 1286, 1289, 1294
  - climate-smart agriculture (CSA) 470, 795, 828, 828–829, 1309, 1757
  - conservation agriculture\* 470, 797, 798, 1757
  - controlled-environment agriculture 1286, 1288
  - digital agriculture 1285, 1286, 1288
  - farming system approaches 469–470, 796–798
  - intensification 768, 1698
  - modernisation 455
  - regenerative agriculture\* 798
  - solar PV deployment 1303
  - sustainable intensification\* 751, 822–823, 828–829, 1286, 1288, 1757
  - urban and peri-urban 875, 910
- Agriculture, Forestry and Other Land Use (AFOLU)\*** 33–34, 107–110, 747–831
- accounting methods 750, 752, 756, 758, 759, 760–762, 761, 762–763
  - adaptation and mitigation 469–471, 753–754, 795, 824–825, 826, 830, 1309–1310, 1757–1758, 1771
  - additionality, permanence and leakage 820–821
  - barriers and opportunities 470, 751, 753, 777, 779, 780, 781, 783, 784, 785, 786–787, 788–790, 791, 792, 793, 794, 796, 800, 803, 804, 823–826, 1310
  - biodiversity 827–828, 829, 1758
  - bioenergy and bio-based options 751, 1299–1302
  - biochar 789–790
  - bioeconomy 1307–1311
  - bioenergy/BECCS 789, 799–802, 801–802, 809, 823, 831, 1758
  - construction materials 995–996, 1308
  - biophysical effects 766
  - carbon sequestration 781, 784, 785, 788–791, 791–792, 821, 823
  - CDR methods 1264, 1265, 1273–1277, 1275–1276
  - climate change impacts 335, 753, 1741
  - climate-smart approaches 470, 782, 782–783, 795, 800, 828, 828–829, 1309, 1757
  - co-benefits and risks 470, 751, 775, 778, 779, 780, 781, 783, 784, 785, 786–789, 790, 791, 792, 793, 794, 795–796, 799–800, 802–805
  - conservation measures 784–787, 798, 815–817, 819, 826, 829
  - conversion of natural ecosystems 768, 784–786
  - cross-sectoral implications 1313, 1730, 1770–1771
  - demand-side measures 529, 530, 750–751, 753, 775, 776, 777, 778, 802–805
  - deployment rate 751
  - development pathways 452–453, 467–468, 469–470
  - digitalisation 1653, 1760, 1761
  - ecosystem services 827–828, 829
  - emissions and removals 8, 159, 750, 754, 755–766, 755
  - accounting methods 752, 760–762, 761, 762–763
  - anthropogenic CO<sub>2</sub> flux 760–762, 761, 762–763
  - food system GHG emissions 1280, 1281, 1282–1283, 1282
  - GHG sources and sinks 755, 765, 766, 1832, 1835–1836
  - global net CO<sub>2</sub> flux 758–759, 758
  - methane (CH<sub>4</sub>) emissions 750, 751, 764–766, 764, 765, 771, 792–793, 795–796, 1832, 1833, 1835–1836
  - net-zero CO<sub>2</sub> emissions 328

- nitrous oxide (N<sub>2</sub>O) emissions 750, 751, 764–766, 764, 765, 771, 793–794, 795–796
- projected emissions with NDCs 419–420, 421
- regional net CO<sub>2</sub> flux 759–760, 759
- total net GHG flux 756–758, 756, 757
- emissions drivers 246, 252–254, 253, 753, 767–773
- emissions reductions 346, 346, 792–796
- emissions trends 750, 751, 753
- global 218, 238, 755–759, 756, 758, 764–765, 764
- regional 238, 759–760, 759, 765–766, 765
- sectoral GHGs 236–237, 237, 246, 252–254, 253
- FAQs 831
- feasibility 751, 753, 777, 789, 826
- food system 802–804, 1280, 1281, 1282–1283, 1282, 1285–1288, 1286
- forest and other ecosystems 779–788, 782–783
- governance 773, 825, 828–829, 1750
- integrated models and scenarios 762–763, 792, 801–802, 805–812, 1741, 1855–1856, 1868–1869, 1892
- international cooperation 1503–1504, 1514
- investment and finance 751–752, 773, 815, 821–822, 824, 824, 1320–1321, 1569
- investment gap 1576–1577
- investment needs 1572, 1573, 1573
- knowledge gaps 830
- land cover change 347
- long-term mitigation options 1260
- marginal abatement costs 807–809
- mitigation measures\* 751, 752, 755, 774–805, 776, 778, 782–783, 791–792, 795, 796–799, 801–802, 1260
- mitigation potential, costs and pathways 38–39, 335, 762–763, 774–777, 776, 778–779, 780–812, 799, 808, 810, 811, 1252–1253, 1254–1255, 1257, 1258, 1259–1260
- monitoring, reporting and verification 760–761, 826, 830
- Paris Agreement 1469–1470, 1476–1477
- policy development 812–815, 813
- policy impacts 272–273
- policy instruments 751–752, 815–823, 828–829, 1382
- regulatory instruments 467–468
- renewable energy impacts 1743
- scenarios and pathways 25, 323, 337, 346–348, 346, 347, 799, 805–812, 807, 808, 810, 811, 1247, 1297–1298, 1892
- sequestration through CDR 1264, 1265
- short-lived climate forcers (SLCFs)\* 766
- subsidies 751, 816, 821–822
- supply-side measures\* 751, 753, 775, 776–777, 779–802
- and sustainable development 810, 827, 829, 1749–1751, 1770, 1771
- synergies and trade-offs with SDGs 41–42, 775, 810, 1309–1311, 1730, 1749–1751, 1757–1758, 1761–1763, 1762, 1764, 1770–1771
- technology and innovation 773, 1285, 1286, 1288, 1697–1698
- transition in sustainable development context 1749–1751, 1770, 1771
- uncertainties 750, 752, 780, 787, 788, 791, 830
- water-energy-food nexus 1753, 1770–1771
- and well-being 827, 829
- see also afforestation/reforestation (A/R); agriculture and farming methods; agroecology\*; agroforestry; land-based mitigation
- agroecological intensification** 1698
- agroecology\*** 796–798, 1285, 1300, 1310, 1697–1698
- agroforestry** 470, 790–791, 791–792, 816, 902, 1274, 1276, 1757
- air conditioning** 439, 961, 973, 974, 987, 1662–1663, 1679
- air pollution\*** 159n, 271–272, 1002
- co-benefits of mitigation 368, 376–377, 441–442, 1755–1756
- and COVID-19 pandemic 163
- deep decarbonisation scenarios 1740
- economic quantification of co-benefit 368
- emissions trends 232–233, 232
- energy systems 623, 623–624
- health and 233, 368, 376–377, 1002, 1755–1756
- household 548
- indoor air quality 705, 875, 960, 1002
- international cooperation 1496
- model assessment 1741–1742
- shipping 1093–1094, 1097
- SLCF reductions 441–442
- warming contribution 349–350
- air quality** 271–272, 705, 875, 960, 1002, 1093–1094
- albedo\*** 766, 780, 781, 1301, 1303
- Amazon** 467–468
- AFOLU mitigation potential 784
- deforestation 768, 769, 769, 818–819
- fire regimes 770
- peatlands 785
- road building 769
- urbanisation 768
- Amazon Soy Moratorium (SoyM)** 467, 784, 818
- ammonia (NH<sub>3</sub>)**
- contribution to warming 225
- emissions 232, 796
- fuel 1052, 1068, 1071
- hydrogen carrier 658
- production 658, 1184, 1192
- anaerobic digestion** 649–650, 796, 910, 1182, 1301
- analytic frameworks** 5, 153–154, 180–187, 191
- animal waste management** 795–796, 806
- Annex I countries** 1823
- Annex II countries** 1823
- anthropogenic\***
- defining emissions/removals as 750n, 760–762, 761
- direct drivers 767–771
- direct effects 760
- indirect drivers 767, 773
- indirect effects 758, 760
- anthropogenic emissions\*** 6–9, 7, 10–11, 217–226, 223–224, 226–228, 229, 230, 231, 234–235, 237, 238
- accounting methods 752, 756, 760–762, 761
- AFOLU GHG emissions 750, 752, 753
- AFOLU land CO<sub>2</sub> fluxes 348, 750, 752, 756–762, 762–763
- AFOLU land GHG fluxes 750, 752, 756–758, 756, 757, 760
- AFOLU net GHG emissions 756–758, 756, 757
- COVID-19 pandemic 925–926
- emission metrics 1830, 1831
- from food systems 1279, 1281
- IAM pathways 348
- net-zero CO<sub>2</sub> emissions 348
- by regions 9, 10–11
- by sector 8, 66
- see also emissions trends and drivers; short-lived climate forcers (SLCFs)\*
- anthropogenic removals\*** 1830
- AFOLU land CO<sub>2</sub> fluxes 762–763
- AFOLU net GHG flux 756–758, 756, 757
- AFOLU sector 755
- IAM pathways 348
- see also carbon dioxide removal (CDR)\*
- appliances and lighting** 979–981, 980, 987, 992
- energy demand 972, 972–973, 974
- energy efficiency 980–981, 980, 1662–1663, 1678, 1679
- international cooperation 1015
- investment 1005
- light bulbs 570, 980, 981
- reducing energy demand 995
- refrigerators and air conditioners 1662–1663
- standards and labelling 1010, 1662–1663, 1678, 1679, 1679
- aquaculture** 827, 1282, 1288
- aquatic ecosystems** 377
- AR6 scenario database** 303, 305–309, 306, 307, 308, 383–384, 1882–1892
- building sector models 1850–1851
- climate classification 1886–1889, 1886–1888, 1890
- collection and vetting 1883–1884, 1883, 1884–1886
- global scenarios 1883–1889, 1883, 1884–1888, 1890, 1891
- national and regional pathways 1891, 1891–1892
- policy classification 1889, 1891
- sector transition pathways 1892, 1892
- Arab States** 870
- Arctic** 770, 1094, 1496, 1506
- Argentina** 434, 437, 567, 803, 1767
- artificial intelligence** 541, 1062
- artificial upwelling** 1271, 1273
- Asia**
- accelerated mitigation pathways 437
- AFOLU emissions 766

- AFOLU mitigation pathways 806–807, 806  
 AFOLU mitigation potential 782, 810–811, 810  
 air pollution 377, 441, 442  
 buildings policies 251  
 climate change impacts on energy supply 668  
 coal use and phase-out 624, 626, 699  
 economic growth and industrial emissions 1175–1176  
 emission drivers 1481  
 emissions and land dynamics 806–807  
 energy access 623  
 energy investment needs 1571, 1603–1604  
 energy sector 437, 1743  
 energy systems emissions scenarios 685, 686  
 energy use 517, 623  
 forest area 767  
 fuelwood harvest 770  
 geologic CO<sub>2</sub> storage potential 641  
 grassland area 784  
 inequality 264  
 land-based emissions/removals 806  
 land cover change 807  
 mining and deforestation 770  
 renewable energy capacity 627  
 rice cultivation 771  
 road building and deforestation 769  
 timing of net zero emissions 324  
 transport 1061  
 transport demand 1101–1103, 1102  
 urban land use trends 883  
 urbanisation 868  
*see also specific countries*
- Asia and Pacific (APC) 1824**  
 AFOLU mitigation potential 777, 778, 781, 782, 789, 790, 791, 792, 793, 803, 804  
 agricultural land use 768  
 buildings emissions 965  
 climate-related economic losses 1594  
 coal use and phase-out 624  
 consumption-based emissions 217, 241, 242  
 emissions embodied in trade 244, 245  
 emissions projections 335  
 emissions trends and drivers 238  
 energy sector emissions 620, 621, 622  
 fertiliser use 794  
 financial flows and stocks 1562, 1563  
 food system 804  
 IMP for energy system transformation 691  
 per capita emissions 218  
 rice cultivation 771  
 services for well-being 515  
 technology transfer and cooperation 1502  
 transport demand 1102, 1103  
 transport emissions 1053, 1099, 1100, 1101  
 urban emissions 863, 885, 885, 886  
 urban emissions scenarios 891, 892  
 urban land expansion 863, 888, 888, 889  
 urbanisation scenarios 888, 888, 889, 891, 892  
*see also Eastern Asia; South-East Asia and Pacific; Southern Asia*
- Asia-Pacific Developed region 968, 973, 974, 988, 989, 991**  
*see also Australia, Japan, and New Zealand*
- Asia Pacific Economic Cooperation (APEC) countries 1751**  
**atmosphere\* 156–157**  
**Australia**  
 accelerated mitigation pathways 437  
 AFOLU mitigation potential 783, 784  
 buildings 1005  
 buildings mitigation potential 989  
 carbon credits 813–814  
 climate change impacts on energy supply 668  
 climate governance and institutions 1366, 1376  
 energy-related CO<sub>2</sub> emission pathways 434  
 energy sector 437  
 fire management 783  
 fire regimes 770  
 geologic CO<sub>2</sub> storage potential 641  
 non-CO<sub>2</sub> emissions 1390  
 REDD+ 1503  
 transport 1060
- Australia, Japan, and New Zealand 1824, 1824**  
 AFOLU emissions 253, 756, 759  
 buildings emissions 250, 964, 965, 966, 968  
 embodied emissions 978  
 reduction potential 968  
 buildings energy demand 971, 973, 973, 974  
 buildings mitigation potential 955, 988, 989, 991  
 emissions trends and drivers 233, 234–235, 236, 246  
 energy investment needs 1571  
 energy sector emissions 248  
 energy system 247  
 industry emissions 248, 249  
 per capita floor area 969  
 transport emissions 252, 1055, 1056  
 urban land use trends 884  
 urban population and urban expansion 883
- Austria 377, 437, 1206**  
**automation/autonomous vehicles 541, 542–543, 1062, 1063, 1095, 1735**  
**autonomous systems 1062, 1095**  
**aviation 251, 252, 1052, 1053, 1056, 1065, 1066, 1068, 1070, 1086–1093, 1105, 1120**  
 COVID-19 pandemic 163, 230, 230, 1087, 1090, 1092  
 emissions 1086–1087, 1086, 1090–1092, 1091, 1092  
 CO<sub>2</sub> emissions 620, 620, 1086–1087, 1086, 1506–1507  
 energy sector 620, 620  
 impact of COVID-19 pandemic 230, 230  
 trends and drivers 230, 230, 237, 251, 252  
 fuel 1087–1089, 1113, 1118–1119  
 governance 1092–1093, 1115, 1115–1116  
 international cooperation 1506–1507  
 shift to high-speed rail (HSR) 1089–1090
- Avoid, Shift, Improve (ASI)\* 187, 508–510**  
 behaviour change 547, 548, 549  
 circular economy 545  
 and cultural change 506  
 demand-side options 560–561, 565–568  
 identifying options 533–535  
 mitigation potential 505  
 policies 565–568
- service-related mitigation options 527–535, 528  
 sharing economy\* 543  
 transport 529–531, 530, 1056, 1059–1061
- B**
- backcasting 454–455, 1853, 1870**  
**banks and financial institutions 1582–1583, 1584, 1603**  
 central banks 1586, 1595  
 development finance institutions (DFIs) 1589, 1605  
 financing firms 1665  
 green banks 1012, 1588  
 international finance institutions 1012, 1589  
 multilateral development banks (MDBs) 1320, 1483–1484, 1505, 1560, 1588, 1595, 1605  
 national finance institutions 1588  
 public development banks (PBDs) 1603
- barriers and enablers 44**  
 accelerating transition in sustainable development context 1729, 1730–1731, 1764–1770, 1771  
 AFOLU mitigation 751, 787, 792, 793, 796, 803, 823–826  
 buildings sector 956, 996, 1005–1007, 1006  
 carbon dioxide removal (CDR) 1272  
 climate governance 1398, 1399–1400, 1401, 1406  
 energy sector 629, 630, 633, 637, 660, 664  
 farming system approaches 470  
 feasibility assessment 1837–1838, 1837  
 industry sector 1164, 1180, 1201, 1203–1204, 1209, 1212–1213  
 international cooperation 1457  
 investment and finance 1574  
 land-based mitigation 789–790, 791  
 net-zero energy systems 677–678  
 sectoral transitions 1399–1400  
 technology and innovation 1644–1645, 1646–1647, 1646, 1652, 1654, 1658, 1696, 1766–1767  
 transport sector 543  
 urban systems 916–917, 918, 921–922
- baseline emissions 992, 995**  
**baseline/reference scenarios\* 303–304, 316, 345, 359, 385, 417, 965, 1101, 1251–1252**  
 compared to historical trends 232  
 policy analysis with IAMs 1861  
 urban areas 890
- batteries 11, 12, 654–655, 654**  
 chemistries 654, 655, 1069–1070  
 cost reductions 258  
 critical minerals 637–638, 1053, 1116, 1116–1117, 1120, 1744  
 EV batteries 11, 12, 257, 258, 628, 654–655, 657, 1069–1070, 1079, 1116, 1116–1117, 1120  
 lithium-ion batteries (LIBs) 11, 654–655, 674, 1053, 1069, 1079  
 critical minerals 1053, 1116, 1116–1117, 1120, 1744  
 for EVs 12, 1069, 1070

- hybrid energy storage (HES) systems 1070  
 prices 11, 12, 627–628  
 recycling 1053, 1069
- prices 11, 12, 615, 627–628  
 recycling 1053, 1069, 1120, 1744  
 redox flow batteries (RFBs) 656  
 technology improvement 257, 259, 627–628,  
 1069–1070  
 for variable renewable energy 615, 627–628,  
 674
- battery electric vehicles (BEVs)** *see* electric  
 vehicles (EVs)
- behavioural changes** 170–171, 185–186,  
 546–549, 549–554, 560  
 accelerated mitigation pathways 440  
 adaptation and mitigation 469  
 changing preferences 166, 513  
 choice architecture 506, 506n, 548–549,  
 549–554, 1295  
 COVID-19 pandemic 163, 507, 511–512  
 dietary shift 528–529, 547, 876, 1292–1295  
 education 1765  
 emissions reductions 908  
 enabling shifting development pathways and  
 accelerated mitigation 412, 460, 463–464  
 encouraging mitigation action 661–662,  
 701–702, 1737  
 energy demand reduction 661, 908–909  
 energy systems mitigation 661–662, 701–703,  
 704  
 financial incentives 701–702  
 habits, values and awareness 548, 1737, 1765,  
 1766  
 household consumption choices 507, 531–532,  
 532  
 information initiatives 1294–1295, 1391,  
 1750–1751  
 information technology 440  
 lifestyle shifts 263  
 low-carbon energy transition 696  
 motivation and capacity for change 506–507,  
 546–547, 548  
 policies 565, 566–567, 566  
 policy instruments 1295  
 scenarios 535, 536–537  
 social movements 1765  
 socio-behavioural aspects of urban mitigation  
 908–910  
 sustainability transitions 1764–1766  
 sustainable development and land management  
 1750  
 transport 440, 908, 909, 1052, 1059–1063,  
 1089, 1111–1112, 1121, 1766  
 waste and waste management 527–528,  
 909–910  
 willingness/reasons to adopt measures 984,  
 985–988, 986
- beliefs** *see* ideas, values and beliefs
- best available technology (BAT)** 1180–1181,  
 1181
- Beyond 2°C Scenario (B2DS)** 1201, 1202, 1203
- big data** 1062
- bio-based materials/products** 751, 804–805, 902,  
 995–996, 998, 1248, 1299, 1308
- biochar\*** 645, 789–790, 1273–1274, 1276, 1277,  
 1299, 1301–1302, 1698
- bioclimatic design** 956, 983–984
- biodiversity\*** 377–378, 753, 1749–1750, 1758  
 and AFOLU 827–828, 829  
 and cities 866  
 conservation 770, 826  
 international cooperation 1504
- bioeconomy** 1248, 1307–1311
- bioenergy\*** 167, 643–646, 644  
 accelerated mitigation pathways 438, 442  
 biomass feedstocks 1186, 1193, 1856  
 biomass trade 684–685  
 carbon neutrality 646  
 climate change impacts 665, 668  
 costs 645, 645  
 crop yields 645–646, 668  
 environmental and societal impacts 645–646,  
 1758  
 land use requirement 645–646, 1299,  
 1300–1301  
 levelised costs of electricity (LCOE) 662  
 linkages among sectors 340–341  
 mitigation potential 644–645, 751, 776  
 policies 818  
 scenarios and pathways 308, 309, 340–341,  
 1247, 1856  
 and SDGs 645, 705, 1749, 1761  
 traditional biomass 622–623, 623–624, 629,  
 644, 970–971, 972  
 trends in energy supply and use 622–623, 622,  
 627
- bioenergy with carbon dioxide capture and  
 storage (BECCS)\*** 28, 433–434, 436, 799–802,  
 801–802, 806, 807, 809, 823, 1182, 1273–1274,  
 1275  
 accelerated mitigation pathways 438  
 annual and cumulative sequestration 1264,  
 1265  
 biomass production 1299–1302  
 co-benefits and adverse side effects 800, 831  
 costs 645, 645  
 impacts on biodiversity and ecosystems 377,  
 831  
 land occupation, impacts and risks 825, 831,  
 1298, 1299–1302  
 linkages among sectors 340–341  
 low-carbon energy transition 693  
 mitigation potential 751, 776, 777, 1253  
 net-zero energy systems 675, 681  
 scenarios and pathways 25, 323, 324, 340–341,  
 348, 348, 538, 811, 812  
 technical potential\* 800, 802, 1273–1274
- bioethanol** 1182
- biofuels\*** 644, 1052, 1053, 1065–1068, 1071,  
 1074, 1075, 1308  
 aviation 1066, 1068, 1088  
 carbon footprint 1066, 1074, 1075  
 conversion technologies 1067  
 feedstocks 1066, 1066, 1068, 1088, 1182, 1186  
 land occupation 1298
- net-zero energy systems 676, 677  
 production 627, 643  
 production costs 645  
 shipping 1068, 1095  
 sustainable biofuels 32  
 technology readiness level (TRL) 1067  
 trends in energy use 622, 623
- biogas** 644, 796, 1095, 1186, 1273, 1301
- biogenic carbon emissions\*** 1195
- biogeochemical effects** 766
- biomass\*** 1182, 1247, 1321  
 for biochar 1274  
 bioeconomy 1307–1311  
 for bioenergy and BECCS 799–802, 801–802,  
 1274  
 conversion technology 1301–1302  
 crops 1299–1300  
 demand 529, 809  
 energy carriers from 643–644  
 feedstock 1186, 1193  
 gasification 657  
 industry scenario analysis 1203  
 land occupation 1298, 1299–1302  
 liquid fuels 677  
 marine biomass CDR options 1273  
 net-zero energy systems 684–685  
 production 85, 751, 1274  
 scenarios and pathways 341  
 solid biomass fuel 1182  
 terrestrial biomass dumping 1273  
 trade 684–685  
 traditional biomass 622–623, 623–624, 629,  
 644, 970–971, 972
- biomethane** 1065, 1182
- biomethanol** 1182
- biophysical effects** 766
- biorefineries** 1301
- black carbon (BC)\*** 441–442, 1496  
 contribution to warming 225, 350  
 emissions trends and drivers 232–233, 232
- black swans** 472
- block funding** 1674
- blockchain** 1062, 1607
- blue carbon\*** 470, 476, 786, 787, 788, 1271, 1272,  
 1275, 1403
- blue infrastructure\*** 875, 876, 877, 878, 902–903,  
 903–904, 920
- bookkeeping models** 750, 752, 758–759, 758,  
 759, 760, 761–762, 761
- border carbon tax/adjustments** 167, 466,  
 1213–1214, 1393–1394, 1500
- Brazil**  
 accelerated mitigation pathways 437, 438, 439  
 AFOLU mitigation 784, 815, 821–822  
 AFOLU subsidies 816  
 agroforestry 791–792  
 Amazon 768, 769, 770, 784, 815, 816, 817, 818,  
 818–819  
 climate governance and institutions 1365, 1366,  
 1367  
 deforestation 272, 467–468, 769, 816, 818–819,  
 1504  
 development pathway 452, 467–468

- diet 254  
emissions 262, 434, 452  
end-use technologies transitions 256  
energy sector 434, 437, 439, 1697  
energy use 517  
fire regimes 770  
forest area 767  
green industrialisation 1754  
household emissions 262  
inequality 517  
mining 769  
Nationally Determined Contributions (NDCs) 1365  
net zero targets 1465  
Paris Agreement 1462–1463, 1465  
REDD+ 816, 1503  
regulatory measures 816, 818–819  
technology transfer and cooperation 1502  
urbanisation 768  
wind power 1697  
zero deforestation pledges 272
- bridging scenarios/pathways** 356
- building codes** 956, 994, 997–998, 1008–1009, 1404, 1677
- Building Information Modelling (BIM)** 962
- building materials** 901–902, 901, 924, 961, 987, 1002–1003  
bio-based 751, 804–805, 902, 995–996, 998, 1299, 1308  
demand 248–249, 923, 923  
embodied energy/carbon 901, 975–977, 976  
regulatory instruments 1218
- building services** 961–962, 983–985  
adopting efficient HVAC systems 987, 992, 993, 994  
classification 962  
digitalisation 975  
electrification 676–677  
energy carrier 970–971, 971–972  
heating and cooling 650, 683, 961–962, 987  
air conditioning 439, 961, 973, 974, 987, 1662–1663, 1679  
climate change impacts 669, 956, 996–997  
cost-effectiveness 992  
district energy networks 981  
district heating and cooling networks 650, 898–899, 1206–1207  
energy demand 513, 669, 972, 972–973, 973, 974, 997  
heat recovery 974–975  
HVAC technologies 992  
refrigeration systems 962  
limited demands for services 984  
retrofits 994  
ventilation 962, 987, 1002
- buildings** 100–104, 953–1018  
accelerated mitigation pathways 435, 436  
adaptation and mitigation 956, 996–998, 1758–1759  
ASI opportunities 531  
barriers 956, 996, 1005–1007, 1006  
behaviour and behavioural interventions 983–988, 1010  
building energy codes 956, 994, 997–998, 1008–1009, 1677  
building envelope 981, 987, 993, 997  
climate change impacts 669, 956, 983, 996–997, 1017  
cohousing strategies 959  
components 961  
construction 961, 975  
see also building materials  
costs and potentials 38–39, 955–956, 988–996, 989, 990, 991, 993, 1016–1017, 1252, 1253, 1255, 1257, 1258, 1259, 1260  
and COVID-19 pandemic 956, 960  
cross-sectoral implications 1313  
demand-side measures 530, 985, 987–988, 992  
design 956, 975, 983–984, 1187  
digitalisation 974–975, 984, 987–988, 992, 1652–1653, 1760  
electricity demand 955, 957, 974, 984–985, 1005  
electrification 439, 676–677, 694, 974, 1001, 1003–1004  
embodied energy and embodied carbon 975–977, 976, 1003  
emissions 8, 66, 955, 957, 963, 967–968  
direct/indirect 250, 513, 955, 957, 963, 991, 995  
drivers 246, 250–251, 250, 955, 967–970, 983  
embodied emissions 963, 977, 978, 995  
energy sector CO<sub>2</sub> emissions 620  
methane (CH<sub>4</sub>) sources 1832, 1834  
net-zero GHG emissions 31  
per capita 965–967, 966  
regional 963, 964, 965, 966  
trends 236–237, 237, 238, 246, 250–251, 250, 963–967, 966, 964, 966  
emissions growth 218  
emissions sources 1832  
energy demand 513, 955, 957, 970–974, 970–971, 997  
climate change impacts 669  
emerging trends 974–975  
financing reductions 1012–1013  
flexibility and limited demand 984–985  
non-technological determinants 983  
per end use 972–974, 972–973  
energy efficiency 439–440, 981, 982, 1008–1011  
energy intensity 251, 343  
energy savings potential 979–981, 979  
FAQs 1018  
feasibility 994, 1005–1006, 1006, 1017  
final energy use/demand 251, 337, 342–343, 343, 513, 955, 957, 970–971  
floor area per capita 955, 956, 968–970, 969, 977, 989  
governance and institutional capacity 956, 1015–1016  
green certification 1005  
health and well-being requirements 956, 960  
heating and cooling see building services  
indoor environmental quality 960, 961–962, 1001–1002  
insulation and thermal efficiency 987, 993–994, 997, 1002, 1003  
international cooperation 1514  
investment and finance 956, 1012–1015, 1014, 1569  
local climate and urban plans 1015  
lock-in 697, 956  
long-term mitigation options 1260  
management systems 961, 983–984, 984  
material substitution 804–805, 977, 978–979  
mitigation non-technological (NT) options and strategies 983–988, 984, 986  
circular and sharing economy (CSE) 985, 988, 1187  
demand-side measures 985, 987–988, 992  
digitalisation and demand-supply flexibility 987–988, 992  
land use and planning 956, 1008, 1015  
limited demands for services 984  
passive/active design and management 981, 982, 983–984  
value chain, social and institutional innovations 985  
mitigation potential 343, 530, 955, 957, 988–996, 989, 990, 991  
mitigation technological options and strategies 961, 975–981, 979  
appliances and lighting 979–981, 980  
building envelope improvements 981, 982, 987, 993–994  
district energy networks 981  
energy efficiency 980–981, 980, 982, 987, 997  
material efficiency and substitution 977, 978–979, 987, 995–996, 998  
on-site renewables 981, 987, 992, 997, 1005, 1013–1014  
models/modelling methods 1848–1851, 1852, 1892  
Nationally Determined Contributions (NDCs) 421  
net zero energy building targets 440  
net zero energy systems 680  
new builds 955–956, 992–993, 997–998  
non-residential 961, 1004–1005  
energy demand 970–971, 974–975, 1016  
pathways and scenarios 31  
planning 956, 1008, 1015  
policies 251, 956, 959, 1015–1016, 1018, 1382  
efficiency policies 1008–1011, 1015–1016  
financing mechanisms 1012–1014  
market-based instruments 1010–1011  
policy packages 31, 1007–1008, 1017  
regulatory instruments 1008–1010  
on-site renewables 1013–1014  
sufficiency policies 1008, 1009, 1015–1016  
rebound effects 1007  
residential 960–961, 1004, 1005  
energy demand 970–971, 972–974, 974–975

- retrofits 955–956, 981, 987, 992, 993–995, 997–998, 1001–1002
- scenarios and pathways 337, 342–343, 343, 963–970, 964–965, 967–968, 969, 970–971, 971, 972, 972–973, 1850–1851, 1850–1851, 1892
- SER framework 955, 956, 957–959, 967–970, 968, 979
- socio-cultural factors 531
- socio-demographic factors 983, 984
- stranded assets 355
- sufficiency approach 955, 957–959, 995, 1008, 1009, 1015–1016
- sustainable development 998–1005
- economic effects 1004–1005
  - energy security 1005
  - environmental benefits 1002
  - health impacts 960, 1000–1002
  - improved resource management 1002–1003
  - meeting SDGs 956, 998, 999–1000, 1000
  - social well-being impacts 1003–1004
  - synergies and trade-offs with SDGs 41–42, 1762, 1763, 1764, 1770
- types and classification 960–961
- data centres 974–975
  - energy efficient 1004–1005
  - exemplary NZE/low-energy buildings 981, 982
  - historical/heritage buildings 981, 997
  - positive energy/energy plus buildings 981
  - warehouses 981
- zero energy/carbon buildings 955–956, 979–981, 982, 992–993, 995, 1009
- see also appliances and lighting
- built environment** 887
- business as usual (BAU)\*** 187, 417, 799
- see also baseline/reference scenarios\*
- businesses and corporations** 506, 557–558, 560, 1736
- business models and financing 1607–1610
  - corporate social responsibility (CSR) 1755
  - energy firms 1766
  - sustainability agendas 1766
- C**
- California** 270, 437, 770, 784, 813–814, 815
- Canada**
- accelerated mitigation pathways 435, 439, 440
  - AFOLU mitigation potential 782
  - buildings 439, 990
  - carbon trading/carbon taxes 815, 1385, 1386
  - climate governance and institutions 1367
  - coal use and phase-out 626
  - development pathways and emissions 452
  - energy-related CO<sub>2</sub> emission pathways 434
  - energy supply transitions 256
  - fire regimes 770
  - forest area 767
  - geologic CO<sub>2</sub> storage potential 641
  - international cooperation 1501
  - marginal/abandoned/degraded land 800
  - net zero targets 1465
  - Paris Agreement 1462, 1465
  - planning and policy implementation 1758
  - policy impacts 270
  - renewable energy support measures 1500
  - transport 440
- capability approach (CA)** 1691
- capacity building** 795, 1368, 1505, 1685, 1686, 1687–1688, 1689, 1769, 1770
- carbon budgets\*** 6–7, 7n, 231–232, 231, 1745
- global carbon budget 179, 473, 520, 1468
  - limiting warming to 1.5°C 174, 217, 231, 231, 255, 274, 319, 320–322, 323, 327, 349
  - limiting warming to 2°C 174, 231, 231, 274, 320–322, 327, 349, 1874
  - models/modelling methods 1874, 1880–1881, 1881
  - net-zero emissions 322, 325, 327, 354
  - remaining carbon budget\* 6, 7n, 155, 174, 217, 231–232, 231, 255, 274, 320–322, 323, 327, 333, 349, 354, 1874, 1880–1881, 1881
  - scenarios and pathways 320–322, 323, 327, 333, 349, 354, 1874, 1880–1881, 1881
  - total carbon budget\* 6–7, 7n, 231–232
- carbon constraint** 443–444, 444
- carbon credits** 813–814, 821
- carbon cycle\*** 871, 901–902, 1261–1262, 1830
- carbon dioxide (CO<sub>2</sub>)\***
- accounting methods 756
  - AFOLU emissions and removals 159, 160, 328, 750, 753, 758–762, 758, 759, 806–807, 806
  - AFOLU emissions reduction 346, 346
  - AFOLU mitigation potential 808, 809, 810, 811
  - AFOLU net GHG emissions 756–758, 756, 757
  - annual global emissions 223
  - anthropogenic land CO<sub>2</sub> fluxes 348, 750, 752, 760–762, 762–763
  - atmospheric lifetime 1489, 1831
  - buildings emissions 620, 955, 957, 963, 967–970, 967–968
  - CO<sub>2</sub> fertilisation 668
  - concentrated CO<sub>2</sub> sources 1185
  - consumption-based emissions 9, 217, 235, 236, 239–245, 241, 244
  - contribution to warming 225
  - conversion of methane into 1833
  - COVID-19 pandemic and emissions 511–512, 1056
  - cumulative emissions 9, 231, 231, 318, 319–324, 320–322, 323
  - future emissions 16, 265–267, 266, 267
  - historical cumulative net CO<sub>2</sub> emissions 6–7, 9, 10–11
  - decoupling of emissions 242–244, 242, 243
  - development pathways and emissions 452–453
  - direct emissions 957, 963, 1100
  - economic growth and emissions 512–513
  - embodied in trade emissions 217–218, 244–245, 244
  - emission datasets 1831, 1832–1833
  - emission metrics 1824, 1825, 1830, 1831
  - emissions from existing and planned infrastructure 16, 265–268, 266, 267
  - emissions growth 228–230, 229
  - emissions reductions 230–231, 269–270, 1258
  - emissions trends 6–7, 7, 228–232, 229, 230, 274
  - emissions uncertainties 222, 224–225
  - energy-related emissions 619–620, 619, 620, 685, 693
    - buildings sector 513, 967–970, 967–968
    - trajectories 433–435, 434  - energy sector emissions 246, 433–434, 619–620, 620, 685–688, 685, 686, 687, 1303, 1836–1837
  - extraction from seawater (with storage) 1273
  - fire emissions 783
  - food system emissions 1280, 1281, 1281, 1282, 1283
  - fossil fuel and industry related (CO<sub>2</sub>-FFI) 6, 6n, 7, 7, 8, 9, 10–11, 159, 159n, 160, 161, 163, 217, 218, 223, 225, 228, 229, 229, 230–231, 233
  - fuels and feedstocks 167, 1080, 1088
  - future emissions estimates 219, 265–268, 266, 267
  - geologic storage potential 641, 641
  - global warming potential (GWP) 1831
  - historical emissions 6–7, 9, 10–11, 231–232, 231
  - household emissions 262
  - hydropower emissions 1303
  - indirect emissions 957, 963, 1836–1837
  - industrial capture, use and storage 1185–1186
  - industrial emissions 1176, 1180, 1189, 1190, 1191, 1192, 1193, 1194, 1199, 1200, 1201n, 1208
  - land-use CO<sub>2</sub> emissions 1831
  - net land use, land-use change and forestry (CO<sub>2</sub>-LULUCF) 6, 6n, 7, 8, 9, 10–11, 160, 161, 217, 221–222, 223, 225, 228, 229, 230, 231, 233, 235, 246, 252–254, 750, 762–763
  - net negative emissions see net negative emissions
  - net-zero emissions see net-zero emissions
  - peatland emissions 785, 786
  - production-based emissions 235, 239, 240, 242–245, 242, 243, 244
  - reconciled anthropogenic land fluxes 762–763
  - regional contributions to global emissions 9, 10–11
  - residual fossil fuel emissions 268–269, 268
  - scenarios and pathways 318, 319–329, 320–322, 323, 325–329, 330–332, 1090, 1091, 1092, 1097–1098, 1098, 1099–1101, 1100
  - global emission pathways 17, 18–20, 21, 23–24, 23, 25
  - Illustrative Mitigation Pathways (IMPs) 26, 811, 812
  - sectoral emissions 8, 1258
  - sources\* and sinks\* 755, 1185
  - transport emissions 1052, 1053, 1056, 1089, 1100, 1109–1110
  - aviation 620, 620, 1086–1087, 1086, 1090, 1091, 1092, 1506–1507
  - cars/vehicles 1056, 1065

- shipping 1093, 1095, 1096, 1097–1098, 1098
- units and unit conversions 1824, 1825
- urban emissions 863, 885, 885, 886, 1059
- utilisation potential 641–642
- carbon dioxide capture and storage (CCS)\***
- 28–29, 167, 615, 641, 642–643, 1188
- accelerated mitigation pathways 436, 438, 441
- capture rates 16n
- climate change impacts 665
- co-benefits for SDGs 1211
- costs 642, 642, 645
- feasibility 438
- with fossil energy 24–25, 615, 646, 647, 648, 693, 699, 700, 1743
- hydrogen production 645, 657, 657, 1068
- industry mitigation strategies/options
- 1185–1186, 1187, 1189, 1190, 1191, 1193, 1195, 1211, 1213
- industry scenario analysis 1200–1201, 1202–1203
- land and water trade-offs 705–706
- low-carbon energy transition 689–691, 693, 698–699, 699, 700, 1743
- net-zero energy systems 672, 674–675
- policy approaches and strategies 1209, 1213
- retrofitting coal-fired plants 693, 1743
- scenarios and pathways 24–25, 345–346, 538, 688, 689–691, 693, 1200–1201, 1202–1203
- synergies and trade-offs with SDGs 705–706, 1755, 1761
- technology improvement and adoption 258, 259, 260
- with waste-to-energy 650
- see also bioenergy with carbon dioxide capture and storage (BECCS)\*
- carbon dioxide capture and utilisation (CCU)\***
- 641–643, 1188
- co-benefits for SDGs 1211
- costs and potential 643
- industry mitigation strategies/options
- 1185–1186, 1187, 1189, 1192, 1192, 1193, 1195–1196, 1211, 1213
- models/modelling methods 1869
- policy approaches and strategies 1209, 1213
- scenarios 538
- synergies and trade-offs with SDGs 1761
- trends in electricity generation 627
- carbon dioxide removal (CDR)\*** 28–29, 113–116, 168, 753, 774, 775, 1247, 1261–1279, 1261–1263, 1322
- accelerated mitigation pathways 436, 438
- acceptability 1277, 1279
- accounting 329
- bioenergy systems 751, 799–800
- see also bioenergy with carbon dioxide capture and storage (BECCS)\*
- categorisation of main methods 1261–1262
- co-benefits 1267, 1268, 1269, 1271, 1274, 1275–1276, 1321
- coastal restoration 470, 787–788
- costs and potentials 1266, 1268, 1269, 1270, 1271, 1273–1274, 1275–1276
- deployment 36, 347, 348, 1263–1265, 1272, 1277
- enabling conditions and barriers 1272
- energy systems 615, 643, 645, 671–674, 675, 681, 692–693, 705–706
- energy transitions 692–693
- enhanced weathering 348, 348, 1247, 1267–1268, 1272, 1273, 1275, 1302
- feasibility assessment 1272, 1273
- governance 1248, 1277–1279, 1277–1278, 1488, 1495
- industry scenario analysis 1200, 1201
- integrated assessment models (IAMs) 305, 1264–1265, 1264, 1267, 1268, 1273, 1274, 1275–1276
- international governance 1278–1279, 1488, 1495, 1514
- land and water trade-offs 705–706
- land-based CDR methods 1273–1277, 1275–1276
- afforestation/reforestation (A/R) 780–781, 1273–1274, 1276, 1277, 1300–1302
- biochar 789–790, 1273–1274, 1276, 1277, 1299, 1301–1302
- improved forest management 1274, 1276
- soil carbon sequestration (SCS)\* 788–789, 1273–1274, 1276, 1277
- land requirement for 1298
- long-term goal compatible pathways 300
- mitigation strategies/pathways 300, 1262–1263, 1264–1265, 1264, 1267, 1268, 1274, 1275–1276
- models/modelling methods 305, 1856, 1869
- net-zero energy systems 671–672, 671, 675, 681
- net zero targets 1247, 1261, 1277, 1277–1278, 1322, 1465–1466
- ocean-based methods 348, 1268–1273, 1272, 1275, 1495
- peatland restoration 786, 1274, 1276, 1750
- policies 1277–1279, 1277–1278
- risks and impacts 471, 1266–1267, 1268, 1269, 1270–1271, 1274, 1275–1276
- scenarios and pathways 24–25, 305, 308, 309, 323–324, 328, 347–348, 348, 354–355, 538, 1264–1265
- technology readiness level (TRL) 114, 115–116
- timing of mitigation action 341, 347
- trade-offs and spillover effects 705–706, 1267, 1268, 1270, 1271, 1274, 1275–1276, 1277, 1321
- uncertainties 1265, 1274
- see also direct air carbon dioxide capture and storage (DACCS)\*
- carbon footprint\*** 261–262, 520–521, 872, 1561
- biofuels 1066, 1074, 1075
- factors affecting 262–265
- food 1294, 1295
- household 260–265
- hydropower 1303
- personal 255, 452, 872
- rural 255
- urban 255, 871–873, 893, 908, 924
- women's 526
- carbon intensity\*** 8, 217, 218
- of consumption 254–255
- decomposition of emissions intensities for service related mitigation 527, 528
- energy sector emissions 622
- in exports 239
- GHG intensities of food commodities 1282–1283, 1283, 1288–1289
- industry 1196, 1197–1198, 1199, 1199
- power generation 247
- transport 1075, 1106, 1107
- urban energy systems 899
- carbon labelling** 1765
- see also standards and labelling
- carbon leakage\*** see leakage\*
- carbon lock-in** see lock-in\*
- carbon markets** 813–815, 1458, 1470, 1488
- see also emissions trading schemes (ETS)
- carbon monoxide (CO)** 1185
- contribution to warming 225
- emissions trends and drivers 232–233, 232
- carbon neutrality\*** 194, 329, 431–432, 432, 439, 646, 671, 830, 914–915, 1363, 1746, 1747
- Carbon Offset and Reduction Scheme for International Aviation (CORSIA)** 1089, 1115, 1506–1507
- carbon offsetting** see offset (in climate policy)\*
- carbon pools\***, urban 871, 905–907
- carbon price\*** and **carbon pricing instruments**
- 188–189, 269, 359, 465–467, 1359, 1587–1588
- AFOLU sector 776, 808–809, 808, 810–811, 810
- combined with housing policies 466–467
- distributional impacts 445–446, 507
- effective carbon price 1382–1383
- energy sector 628–629, 700
- equivalent carbon price 1383
- fairness 568, 569
- impact on employment 445
- industry 1164, 1213–1214
- and leakage 1500
- low-carbon energy transition 700
- national and regional 270, 463
- policies 1384–1388, 1767
- policy packages 569, 700
- public-private partnerships (PPPs) 1510
- scenarios and models 1847, 1875
- shipping sector 1097
- see also carbon taxes; emissions trading schemes (ETS)
- carbon pricing gap** 269, 269n
- carbon sequestration** 790–791
- carbon sinks\*** 347–348, 750, 902
- carbon sources** 1185–1186
- carbon stock\*** 272, 826
- coastal wetlands see blue carbon\*
- forest 781, 784, 816
- mangroves 787
- peatlands 785, 786
- urban land areas 863, 871, 883, 884
- urban trees 905–907
- wood products 805
- carbon storage** 823, 905, 905–907

- carbon taxes** 13, 167, 270, 446, 465–467, 1384, 1385–1386, 1396  
 AFOLU sector 815  
 benefits and drawbacks 1587–1588  
 border carbon tax/adjustments 167, 466, 1213–1214, 1393–1394, 1500  
 and green paradox 1320  
 industry sector 1213–1214  
 public pricing and taxation 1561  
 socio-technical impacts 1676
- carbon trading** *see* emissions trading schemes (ETS)
- Caribbean** 668, 1594, 1595, 1596, 1686  
*see also* Latin America and Caribbean
- Caribbean Catastrophe Risk Insurance Facility (CCRIF)** 1595, 1596
- cascading mitigation effects** 506, 864, 894, 895–896, 919, 920, 923
- cash transfer programs** 445, 1011
- cellular agriculture** 1286, 1289, 1294
- cement and concrete industry** 430, 902, 1164, 1190–1191, 1197, 1204, 1205, 1208
- Central America** 668, 767  
*see also* Latin America and Caribbean; South and Central America
- China**  
 accelerated mitigation pathways 435, 437, 438, 439, 440, 441  
 air pollution 271, 1740  
 buildings 251, 439, 440  
 carbon neutrality 432  
 carbon pricing policies 1384, 1385, 1397  
 circular economy 442  
 climate change impacts 667, 668  
 climate governance and institutions 1366, 1366, 1367  
 climate policy support 1373  
 coal use and phase-out 624, 625, 626, 697, 699  
 conservation programs 816  
 critical minerals 1117  
 decoupling of transport-related emissions 1058  
 Deep Decarbonisation Pathways Project (DDPP) 1740  
 development pathways 452  
 eco-industrial parks 1180, 1755  
 economic growth 247  
 electric vehicles (EVs) 567, 1387  
 emissions 251, 452, 1058  
 AFOLU sector 254  
 consumption-based 244  
 embodied in trade 245  
 growth 233  
 household 260, 262  
 non-CO<sub>2</sub> emissions 1390  
 trends and drivers 247  
 Emissions Trading System (ETS) 1384, 1397  
 end-use technologies transitions 256  
 energy efficiency programmes 1679  
 energy-related CO<sub>2</sub> emission pathways 434  
 energy sector 247, 434, 437, 439  
 carbon dioxide capture and storage (CCS) 438  
 climate change impacts on energy supply 667, 668  
 fossil fuel use and phase-out 438, 624, 625, 626, 697, 699, 1743–1744  
 investments 1568  
 renewables 627, 635, 636, 1502, 1568, 1747–1748  
 energy use 518–520  
 finance flows 1577  
 forest area 767  
 geologic CO<sub>2</sub> storage potential 641  
 green-city initiatives 1756  
 income inequality 1746–1747  
 industry 441, 464, 1176, 1204, 1206, 1208  
 inequality 517, 518–520, 1746–1747  
 international cooperation and technology transfer 1502  
 international trade and consumption 520  
 local capital markets 1606  
 low emission strategies 433, 434  
 manufacturing PV 1747–1748  
 marginal/abandoned/degraded land 800  
 mitigation policies 1390, 1397, 1397  
 national development plans 451  
 net zero targets 1465  
 Paris Agreement 1462–1463, 1465  
 policy impacts 270, 271, 913  
 population projections 313  
 Shanghai low-carbon urban development 913  
 subsidies 1387  
 technology and innovation 1502, 1682  
 transport 440, 542, 567, 1058, 1060, 1065, 1089–1090, 1103, 1104, 1117, 1387  
 urban areas 884, 888, 905, 913, 1756  
 wind energy 635, 636, 1502
- chlorofluorocarbons (CFCs)** 221, 224, 229
- choice** 260–265, 507, 513, 531–532, 532, 1391  
 choice architecture\* 506, 506n, 548–549, 549–554, 1295  
 factors affecting 262–265  
 transport 1052, 1059–1061  
*see also* behavioural changes
- circular economy\*** 120, 538, 539, 544–546, 544, 1188, 1192  
 accelerated mitigation pathways 442  
 bioeconomy 1248, 1309  
 building sector 985, 988, 1187  
 co-benefits for SDGs 1210  
 critical minerals 1117  
 cross-sectoral perspective 1314  
 industry 1179–1180, 1187, 1192–1193, 1192, 1209, 1210, 1213, 1220, 1220–1221  
 mitigation potential 505  
 policy approaches and strategies 1209, 1213, 1220, 1220–1221  
 transport 1061  
 urban mitigation 901, 909–910
- cirrus cloud thinning (CCT)** 1489, 1490, 1492
- cities\*** 863–865, 867–868  
 accelerating transition 1755–1756, 1770  
 adaptation and mitigation 1403–1404, 1758  
 biodiversity 866  
 carbon cycle 871  
 climate action 866–867  
 and climate change 864, 865, 866–867, 877–880  
 climate policy 1512–1513  
 COVID-19 pandemic 925–926  
 creditworthiness 915–916  
 deep decarbonisation and systemic transformation 864  
 demand-side measures 528  
 developing countries 265, 871  
 development pathways for sustainable development 1755–1756  
 emissions trends and drivers 260, 262, 884–894, 887, 926  
 established cities 919, 919, 920, 921–922  
 institution building 1369–1370  
 investment and finance 1596–1598  
 just transitions 1370  
 megacities\* 542, 558–559, 869, 870, 870, 900–901, 913, 1767  
 mitigation pathways 378, 920, 921–925  
 mitigation potential 429–430  
 networks and partnerships 914, 1378–1379, 1512–1513, 1597, 1736, 1756, 1758, 1770  
 new and emerging cities 919, 919, 920, 922–925  
 planning and infrastructure policy 565–566  
 public-private partnerships (PPPs) 1597  
 rapidly growing cities 919, 919, 920, 922  
 size and population 881–882, 883–884  
 small and medium-sized 869–870, 870  
 smart cities 1653  
 street layout 896, 897, 897  
 and sustainable development 378, 866, 867, 873–875  
 transport 466–467, 558–559, 565–566, 897–898, 915, 1058–1059, 1058, 1059, 1060, 1062, 1755–1756, 1770  
*see also* urban systems\* and other settlements
- citizen engagement** 1374–1375, 1375, 1380
- citizen science\*** 1380
- civil society** 46, 524, 1370, 1375  
 food systems governance 1296, 1296–1297  
 influence on climate policy 165, 1223, 1279, 1374–1375  
 land-based mitigation 1304  
 local government and community action 1510–1511  
 low-carbon energy transition 696, 701–703  
 reducing deforestation 467, 818–819  
 social movements 556–557, 1374–1375, 1375, 1508–1509, 1765  
 sustainable development 1733–1734, 1736  
 transport strategies 1117–1118
- Clean Development Mechanism (CDM)** 1394, 1475–1476, 1484, 1568  
 AFOLU projects 812, 813  
 and Paris Agreement 1470, 1471, 1488  
 technology transfer 1645, 1684, 1686–1687
- Clean Technology Scenario (CTS)** 1201, 1202
- Climate Action Network** 1508
- climate-carbon cycle feedbacks** 1830
- climate change\*** 40

- adaptation 877–880, 1207  
 asymmetries 183  
 avoiding damages from 37  
 barrier to AFOLU mitigation 751  
 and cities 864, 865, 866–867, 877–880  
 costs, quantifying 157  
 economic benefits of avoided impacts in long-term mitigation pathways 365–367  
 and fire regimes 770  
 gender, race and intersectionality 525–527  
 impacts *see* impacts\* (of climate change)  
 international assessments and cooperation 1732–1734  
 media coverage 1377–1378  
 misinformation and counter-movements 1377–1378  
 mitigation pathways and avoided impacts 365–367, 370, 371, 373, 374, 375, 376, 377, 378  
 narratives 555  
 renewable energy production impact on climate 670–671  
 risk assessment 157  
 risks of solar radiation modification (SRM) 1490–1491, 1492–1493  
 and sustainable development 176, 1732–1734  
 urban adaptation and mitigation 877–880
- climate clubs** 356–358, 1458–1459, 1458, 1495, 1501, 1505
- climate extreme (extreme weather or climate event)\*** 753, 997  
*see also* extreme weather events\*
- climate finance\*** 13, 47–48, 158–159, 168–169, 462–463, 879, 880, 1482–1485, 1485, 1552–1553, 1552  
 bilateral finance 1483  
 community, city and subnational level 1596–1598  
 COVID-19 pandemic impacts 1549, 1550, 1557–1560  
 developed countries 1482–1485, 1564, 1577  
 developing countries 915–916, 1471–1472, 1482–1485, 1560, 1564, 1565, 1577  
 estimates of finance flows 1563–1566  
 financing gaps 159, 169, 1549, 1555, 1574–1579, 1580, 1610  
 financing needs 1549, 1567–1574, 1597  
 gender-responsive 1609–1610  
 green bonds 915–916, 1484–1485, 1550  
 institutional investors 1485  
 international 1553, 1558, 1560  
 just transitions 1559–1562  
 macroeconomic context 1556–1557  
 multilateral climate funds 1484  
 multilateral development banks (MDBs) 1320, 1483–1484, 1505, 1595  
 Paris Agreement 1471–1472, 1483, 1484  
 private sector financing 1484–1485, 1565  
 public-private partnerships (PPPs) 1510, 1511–1512, 1597  
 public sector finance 1565  
 by sector 1564  
 subnational 1596–1598
- urban mitigation and adaptation 915–916  
 USD100 billion a year commitment 1560, 1565, 1604  
*see also* investment and finance
- climate governance\*** 45–46, 172, 190, 461–462, 1360, 1411, 1413, 1481–1482, 1482, 1768  
 actors, influence of 1373–1378  
 adaptation and mitigation 1404–1405, 1406  
 barriers 1398, 1399–1400, 1401, 1406  
 challenges 1367–1368, 1410  
 climate litigation 1358, 1374, 1375–1377, 1376  
 consumer/citizen engagement 1374–1375, 1375, 1380  
 coordination 1367, 1410–1411, 1412  
 enabling conditions 1398, 1399–1400, 1406, 1407  
 experimentation and policy innovation 1380, 1381  
 and ideas, values and beliefs 1372–1373  
 institutional capacity 1368  
 institutions 1365–1368  
 integrated policy packages 1394–1398  
 international policy frameworks 1404–1405  
 material endowments and 1371  
 media, role of 1377–1378  
 mediating interests 1367–1368  
 multi-level, multi-player 912–913, 913  
 national climate laws 1358, 1360, 1361–1363  
 national strategies 1363–1365  
 networks 1369, 1378–1379, 1379  
 partnerships 1380  
 policy evaluation 1382–1384, 1383  
 policy integration 1397–1398, 1399–1400, 1405, 1406  
 policymaking for direct mitigation 1379–1380, 1381–1394, 1395  
 policymaking for transitions 1395–1398, 1399–1400  
 political systems and 1371–1372  
 public support 1358–1359, 1369, 1372–1373  
 regional free trade agreements 1501  
 regulatory instruments 1359  
 sector transitions 1398, 1399–1400  
 setting strategies 1368  
 shaping 1370–1378, 1411  
 structural factors 1358, 1370–1373  
 sub-national actors 1378–1381  
 sub-national institution building 1369–1370  
 transnational networks 1369, 1378–1379, 1379
- climate impact drivers** 665
- climate institutions** 46, 461, 1411
- climate justice\*** 43, 1368, 1370, 1370, 1508–1509, 1559  
*see also* justice\*
- climate laws** 1358, 1360, 1361–1363
- climate litigation** 1358, 1374, 1375–1377, 1376, 1509
- climate model emulators** 1856–1857, 1859, 1880
- climate policies** 1412, 1413  
 accelerated mitigation 412  
 acceptability 702–703  
 'direct' climate laws 13  
 distributional implications 445–446
- impact on emissions 219  
*see also* specific sectors
- climate politics** 172, 1411
- climate-related financial risk** 1549–1550, 1555–1556, 1580–1585, 1590  
 assessments 1567, 1580  
 risk pooling and insurance 1594–1596
- climate-resilient pathways\*** 1401, 1757, 1758
- climate-smart agriculture (CSA)** 470, 795, 828, 828–829, 1309, 1757
- climate smart cocoa (CSC)** 828–829, 1399
- climate-smart forestry (CSF)** 782, 782–783, 800, 1309
- climate-smart villages (CSV)** 795
- climate strikes** 557, 1374, 1375
- Climate Technology Centre & Network (CTCN)** 1486–1487, 1578, 1686
- climatic impact driver** 1829
- cloud cover** 667, 668, 1087
- co-benefits\*** 181, 187, 1248  
 adaptation and mitigation 876, 1400–1403  
 adaptation co-benefits 903, 903–904, 905  
 AFOLU measures 751, 786–787, 792, 794, 795–796, 804–805  
 air pollution reduction 1741–1742  
 biochar 789, 790  
 bioenergy and BECCS 800  
 buildings mitigation 1000–1002, 1018  
 carbon pricing policies 1385  
 CDR methods 1267, 1268, 1269, 1271, 1274, 1275–1276  
 circular economy 1180, 1210  
 climate policies 1397  
 coastal wetland conversion reduction 786–787  
 cross-sectoral perspective 1311–1313  
 demand-side measures 521  
 diet 803, 876  
 economic quantification 368  
 efficient cooling and refrigeration 439  
 energy systems mitigation and SDGs 698, 704–706, 705  
 environmental and socio-economic 1300  
 farming system approaches 470  
 food loss and waste reduction 804  
 food system mitigation 804, 1286–1287  
 fossil fuel subsidies, reducing 1387  
 for health 233, 375–377, 376, 803, 873, 875, 898, 905, 908, 1000–1002, 1741–1742, 1755–1756  
 industrial mitigation options 1210–1211, 1754  
 industrial symbiosis 1180  
 land-based mitigation 775, 778, 786–787, 788–789, 790, 791  
 land occupation by mitigation options 1299–1304, 1306–1307  
 long-term mitigation pathways and SDGs 369–378, 370, 371, 376  
 model assessment 1740, 1741–1742  
 national and sub-national policies 1359, 1383–1384, 1383, 1385, 1387, 1400–1403  
 Paris Agreement 1477  
 peatland restoration 786  
 pollution policies and regulation 271–272

- potential for net co-benefits 187  
 REDD+ 1402, 1402, 1497  
 renewable energy 1743  
 for SDGs 369–378, 370, 371, 376, 867,  
 873–875, 874, 903, 903–904, 1210–1211,  
 1224, 1268, 1311–1313, 1312, 1742, 1754  
 sector-specific policies 272  
 SLCF reductions 439, 441–442  
 technology and innovation 1671, 1695  
 transport 1058  
 urban green and blue infrastructure 864, 875,  
 876, 877, 878, 903–908, 903–904, 905–907  
 urban mitigation 378, 864, 873–877, 874,  
 878, 897, 903–908, 903–904, 905–907,  
 1755–1756  
 waste and waste management 876, 1210  
 wood products, enhanced use of 804–805
- CO<sub>2</sub> equivalent (CO<sub>2</sub>-eq) emissions\*** 159, 222,  
 226–228, 229–230, 229, 1830  
 fluorinated gases (F-gases) 224, 229  
 urban systems and other settlements 885, 890,  
 891
- coal** 647–648  
 building sector energy carrier 970–971  
 consumption 232  
 dependent countries 624–625  
 energy sector emissions 619–620, 620  
 final energy demand per fuel 971  
 gasification 647, 657  
 infrastructure 697  
 low-carbon transition 698–699, 699  
 methane (CH<sub>4</sub>) emissions 646, 647  
 mining 647  
 phase-out 624–625, 625–626, 697, 698–699,  
 705  
 power generation emissions 247–248, 267  
 production and demand trends 622, 622  
 retrofitting coal-fired plants 693, 1743  
 role in global energy system 1742–1744, 1743  
 scenarios and pathways 341  
 stranded assets 355–356, 615  
 transition from 1742–1744, 1743, 1746, 1748
- coastal ecosystems** 377, 470, 1403  
**coastal wetlands** 470, 786–788, 1274, 1276  
**cobalt** 1744  
**collective action** 506, 555, 556–557, 1765  
**Colombia** 434, 437, 567, 815, 1376  
**combined global temperature change potential (CGTP)** 227  
**committed emissions** 355, 697, 919, 923,  
 1208–1209, 1743  
**communication** *see* information and  
 communication technology  
**community forest management (CFM)** 817–818,  
 817  
**community-wide infrastructure supply chain  
 footprinting (CIF)** 872  
**complex system theories** 182  
**compressed air energy storage (CAES)** 655  
**Computable General Equilibrium (CGE) models**  
 1845, 1855–1856  
**concentrating solar power (CSP)** 12, 258, 627,  
 630–632, 631, 633, 634, 1302–1303
- Conference of the Parties (COP)\*** 172, 1471  
**confidence\*** 4n  
**Congo Basin peatlands** 785  
**conservation agriculture\*** 470, 796–798, 1757  
**conservation measures** 784–787, 798, 815–817,  
 819, 826, 829, 1497  
**construction materials** *see* building materials  
**consumers** 219, 539, 557, 1207, 1391, 1410  
**consumption** 166–167, 170–171, 518–520, 524,  
 887  
 AFOLU emissions and drivers 773, 803  
 choices and changing preferences 507, 513  
 dietary shifts 547  
 emissions growth and 247, 248–249  
 energy accounting 520  
 GHG accounting frameworks 872  
 household 260–265, 520, 1750–1751  
 in mitigation pathways 361  
 reduction measures 1561  
 subsidies 1387  
 sustainable 514  
 and well-being 514, 516
- consumption-based carbon footprint  
 accounting (CBCF)** 872  
**consumption-based emissions\*** 9, 10–11, 167,  
 217, 235, 236, 239–245, 244, 261–262, 273,  
 1165, 1176  
 decoupling 242–244, 242, 243  
 global and regional trends 240–242, 241, 244  
 household 453, 531–532, 532  
 policy applications 239, 239–240  
 urban 863, 885, 885, 886, 908  
 urbanisation and 255  
 variations in 520–521
- contract for difference (Cfd)** 1220  
**contrails** 1087, 1089  
**controlled-environment agriculture** 1286, 1288  
**Convention on Long-Range Transboundary Air  
 Pollution (CLRTAP)** 1496  
**cooking energy/technology**  
 access to modern energy services 517, 548, 559,  
 623, 623, 1003–1004, 1603–1604  
 electrification 559, 567, 705, 1001  
 energy demand 972–973  
 energy efficiency 567  
 health impacts of lack of clean energy  
 1000–1001  
 policy packages 569  
 socio-behavioural aspects 548  
 subsidies 629  
 traditional biomass 622–623, 623–624
- cooling systems** 375, 439, 668, 974, 1752  
*see also* building services  
**corporate actors** 1373–1374  
**corporate responsibility** 506, 557, 1755  
**corruption** 916, 1372  
**cost-benefit analysis\*** 87–88, 153, 180–181,  
 366–367, 367, 377, 446, 1846–1847  
**cost-benefit IAMs** 88, 1875  
**cost-effective pathways** 298, 305, 328–329, 351,  
 356, 1875  
**cost-effectiveness analysis (CEA)\*** 87, 153,  
 180–181, 359, 1846, 1847
- Costa Rica** 1501  
**costs**  
 abatement costs 1085–1086, 1190, 1191, 1196,  
 1197–1198  
 energy systems transitions 1741  
 extreme events 877  
 fuels and fuel alternatives 1088, 1148  
 levelised cost metrics 1826–1827  
 low-carbon technologies 153  
 marginal abatement cost of carbon 359, 360,  
 360  
 marginal abatement costs 807–809, 1259, 1735  
 mitigation 155, 170  
 model assessment 1741  
 policy costs 362–363  
 quantifying 157  
 renewable energy technologies 165, 168  
 shadow cost of carbon 1391  
 soft costs 1577–1578  
*see also* levelised cost; lifecycle costs (LCCs);  
 mitigation costs; *specific sectors*
- costs and potentials** 1251–1260, 1252,  
 1254–1256, 1257, 1258, 1259  
 aggregated 1256–1260, 1257  
 carbon dioxide removal (CDR) 1266, 1268,  
 1269, 1270, 1271, 1273–1274, 1275–1276  
 cross-sectoral 1256  
 sectoral analysis 1252–1256, 1254–1256  
*see also specific sectors*
- countermovement coalitions** 557  
**court actions** 1499, 1509  
*see also* climate litigation  
**COVID-19 pandemic** 60–61, 153, 154, 162,  
 162–164, 925–926  
 and aviation 163, 230, 230, 1087, 1090, 1092  
 and buildings 956, 960  
 and demand-side scenarios 538  
 economic impacts 163, 512, 1549, 1557–1560,  
 1591–1592, 1598  
 and emissions 7, 162–163, 230–231, 230, 316,  
 511–512, 1056  
 impact on low-carbon transitions 1745  
 industry in context of 1165  
 intersectional impacts 525–526  
 long-term emissions impacts 316  
 national and sub-national policies 1408–1409  
 near- to mid-term emissions implications 421  
 opportunities 164, 472  
 recovery packages 163–164, 1550, 1557–1559,  
 1590–1591, 1591–1592  
 role of digitalisation 1759  
 service provisioning and mitigation 511–512  
 and transport 1056, 1060, 1090, 1092, 1121
- critical strategic minerals** 637–638, 1053, 1116,  
 1116–1117, 1120, 1744  
**crops and croplands** 821, 1299–1300, 1301,  
 1309–1310, 1758  
 crop nutrient management 794  
 crop production 768, 771, 772, 793  
 crop yields 373–374, 1491, 1753  
 grassland conversion 784–785  
 impact of solar radiation modification (SRM)  
 1491

- irrigation 1753
- rice cultivation 771, 789, 793, 806, 1698
- soil carbon management 788–789
- cross-sector social partnerships (CSSPs)** 1510–1511
- cross-sectoral perspectives 1245–1322**
  - adaptation and mitigation 1307–1311, 1756–1759
  - approaches to mitigation 1248
  - bioeconomy 1307–1311
  - carbon dioxide removal (CDR) 1261–1279, 1261–1263
  - co-benefits and adverse effects with SDGs 1311–1313, 1312
  - coordinated policies 42
  - cross-sector linkages 336–341, 337
  - cross-sectoral governance 1295–1296, 1296–1297
  - digitalisation 1759–1761
  - FAQs 1322
  - financing solutions 1320–1321
  - food systems 1279–1296, 1296–1297
  - land occupation and mitigation options 1297–1304, 1304–1311
  - long-term mitigation options 1260, 1260
  - mitigation measures 1313–1314, 1314, 1315–1316
  - mitigation potentials 1256
  - policy interactions 1316–1317, 1317–1318
  - spillovers and competitiveness effects 1318–1320
  - sustainable development 1730, 1749–1764, 1770
  - synergies and trade-offs 1730, 1761–1764, 1762, 1770
  - transitions 1730, 1749–1764, 1770
  - urban systems 898, 1755–1756, 1770
- crowding out** 1587, 1675
- cryptocurrencies** 168, 541
- cultural change** 506, 535, 536–537, 1737
- cultural norms** 157, 563, 1304
- cumulative emissions\*** 6–7, 9, 10–11, 217, 218, 227, 231, 231
  - CO<sub>2</sub> emissions and temperature goals 319–324, 320–322, 323, 329
  - future CO<sub>2</sub> emissions from existing infrastructure 265–267, 266, 267
  - modelled pathways 23–24
  - scenarios and pathways 308, 309, 319–324, 320–322, 323
- Current Policies (CurPol)** 310–312, 313, 337, 1100, 1102, 1108, 1200, 1200
  - cross-cutting implications 893
  - emissions and energy characteristics 338
  - emissions and warming characteristics 331
  - level of ambition and scenario features 174, 175
  - physical and transition risk 1585, 1585
  - quantitative scenario selection 1879
  - storyline 175, 1878, 1878
  - warming levels 307, 309, 331
- Current Policies Scenario (WEO-2019)** 1251–1252, 1252
- D**
- data centres** 1652–1653
- decarbonisation\*** 153–154, 169–170, 864, 1769
  - buildings 956, 994–995, 1007–1011, 1014–1015
  - deep decarbonisation and sustainable development 1740
  - and digitalisation 1654
  - electricity 436, 436–437
  - energy system 246
  - industry deep decarbonisation 1164, 1180, 1187, 1195–1196, 1197–1198, 1206, 1222–1223
  - pathways 1657–1658, 1658–1659
  - policy approaches and strategies 1211–1223
  - rapid 412–413
  - supply-side 1196
  - sustainable development pathways model assessment 1739–1742
  - transport 1074–1098
  - transport technology for 1064–1073, 1064
- decent living standards (DLS)\*** 9, 218, 254–255, 505–506, 509–510, 514, 516, 957, 1742
  - buildings 970
  - emissions and energy footprints 66, 521
  - energy required for 516–517
  - long-term goal compatible mitigation pathways 301
- Decent Living with minimum Energy (DLE)** 970
- decision-making** 43, 1751
  - development priorities 449, 450, 451, 452
  - financial risk management 1584–1585
  - governance and institutional capacity 461
  - holistic view and nexus approach 1769
  - individual 1765
  - multilevel 925
  - participation 702–703
  - risk management 1829
  - technology readiness levels (TRLs) 1649–1650
  - urban mitigation and adaptation 879
- decoupling\*** 217, 242–244, 242, 243, 247, 264, 274, 452, 512–513
  - transport sector 1058
  - urban development/mitigation 864, 875, 921, 923
- Deep Decarbonisation Pathways Project (DDPP)** 1740
- definitions, units and conventions 1821–1838**
  - assessment methods 1837–1838, 1837
  - countries and areas classification schemes 1823–1824, 1824
  - economic growth rates 1828
  - emissions datasets 1831–1837, 1832–1833, 1834–1836
  - emissions growth rates 1827–1828
  - GHG emission metrics 1824, 1825, 1830, 1831
  - levelised cost metrics 1826–1827
  - monetary unit conversion 1826
  - physical units conversion 1825, 1825
  - primary energy accounting 1828
  - risk, concept of 1828–1830
  - standard units 1824–1825
- trends calculations 1828
- deforestation\*** 750, 767–771, 767, 769
  - afforestation/reforestation (A/R) 1300
  - and development pathways 467–468
  - emissions trends and drivers 759
  - international agreements and cooperation 1503–1504
  - reducing 779–780, 818
  - regulatory measures 816, 818–819
  - road construction and 768, 769
  - zero deforestation pledges 272–273
  - see also REDD+
- demand, services\*, and social aspects of mitigation 117–124, 166, 503–572**
  - access to services 514, 515, 516–517, 517–518
  - AFOLU sector modelling of demand 1855–1856
  - biomass demand 809, 1307–1311
  - critical minerals demand, for batteries 1116, 1116–1117, 1744
  - demand control measures (DM) 1188
  - demand for goods/products 540, 541, 1854, 1854
    - GHG-intensive products 513
    - wood products 770
  - demand for services 508–509, 510, 984
  - demand reduction 441
  - demand sector emission growth 218
  - efficient service provision 527–532, 528
  - energy demand reduction 441
  - FAQs 572
  - industry sector models for demand 1854, 1854
  - international cooperation 1514
  - mobility services 509, 514, 567
  - scenario modelling 535–538, 536–537, 570
  - service delivery systems 533–535, 533
  - service transition scenarios 1872
  - services for well-being 514–516, 515, 519
  - social aspects of mitigation 133, 182–183, 572, 1736–1737
    - bibliometric overview 510–511
    - changing preferences 513
    - demand-side measures 505–506
    - encouraging mitigation action 661–662, 701–702
    - energy systems mitigation 618–619, 661–662, 684, 701–703
    - gender, race and intersectionality 525–527
    - public acceptability 702–703
    - social influence/influencers 506, 547, 702
    - societal preferences 684
    - socio-cultural factors for emissions reduction 529–531, 530
    - transformative megatrends 538–546, 558–559
    - see also behavioural changes; just transitions\*; social movements; well-being\*
  - transformation and transition 513, 546, 546, 555, 560–561, 565, 1411
  - water demand 1751–1752
  - see also demand-side measures\*; demand-side mitigation; service provisioning\*

- demand-side measures\*** 122, 527–535, 528, 560–561  
 accelerated mitigation 512  
 AFOLU mitigation potential 775, 776, 777  
 AFOLU sector 753, 778, 802–805  
 agriculture and forestry 750–751  
 changing preferences 513  
 circular economy 120, 538, 539, 544–546, 544  
 costs and potentials 1257  
 cross-sectoral implications 1313  
 digitalisation 529, 538, 539–541, 539, 987–988, 1653  
 energy demand-supply flexibility 987–988  
 energy system flexibility technologies 652  
 energy systems 661–662, 704  
 equity and 506–507, 521–525, 525–527  
 household energy demand 985  
 infrastructure use 528, 529, 530, 531  
 interacting benefits 505, 512, 514, 521–525, 522, 559  
 mitigation potential 505, 514, 516, 528–529, 530, 532, 541, 543, 545, 775, 776, 777  
 models/modelling methods 1866  
 motivation and capacity for change 506–507  
 policy design 507, 565–568  
 preconditions and instruments for transformation 506–507  
 rebound effects 531, 532, 538, 539–540, 540, 541, 544  
 scenarios and pathways 34, 35, 336, 337, 508, 509, 535–538, 536–537  
 and SDGs 120, 120, 523  
 service provision efficiency 527–535, 528  
 sharing economy 538, 539, 541–543, 544  
 social influencers and thought leaders 506, 547, 702  
 socio-cultural factors 528–529, 530, 531, 535, 547, 561  
 structural and cultural change 507  
 technology adoption 528, 529–531, 530, 535, 555, 561  
 transport sector 32  
 and well-being 521, 523, 572
- demand-side mitigation** 117–124  
 behavioural drivers 546–549, 549–554, 560  
 bibliometric overview 510–511  
 business and corporate drivers 557–558, 560  
 COVID-19 and service provisioning 511–512  
 gender, race and intersectionality 525–527  
 governance, trust and participation 521–525, 522, 564  
 institutional drivers 558, 559, 560  
 interaction between drivers 570–571  
 low demand scenarios 535–538, 536–537  
 mitigation pathways 300  
 opportunity space 527–546  
 policies 564–570, 564–565  
 services, well-being and equity 506–507, 512–527, 522, 523, 525–527  
 socio-cultural drivers 555–557, 560  
 technological and infrastructural drivers 559, 560  
 transformative change 546
- transition to high well-being low-carbon-demand society 546, 546, 560–561
- demand-side transitions** 560–561, 565
- dematerialisation of society** 1169
- Democratic Republic of Congo** 770
- demographic drivers** 773
- demographics** 262, 548
- Denmark** 256, 437, 908, 1073, 1206
- desertification\*** 785
- deserts** 1303
- Developed Countries/developed countries\*** 1824  
 AFOLU emissions 253  
 AFOLU mitigation potential 777, 778, 781, 782, 789, 790, 791, 792, 796, 803, 804  
 agricultural land use 768  
 appliances and lighting 980  
 biomass use 972  
 building retrofits 994  
 buildings 955–956  
 buildings emissions reduction potential 968, 970, 992  
 buildings mitigation potential 955, 992  
 buildings policies 1008  
 classification 1823–1824, 1824  
 climate finance 1482–1485, 1564, 1577  
 consumption-based emissions 217, 241, 242  
 decoupling of transport-related emissions 1058  
 diet 254  
 digitalisation 538  
 distributional effects of mitigation 446  
 emissions embodied in trade 218, 244, 245  
 emissions projections 335  
 emissions trends and drivers 65, 218, 233, 247  
 energy use 516  
 fertiliser use 794  
 financial flows and stocks 1562–1563, 1562, 1563  
 food system 804  
 IMP for energy system transformation 690, 691  
 industry 1176  
 international trade and emissions 167  
 manure management 796  
 material demand 1177  
 net zero energy buildings 440  
 Paris Agreement 1472, 1473  
 services for well-being 515  
 sufficiency measures 992  
 sustainable development pathways and SDGs 179  
 technology development and transfer 1472  
 transport demand 1102  
 transport emissions 1053, 1099, 1100, 1101  
 urban emissions 863, 885, 885, 886  
 urban emissions scenarios 891, 892  
 urban land expansion 863, 888, 888, 889  
 urbanisation scenarios 888, 888, 889, 891, 892  
 well-being metrics 513–514  
 see also industrialised (developed\*) countries
- developing countries\***  
 adaptation and mitigation 1757, 1759  
 adaptation finance 1579  
 AFOLU emissions 253–254  
 agroecology 1697–1698  
 biomass use 972  
 bond markets 1606  
 building retrofits 994  
 buildings 955–956, 989–990, 992  
 buildings mitigation potential 955, 988, 989, 991, 992  
 capacity building 1473, 1487–1488, 1596, 1685, 1687  
 circular economy 538  
 classification 1823–1824, 1824  
 climate finance 915–916, 1471–1472, 1482–1485, 1560, 1564, 1565, 1577  
 climate governance and policies 1375  
 climate investment trap 1569  
 climate-related investment 169  
 climate risk pooling and insurance 1594, 1595–1596  
 coal use 624–625  
 decoupling of transport-related emissions 1058  
 diet 254  
 digitalisation 538, 1654  
 emissions embodied in trade 218, 245  
 emissions trends and drivers 65, 218, 247, 1481  
 energy investments 1556, 1603–1604  
 energy use 516, 524  
 finance gap 1549  
 financial flows and stocks 47–48, 1562–1563, 1562, 1563  
 financing mechanisms for renewables 1014  
 fossil fuel-dependent 624–625, 1746, 1747, 1748, 1771  
 fossil fuel resource rich 1769–1770  
 GHG mitigation 1684  
 governance 956, 1767  
 hydropower potential 639  
 income inequality 524  
 industry 1176  
 inequality 264–265, 524  
 informal economy 870, 910  
 informal sector 925  
 informal settlements 884  
 innovation and low-emission technology adoption 11  
 innovation systems 1661  
 institutional capacity 956  
 intellectual property rights (IPR) regimes 1657, 1682, 1687–1688  
 international cooperation 1501–1502, 1602, 1656, 1698  
 international trade and emissions 167  
 investment and finance 1550, 1602  
 investment gap 1577, 1578  
 low emission strategies 433  
 low-emission technology uptake 1684–1685  
 material demand 1177  
 material endowments and climate governance 1371  
 media and climate change reporting 1378  
 mitigation policies 1394, 1398  
 National Adaptation Plans (NAPs) 1401  
 net zero emissions 328–329  
 Paris Agreement 1462–1463, 1472, 1473, 1475

- public finances and debt 1592–1593  
public procurement 1672–1673  
rapid urban growth 255  
REDD+ 812–813  
renewable energy deployment, carbon leakage and lock-in 1745  
sectoral policy interactions 1317  
sharing economy 538, 542  
socio-technical policy impacts 1676  
stranded assets and structural inequalities 1745  
sufficiency measures 989–990  
technological change 1644  
technology and innovation 1645, 1699  
technology development 1472, 1487, 1684  
technology transfer 1472, 1487, 1645, 1656  
transport emissions 1058, 1101  
urbanisation 869, 870–871  
waste and waste management 910  
well-being metrics 513–514
- developing economies** 1462–1463  
COVID-19 impacts 1559–1560, 1592  
emission transfers 245  
finance 169, 1561  
fossil fuel use and phase-out 699, 1567, 1743–1744  
impacts of building mitigation 998  
informal economy 870  
leakage 1318  
public procurement 1672–1673
- development pathways\*** 4, 45, 415, 448–472, 448, 456–459, 1739–1740  
adaptation and mitigation 468–471  
assessing 454–455  
climate-resilient 414, 450, 1405, 1757  
emissions and mitigation capacity 452–453, 454, 455  
innovative 454  
international cooperation 1458  
low-carbon development pathways 1740–1742  
low-emission development pathways 30  
national development plans 451, 452, 453, 453–454  
policy measures 455, 455, 456–457, 458, 460–461, 467–468  
risks and uncertainties 471–472  
shifting *see* shifting development pathways\*  
socio-economic development pathways 361  
spatial patterns of development 452–453, 466–467  
synergies 453  
and system dynamics 1694  
unsustainable 1737–1738  
urban systems 873
- diet\*** 171, 528–529, 802–803, 825, 1279–1280  
and agricultural emissions drivers 771  
co-benefits 803, 876  
dietary shifts 528–529, 530, 547, 561, 1285, 1750  
emissions drivers 111, 254  
food labels, guidelines and regulation 1292, 1293–1295  
food types and emissions 1247, 1282–1283, 1283, 1288–1289
- health and nutrition 1279–1280, 1284–1285, 1284, 1292, 1293  
novel and future foods 1247, 1286, 1288–1289, 1294  
plant-based 1285, 1286, 1288–1289, 1294  
scenarios and pathways 315  
sustainable healthy diets 1279, 1294–1295
- digital activism** 1375  
**digital agriculture** 1285, 1286, 1288  
**digital economy** 570  
**digitalisation** 11, 140, 273, 464, 538, 539–541, 539, 1652  
accelerating transition 1730, 1759–1761  
buildings 974–975, 984, 987–988, 992, 1652–1653, 1760  
COVID-19 pandemic 1759  
cross-sectoral 1314, 1759–1761  
demand-supply flexibility 987–988  
efficiency potentials 1652–1653  
energy demand 539–540, 974–975  
and energy efficiency 1652–1653, 1760  
energy systems 652, 1653  
governance 1654  
in low-emissions pathways 1700  
mitigation potential 505, 541  
and sustainable development 11, 1759–1761  
technology and innovation 1645, 1652, 1652–1654, 1700  
transport 1062–1063, 1062, 1653, 1760, 1761
- direct air capture (DAC)\*** 678, 1080, 1186  
**direct air carbon dioxide capture and storage (DACCS)\*** 25, 28, 324, 348, 348, 681, 1247, 1264, 1265–1267, 1272, 1273, 1275  
**direct emissions\***  
buildings sector 250, 513, 955, 957, 963, 991, 995  
industry 248, 1172–1174, 1173, 1174, 1175  
sectoral trends 236–237, 237  
transport 251, 1052, 1055–1056, 1055  
urban systems and other settlements 886
- disaster risk management (DRM)\*** 1595  
**disaster risk reduction finance** 1554, 1566  
**discount rate\*** 226, 228, 305, 360, 1875  
**discounting\*** 180–181, 1846–1847  
**disequilibrium theories** 182  
**disruptive innovation\*** 1057–1058  
**distributional effects/outcomes** 43, 1383, 1383, 1386, 1387, 1515, 1741  
**distributive equity\*** 369, 412, 445–446, 1386, 1460  
**distributive justice** 1405, 1407, 1746, 1748  
**distributive outcomes** 1460, 1460, 1477, 1515  
**district heating and cooling networks** 650, 898–899  
**divestment** 1744–1745  
**Dominica** 1686  
**drivers of emissions** *see* emissions trends and drivers; *specific sectors*  
**drought\*** 374, 668, 1751–1752  
**dynamic efficiency** 181  
**dynamic global vegetation model (DGVM)**  
models 758, 760, 761
- E**
- early warning systems** 1686  
**Eastern Asia** 1823, 1824  
AFOLU emissions 253, 756, 759, 765, 766  
buildings emissions 250, 250, 964, 965, 966, 968  
embodied emissions 978  
reduction potential 970  
buildings energy demand 971, 973, 973, 974  
buildings mitigation potential 989, 991  
emissions trends and drivers 233, 234–235, 236, 238, 246, 247  
energy investment needs 1571  
energy sector emissions 248, 620, 621, 622  
energy use trends 623  
finance flows 1577  
industry emissions 248, 249  
international cooperation 1501  
nuclear power 640  
per capita floor area 969  
transport 251  
transport emissions 252, 1055, 1056  
urban population and urban expansion 883, 883  
water-energy-food nexus 1753
- Eastern Europe and West-Central Asia (EEA)** 1824, 1824  
AFOLU emissions 756  
AFOLU mitigation potential 777, 778, 781, 782  
consumption-based emissions 241, 242  
emissions embodied in trade 244  
emissions projections 335  
emissions trends and drivers 233, 234–235, 236  
energy investment needs 1571  
rice cultivation 771  
services for well-being 515  
transport demand 1102  
transport emissions 1053, 1055, 1056, 1100, 1101  
urban emissions 863, 885, 885, 886  
urban emissions scenarios 891, 892  
urban land expansion 863, 888, 888, 889  
urbanisation scenarios 888, 888, 889, 891, 892
- Eastern Europe geologic CO<sub>2</sub> storage potential** 641  
**eco-industrial parks** 1180, 1755  
**ecological barriers and opportunities** 825–826  
**economic development** 43, 773, 1175–1176  
**economic drivers** 245–255, 274  
AFOLU sector 252–254, 253, 773  
buildings sector 250–251, 250  
energy systems 247–248, 248  
global and regional 245–247, 246  
industry 248–250, 249  
low-carbon societal transition 153  
poverty and inequality 254–255, 264–265  
rapid and large-scale urbanisation 255  
transport 251–252, 252
- economic effectiveness** 1383–1384, 1383, 1385–1386, 1515  
**economic efficiency** 180–181  
**economic factors** 165–169, 1729, 1734–1735, 1770

- accelerating sustainable transition 1734–1735  
 feasibility assessment 187, 188  
 finance and investment 168–169  
 impacts of COVID-19 pandemic 163, 512, 1549, 1557–1560, 1591–1592, 1598  
 implications of mitigation  
   buildings sector 1004–1005  
   enhanced asset values 1004–1005  
   labour productivity 1004  
   macroeconomic effects 1005  
 services, sectors and urbanisation 166  
 technology 167–168  
 trade, consumption and leakage 166–167
- economic frameworks** 1845–1847  
**economic governance** 1501  
**economic growth** 245–247, 274, 464–465  
   decoupling emissions from 242–244, 242, 243  
   development pathways and emissions 452  
   energy-growth nexus 512–514  
   growth rates 1828  
   impact of IPR regimes 1681–1682  
   modelling methods 1845  
   and near- to mid-term mitigation 442–445, 443  
   projections 313, 314  
   socio-economic equity 521  
   urbanisation and 255
- economic/market-based policy instruments**  
 46, 628–629, 700, 815–816, 956, 1010–1011, 1292–1293, 1379, 1381, 1383, 1384–1388, 1767  
*see also* carbon markets; carbon price\*; carbon taxes; emissions trading schemes (ETS); subsidies
- economic potential\*** 774, 1251  
 AFOLU sector 33, 750, 755, 775, 776, 777, 807–809, 831  
 agriculture 789, 790–791, 792, 793, 794, 796  
 bioenergy and BECCS 802  
 demand-side measures 804, 805  
 forests and other ecosystems 780, 781, 782, 784, 785  
 supply-side measures 775, 776  
 hydropower 638  
 projected 779  
 regional AFOLU mitigation potential 777, 780, 781, 810–811, 810
- ecosystem services\*** 753  
 AFOLU linkages 827–828, 829  
 CANOPIES agroforestry project 791–792  
 and Land Degradation Neutrality (LDN) 1304–1306  
 payment for ecosystem services (PES) 815–816  
 trade-offs 1301
- ecosystems** 750, 780–781, 1497, 1504  
   conversion to agriculture 768, 784–786  
   ecosystem-based adaptation (EbA) 1403  
   impacts of solar radiation modification (SRM) 1490, 1491, 1492
- Ecuador** 1673, 1746, 1756  
**education** 264, 507, 513, 548, 1765  
   capacity building 1473  
   climate change 1737  
   education for sustainable development (ESD) 1765  
   information initiatives/policy instruments 1294–1295, 1750–1751
- effective carbon price** 1382–1383  
**effective carbon rate (ECR)** 269n  
**effective radiative forcing (ERF)** 1086, 1087  
**efficiency** 957–958  
   economic efficiency 180–181  
   land efficiency 253, 254  
   regulations and innovation 1677–1678  
   resource efficiency 911  
   SER framework 955, 956, 957–959, 967–970, 968, 1849–1850  
   service provision efficiency 527–535, 528  
   water use efficiency 793  
*see also* energy efficiency\*; material efficiency (ME)
- Egypt** 254, 1390  
**electric vehicles (EVs)** 11, 32, 900, 1052, 1061, 1074–1079, 1108–1109, 1112–1113, 1118–1119  
   accelerated mitigation pathways 440  
   adoption/adoption rate 529, 567–568  
   automated vehicles 542–543  
   batteries 11, 12, 257, 258, 628, 654–655, 657, 1069–1070, 1079, 1116, 1116–1117, 1120  
   buses and passenger rail 1079, 1080, 1081, 1082  
   charging infrastructure 628, 1071–1073  
   costs 1080, 1082  
   critical minerals 1116, 1116–1117  
   critical strategic minerals 637–638  
   emissions 1074–1077, 1075, 1077, 1081  
   freight rail 1083, 1084–1085, 1085  
   freight trucks 1082, 1083, 1084–1085, 1085  
   fuel efficiency 1146–1147  
   hybrid electric vehicles (HEVs) 1069, 1074–1076, 1075, 1077, 1079, 1081, 1083, 1146–1147  
   infrastructure 271  
   lifecycle assessment 1145–1146  
   lifecycle costs (LCCs) 1078, 1079, 1080, 1082, 1148–1149  
   operating emissions 1074, 1076  
   plug-in hybrid electric vehicles (PHEVs) 1074–1076, 1079  
   policy impacts 271  
   policy packages 569  
   potential 1074, 1076  
   prices 628, 1079, 1082, 1148–1149  
   production-based emissions 1076  
   subsidies 1387  
   trends and developments 628, 1076–1077  
   two-wheelers 1077, 1113  
   vehicle size 1076–1077
- electrical energy storage systems (EES)** 1069–1070  
**electricity**  
   access to 556, 623, 623–624  
   demand 688, 955, 957, 974, 984–985, 1005, 1183  
   final energy demand per fuel 970–971, 971  
   prices 615  
   transmission 660, 665
- electricity generation**  
   climate change impacts 666–668  
   decarbonising 436, 436–437, 688–689, 703  
   feed-in tariffs 1387, 1388  
   fossil fuel-based 623  
   GHG emissions trends 236, 237  
   production costs 647  
   renewable 28, 436, 436–437, 616, 675–676, 1388  
   Renewable Portfolio Standards (RPS) 1388
- electricity sector**  
   costs and potentials 530, 1257, 1257, 1259  
   demand-side mitigation measures 530, 984–985  
   emissions 620, 687  
   low-carbon transition outcomes 703  
   policies 1382, 1387, 1388
- electricity systems**  
   100% renewable 616, 675–676  
   climate change impacts 665, 666–668, 670  
   integration 684  
   low-carbon 688–689, 688  
   models/modelling methods 1847–1848  
   powered by renewables 28  
   smart grids 660, 900  
   system management 674  
   vulnerability 670  
   zero/negative CO<sub>2</sub> emissions 674–675
- electrification** 91–92, 1188  
   accelerated mitigation pathways 436, 439  
   buildings 439, 676–677, 694, 974, 1001, 1003–1004  
   buildings services 676–677  
   co-benefits, synergies and trade-offs 705, 900–901, 1001, 1003–1004, 1211  
   cooking energy/technology 559, 705, 1001  
   direct electrification 1182–1183  
   of end uses 676–677, 691–692  
   energy systems 652  
   governance 912  
   indirect emissions 1056  
   industry 441, 677, 694, 1163, 1182–1183, 1187, 1191, 1192, 1194, 1203, 1207, 1211, 1213  
   investment needs 1571–1572  
   long-term goal compatible mitigation pathways 299  
   mitigation potential 1257  
   net-zero energy systems 676–677  
   policy approaches and strategies 912, 1209, 1213  
   rural households 1001, 1003–1004  
   and SDGs 705, 1211  
   and sustainable development 704, 705  
   transport 440, 676, 677, 899–901, 1053, 1108–1109  
   electric rail systems 1079  
   electromobility 440, 1052, 1112–1113, 1116–1117, 1118–1119, 1120  
   shipping 1095, 1098  
   *see also* electric vehicles (EVs)  
   urban energy systems 873, 875, 912  
   urban systems 899–901, 912

- electromobility** 440, 1052, 1112–1113, 1116–1117, 1118–1119, 1120
- embodied (embedded) emissions\*** 156, 159n, 162, 217–218, 244–245, 244, 520, 1176, 1213–1214
- buildings 955, 957, 963, 977, 978
- construction materials 901–902, 901, 977
- passenger rail 1079–1080
- emerging economies**
- committed emissions 697
- industry 1207
- informal economy 870
- socio-technical policy impacts 1676
- urbanisation 869
- emission metrics** 6n, 222, 225–226, 226–228, 319, 417, 1824, 1825, 1830, 1831
- emission pathways\*** 14–25, 15–16, 18–20, 26–27, 298, 303, 762–763
- with current policies 298
- impact of climate 335
- socio-economic drivers of emissions 313–315, 314
- temperature outcomes 315–334, 315, 317, 330–332, 1741–1742
- timing of net zero emissions 324, 327
- until 2050 1260, 1260
- emissions\***
- accounting approaches 65, 239–240
- accounting frameworks 871–873, 927
- air pollution 271–272
- allocating by sector 8
- anthropogenic mercury emissions 1497
- Arctic 1094
- assessment methods for projected emissions 416–418
- behavioural changes and 163
- biomass supply 801
- co-emissions 232–233
- committed emissions 355, 697, 919, 923, 1208–1209, 1743
- contribution to warming 225, 226, 232
- and COVID-19 pandemic 7, 162–163, 511–512
- datasets 221–222, 240, 240, 273, 760–761, 764, 765, 1831–1837, 1832–1833, 1834–1836
- decoupling from economic growth 242–244, 242, 243, 247
- dietary 1247
- drivers see emissions trends and drivers
- economic development and 178–180, 179
- estimation methods 760–762, 761, 762–763, 927
- existing fossil fuel infrastructure emissions 16, 68, 265–268, 266, 267, 1743–1744
- fire emissions 783, 784
- growth rates 1827–1828
- historic cumulative emissions 6–7, 233, 235, 239
- historical 222, 231–232, 231
- historical data 1831
- household emissions 9, 260–265, 1747
- hydrofluorocarbons (HFCs) 221, 224, 229, 1496
- impact of development pathways 452–453
- and income 505–506
- inequality and emitters 264
- international cooperation 172–173
- international transport emissions 1506–1508
- inventories 221–222, 273
- and long-term temperature pathways 424–426
- models/modelling methods 1865
- near-term emission levels, implications on long-term goals 351–356, 352, 353
- near-term projections 418–422, 419–420, 421, 422, 424–426
- ozone-depleting substances (ODS) 1496
- peatlands 785
- per capita 160, 161, 178, 179, 218, 241, 242, 246, 263
- CO<sub>2</sub>-FFI emissions 233
- GHG emissions 9, 10–11
- per unit GDP 161, 162
- policy impacts 171, 219, 269–273
- projections 17–25, 18–20, 26–27
- reductions 9, 13, 17, 18–20, 28–34, 35
- biochar 790
- carbon pricing policies 1385
- energy efficiency 1387
- fossil fuel subsidy removal 1387
- illustrative pathways (IP) 309, 312
- institutions and governance 1358
- international aviation and shipping 1506–1508
- international cooperation 1467, 1506–1508
- Kyoto Protocol 1475
- legislation for 1361–1363, 1362
- market mechanisms 1359
- models/modelling methods 1856
- net zero targets 1407–1408
- Paris Agreement 1467, 1476–1477
- policy attribution 1479–1481
- targets 1460
- voluntary for offset credits 1386
- regional contributions 9, 10–11
- reporting 239
- residual emissions 268–269, 268, 671, 692–693
- scenarios 21–23
- sectoral 6, 8, 194
- sectoral contributions 247–254, 248, 249, 250, 252, 253
- sectoral mapping on sources 1831–1837, 1832–1833, 1834–1836
- SLCFs see short-lived climate forcers (SLCFs)\*
- targets 328–329, 1359, 1363, 1364, 1517
- territorial 167, 221–238, 239, 240, 1165, 1176, 1283–1285, 1284
- trends calculations 1828
- uncertainties 222–226, 229, 240
- units and unit conversions 1824, 1825
- urban 8, 871–873, 927, 1755–1756
- urban land use and GHG emissions 880–881
- urban-rural differences 255, 260, 262, 263
- see also anthropogenic emissions\*;
- consumption-based emissions\*;
- cumulative emissions\*;
- embodied (embedded) emissions\*;
- production-based emissions\*;
- specific gases and sectors
- Emissions Database for Global Atmospheric Research (EDGAR)** 221–222, 757, 764, 765, 1831, 1833, 1836–1837
- emissions gap** 14, 14n, 351, 358, 411, 414, 422, 425, 763, 913–914, 1477
- emissions pathways** 417, 422, 431
- national 431, 432, 433–435, 434
- emissions scenarios\*** 173–176, 1870
- AFOLU 806–807, 806
- GHG emission metrics 228
- high-end emissions 317, 385
- historical trends and baseline scenarios 232
- socio-economic drivers 1875
- SSP-based 1873, 1874, 1875
- emissions trading schemes (ETS)** 13, 270, 815, 1365, 1383, 1384–1385, 1386, 1393, 1394
- aviation 1089
- building sector finance 1012
- and Clean Development Mechanism (CDM) 1386, 1394, 1475–1476, 1484
- effectiveness 465–466, 1385–1386, 1396, 1587–1588
- energy sector 628–629
- impact on innovation 1675
- international linkage 1488
- international trade agreements 1500
- policy interactions 1396–1397
- emissions trends and drivers** 6–16, 7, 10–11, 59–68, 166, 215–274
- air pollution 232–233, 232
- anthropogenic GHG emissions trends 217, 228–232, 229
- behavioural choices and lifestyles 260–265
- consumption-based emissions 217, 239–245, 241, 244, 247
- COVID-19 pandemic 60–61, 217, 230–231, 230
- cumulative emissions 10–11, 217, 218, 233, 235, 239
- decoupling 217, 247
- direct drivers 767–771
- economic drivers 245–255, 274, 773
- emissions embodied in trade 217–218, 244–245, 244
- emissions growth 217, 218, 228–230, 233, 236–237, 236, 238
- emissions reductions 217, 219, 230–231, 233, 236, 236, 247, 255–256, 274
- FAQs 274
- future CO<sub>2</sub> emissions 219
- global AFOLU emissions 756–759, 756, 758, 762–763, 764–765, 764
- global emissions trends 159, 160, 246
- global GHG emissions trajectories 228–232
- global GHG emissions trends 10–11, 238
- historic cumulative emissions 10–11, 233, 235, 239
- historic emissions 222, 231–232, 231
- impact of economic and geopolitical events 230
- impact of mitigation policies 1479–1481
- indirect drivers 767, 773
- infrastructure, existing and planned long-lived 265–269
- knowledge gaps 273

- mitigation in context of 159–162, 160–161  
 OECD and non-OECD countries 245, 247, 251, 254  
 past and present trends  
   consumption-based CO<sub>2</sub> emissions 239–245, 241, 244  
   emissions embodied in trade 244–245, 244  
   per capita emissions 218  
   policy attribution 1479–1481  
   policy impacts 171n, 219, 273  
   policy instruments 269–273  
   production-based emissions 247  
   projected trends 14–16, 15, 156  
   regional AFOLU emissions 756–758, 756, 759–760, 759, 765–766, 765  
   regional GHG trends 159–162, 161, 233–236, 234–235, 236, 238, 246  
   regional sector emissions 245–254, 246, 248, 249, 250, 252, 253  
   sector-specific policies 271–273  
   sectoral climate policies 270–271  
   sectoral drivers 247–254  
   sectoral GHG emissions trends 230–231, 236–237, 237, 238, 246, 248, 249, 250, 252, 253  
   short-lived climate forcers (SLCFs) 232–233, 232  
   technological change 168, 255–259, 260  
   see also *specific sectors*
- employment** 445, 464–465, 474  
 and coal phase-out 624–625  
 energy sector transformation 368–369  
 energy transition 1695  
 food systems 1280  
 just transitions 1560–1561, 1747  
 pathways and scenarios 300, 368–369  
 sub-national policies and green jobs 1682  
 working conditions 1755
- enabling conditions (for adaptation and mitigation options)\*** 44–48, 165–166, 187, 188, 412  
 for accelerated mitigation 412–413, 414, 459–464  
 behaviour and lifestyle changes 412, 463–464, 1764–1766  
 for CDR deployment 1272  
 equity and just transition 1768–1769  
 financial systems and economic instruments 1767  
 holistic planning and nexus approach 1769–1770  
 improved institutions and governance 412, 460, 461–462  
 institutional capacity and multi-level governance 1767–1768  
 investment and finance 412, 460, 462–463  
 policy integration 412, 460, 461  
 policy sequencing and packaging 569–570  
 for shifting development pathways 412, 413, 414, 458–459, 459–464  
 sustainability transitions 1730–1731, 1764–1770, 1771  
 technology and innovation 460, 464, 1645, 1693–1694, 1698–1699, 1766–1767
- transport 1111–1118, 1118–1119  
 urban mitigation and adaptation 880
- energy access\*** 375, 516–517, 517–518, 568, 623, 623–624, 1000–1001, 1001  
 electricity from renewable source 556, 623  
 and electrification 705  
 energy system integration 706  
 fossil fuel-based electricity 623  
 interaction with other SDGs 705, 705  
 international cooperation 1485, 1505  
 just transitions and climate finance 1560, 1603–1604  
 modern energy services\* see access  
 subsidies 629
- energy auctions** 1676
- energy audits** 1009–1010, 1391
- energy carriers** 91–92, 643–644, 658, 691–692, 692, 970–971, 971
- energy communities** 1014
- energy conservation** 435
- energy demand** 513, 516, 534  
 behavioural interventions 548–549, 549–554  
 building sector models 1849, 1852  
 buildings 955, 957, 970–974  
   climate impacts 996–997  
   major trends 974–975  
   per end use 972–974, 972–973  
   per fuel 970–972, 970–971  
 climate change impacts 665, 669  
 for cooling 375  
 digitalisation 539–540, 974–975  
 direct air carbon dioxide capture and storage (DACCS) 1266–1267  
 modelling methods 1849  
 projections 313–315, 314  
 reducing 679–680, 692  
 trends 615
- energy efficiency\* 1188**  
 accelerated mitigation pathways 435, 439–440, 441  
 air conditioning systems 974  
 appliances and lighting 980–981, 980, 1662–1663, 1678, 1679  
 buildings 439–440, 981, 982, 1008–1011  
 cement and concrete 1190  
 climate finance 1564  
 cooking energy/technology 567  
 cooling and refrigeration 439, 974  
 and digitalisation 1652–1653, 1760  
 efficiency regulation 1677–1678  
 electric vehicles (EVs) 1076  
 and electrification 705  
 emissions trends and drivers 245–246  
 end-use efficiency strategies 661, 662, 679–680, 695, 704  
 food storage and distribution 1290–1291  
 household 909  
 industry 249–250, 441, 1171–1172, 1180–1182, 1181, 1187, 1191, 1203, 1211, 1213  
 inequitable societies 524  
 investment 695, 1569, 1576  
 investment needs 1572, 1573  
 net-zero energy systems 679–680
- policies 1209, 1213  
 and SDGs 704, 705, 1211  
 service provisioning 533–535, 533, 534  
 shipping 1507  
 standards and labelling 1011, 1391, 1662–1663, 1677–1678, 1679  
 steel 1189  
 subsidies 1387  
 tradable white certificates 1677  
 transport 251, 252, 1106, 1107, 1507  
 urban systems 899, 909
- energy governance** 1504–1506
- energy intensity** 247, 1747  
 appliances and lighting 980  
 buildings 251  
 industry 249–250, 1199, 1199
- energy labels** see standards and labelling
- energy nexus approaches**  
 energy-growth nexus 512–514  
 energy-water-land nexus 1859  
 see also water-energy-food nexus
- Energy Performance Contracting (EPC)** 1012
- energy performance standards** 1010, 1012, 1678
- energy poverty\*** 516–517, 524, 873, 875, 876, 1001–1002, 1003, 1603–1604
- energy prices** 1655
- energy resources** 682
- energy security\*** 623, 684, 1005
- energy services\***  
 access to 9, 218, 254–255  
 efficient 256  
 well-being 514–516, 515
- energy sources** 616, 630–650  
 low-carbon trends 627  
 urban and industrial waste 1180  
 waste heat to power (WHP) 1181  
 waste-to-energy 649–650, 910
- energy storage** 627–628, 639, 652–657, 653, 654  
 cross-sector coupling 650  
 energy conversion 653–654  
 flexibility technologies 652  
 net-zero energy systems 674, 675  
 social aspects 656–657  
 technologies 652–653, 653, 654–656  
 see also batteries
- energy systems** 89–94, 613–707, 617–618  
 100% renewable 332–333, 616, 674, 675–676, 707  
 accelerated mitigation 435–439, 436–437  
 air pollution emissions 233  
 barriers and enablers 629, 630, 637, 660, 664  
 buildings, on-site renewables 981, 1005  
 carbon capture (CCU and CCS) 615, 641–643, 645, 646–647, 657, 668, 672–675, 693, 700, 705–706  
 carbon dioxide removal (CDR) 615, 643, 645, 671–674, 675, 681, 692–693, 705–706  
 climate change impacts 375, 616, 663, 665, 669, 1752–1753  
 on electricity system vulnerability 670, 1752  
 on energy consumption 669  
 on energy supply 666–668

- renewable energy impact on climate 670–671
- climate litigation 1376, 1377
- cooling 1752
- costs and benefits 647, 661–662, 703–706
- costs and potentials 38–39, 1252, 1254, 1256–1257, 1257, 1258, 1258, 1259, 1259
- COVID-19 pandemic 163, 230–231, 230
- cross-sector coupling 650–651
- cross-sectoral interactions and integration 1115, 1206–1207, 1313
- definitions 619
- digitalisation 652, 1653
- district energy networks 981
- electric vehicle-grid integration 1072–1073
- electricity prices 615
- emissions 8, 230–231, 230
  - CO<sub>2</sub> emissions 246, 433–434, 619–620, 620, 685–688, 685, 686, 687, 1303, 1836–1837
  - committed emissions 697
  - food system GHG emissions 1280–1281, 1281, 1282
  - fossil fuel CO<sub>2</sub> emissions 619–620, 619, 620
  - fossil fuel methane emissions 646
  - methane (CH<sub>4</sub>) 28, 646, 1832, 1833, 1834–1836
  - net negative emissions 433–434
  - net zero 28, 671–672
  - residual emissions 671, 692–693
  - sources 1832, 1833, 1834–1836
- emissions growth 218
- emissions pathways 685–688, 685, 686, 687
- emissions reductions 309, 312, 616, 685–688
- emissions trends and drivers 236–237, 237, 238, 246, 247–248, 248, 615, 619–622, 619, 620, 621
- end-use efficiency strategies 661, 662, 679–680, 695, 704
- energy storage *see* energy storage
- FAQs 707
- feasibility 629, 630, 663, 664
- fossil fuel phase-out 624–625, 625–626, 693, 1742–1749, 1743, 1771
- gap indicators 425–426
- global energy flows 92–93
- governance and institutions 681–682, 682, 700–701, 1504–1506
- grid services 653, 653, 656
- illustrative pathways (IP) 309, 312
- infrastructure 693, 697
- institutions 1367
- integrated approach 661
- integration 616, 650–652, 680–681, 684, 684–685, 706
- interconnected and smart grids 660, 900
- international cooperation 1504–1506
- investment and finance 300, 615, 693–695, 694, 695, 697, 1505–1506, 1556, 1566–1567, 1568–1569, 1570–1572, 1570–1571, 1603–1604
- investment gap 1576
- investment needs 363–364, 363, 364, 1572, 1573
- land occupation 1298, 1302–1303
- levelised costs of electricity (LCOE) 662–663, 662, 663
- lock-in and path dependence 696, 697–698
- long-term mitigation costs 616, 703–704
- low emission energy sources 436
- micro-grid systems 1005
- mitigation options 629, 630, 662–663, 664
  - cost-effectiveness 616
  - demand-side measures 661–662, 704
  - digitalisation and advanced control systems 652
  - end user engagement 661
  - energy sources and conversion 616, 630–650
  - energy storage for low-carbon grids 652–657, 653, 654
  - energy system integration 650–652
  - energy transport and transmission 657–660
  - flexibility technologies 650, 651–652
  - long term 1260
  - prices 615, 627–628
  - public support 633, 637, 639, 640–641, 642–643, 646, 648, 649, 650
- models/modelling methods 1845–1846, 1847–1848, 1892
- Nationally Determined Contributions (NDCs) 416, 418, 421
- net-zero *see* net-zero energy systems
- nuclear power 438–439
- policies 628–629, 629, 696, 700–701, 1767
  - for CCS deployment 643
  - economic instruments 1385, 1386, 1387–1388
  - financial schemes 701–702
  - information programmes 702
  - market-based instruments 628–629, 700
  - near term choices 697
  - policy packages 700–701
  - power system management 1752–1753
  - regulatory instruments 628, 1388, 1389
  - for systemic transformation 1667–1669, 1667–1668
- production costs 645, 647
- public R&D funding 1673, 1674–1675, 1674–1675
- regional factors 666–669, 682–684, 684–685, 695
- renewable electricity generation 436, 436–437
- renewable energy penetration 627, 1742–1744, 1743, 1771
- resilience 652, 653–654, 669
- scenarios and pathways 24–25, 28–29, 308, 332–334, 338, 615, 703, 1892
- bioenergy cross-sector linkages 340–341
- cumulative emissions and temperature goals 323
- emissions 685–688
- energy supply 341, 342, 342
- energy technology diffusion 1657–1658, 1658–1659
- final energy demand 313–315, 314
- fossil fuels 698–700, 699
- global energy flows 92–93
- Illustrative Mitigation Pathways (IMPs) 309, 312, 333, 334, 689–691
- near and medium term transition 685–693
- net zero emissions 337, 680, 686
- sustainable development 375
- technology/infrastructure investment 693–695
- sector coupling 675, 681
- service-based business models 1607
- smart charging strategies 1072–1073
- smart energy systems 899, 900, 1182, 1760, 1761
- social aspects 618–619
  - acceptability 702–703
  - encouraging mitigation action 701–702
  - energy storage technologies 656–657
  - societal preferences 684
- spillover effects 1319–1320
- stranded assets 355
  - and sustainability 616, 623–624, 698, 703–706
- synergies and trade-offs with SDGs 41–42, 698, 704–706, 705, 1761, 1762
- transformation and employment 368–369
- transformational change 1667–1669, 1667–1668, 1767
- transition 256–259, 1695, 1741, 1767, 1768–1769
  - implications of near-term emission levels 352, 354
  - transition indicators 693
  - see also* low-carbon energy transition
- trends and developments 619–629
  - coal phase-out 624–625, 625–626
  - energy supply and use 622–623, 622
  - non-climate factors 623, 623–624
  - policies 628–629, 629
  - renewables and low-carbon energy sources 627–628, 627
- urban 899–901, 981
- urban symbiosis 1180
- voluntary initiatives 430
- vulnerability 1752
- waste heat to power (WHP) 1181
- waste-to-energy 649–650, 910
- water-energy-food nexus 1751–1754
- energy systems models (ESMs)** 535–538
- energy technologies** 167
  - deployment and diffusion 1649, 1657–1658, 1658–1659
  - investment and finance 1664–1665, 1664, 1665–1666, 1673–1675, 1674–1675
  - synergies and trade-offs 1695–1696
  - technology costs 1657, 1658–1659
- energy use** 513, 519
  - appliances and lighting 979–981, 980
  - digitalisation solutions 540
  - and electrification 704, 705
  - feedback 702
  - food system GHG emissions 1284–1285, 1284
  - household 520, 979–981, 980

- and income 516–517, 516  
 industry 1171, 1176  
 per capita 516  
 reduction 435  
 residential 908–909  
 trends and developments 622–623, 622  
 variations in 518–521, 524
- Enhanced Transparency Framework** 422
- enhanced weathering\*** 348, 348, 1247, 1267–1268, 1272, 1273, 1275, 1302
- enteric fermentation\*** 253, 771, 789, 792–793, 806–807, 806
- environmental effectiveness** 1383–1384, 1383, 1385, 1515
- environmental finance** 1552
- environmental goods** 1500–1501
- environmental impacts** 632, 637, 639, 640
- environmental impacts indicators** 1856
- environmental knowledge** 264
- environmental taxes** 1676
- equality\*** 1746–1749, 1771
- equity\*** 43, 153, 170, 179, 180, 476, 506–507, 1745–1749
- accelerated mitigation 412, 415, 472–474, 474, 475
- climate change asymmetries 183
- climate governance 1359
- and demand-side mitigation 521–525, 525–527
- distributional effects of mitigation 445–446
- and economic growth 521
- environmental impact of increasing 521
- inequity in access to basic energy use and services 516–521, 517–518
- integrated governance 1405
- international cooperation 1458
- Nationally Determined Contributions (NDCs) 423, 1468
- Paris Agreement 1465
- positive feedbacks 522
- regional share of global emissions 235
- shifting development pathways 415
- socio-economic 521–525, 525–527
- stranded regions 1410
- sustainability transitions 1768–1769
- urban mitigation co-benefits 875, 876
- ESG (environmental, social, and governance)**
- financial products** 1550, 1600–1601
- ETC Supply Side scenario** 1202, 1203
- ethics** 153, 170, 182–183, 1493
- Ethiopia** 1754, 1755
- Eurasia**
- AFOLU emissions 253, 759, 765–766, 765
- AFOLU removals 760
- buildings emissions 250, 251
- buildings mitigation potential 989
- emissions trends and drivers 238, 246
- energy sector emissions 248, 620, 621, 622
- energy system 246
- financial flows and stocks 1562, 1563
- industry emissions 249
- transport emissions 252
- see also Europe and Eurasia
- Europe** 1823–1824, 1824
- adaptation and mitigation 878
- AFOLU 1757
- emissions 253, 756, 756, 759, 765, 766
- mitigation potential 781, 782
- policy and regulation 272
- removals 760
- ASI behaviour 548
- bioenergy 438
- buildings emissions 250, 250, 251
- buildings mitigation potential 955, 988, 989, 989, 991
- buildings policies 251
- buildings technology 994–995
- carbon pricing 270, 1213
- carbon taxes 1384, 1385
- climate change impacts on energy supply 667, 668
- climate-related economic losses 1594
- climate-smart forestry (CSF) 782, 782–783
- coal use and phase-out 624, 625, 626, 699
- critical minerals 1117
- decoupling of transport-related emissions 1058
- deforestation and REDD+ 1504
- emissions embodied in trade 245
- emissions trends and drivers 233, 234–235, 236, 238, 246
- energy-efficient lighting transition 570
- energy investment needs 1571
- energy sector emissions 248, 620, 621, 622
- energy system 246, 247, 250, 1752
- energy use 623, 1747
- EV uptake 567
- forest area 767
- fuelwood harvest 770
- geologic CO<sub>2</sub> storage potential 641
- impacts of solar radiation modification (SRM) 1491
- industry 1206–1207, 1215–1216, 1217
- industry emissions 248, 249
- non-CO<sub>2</sub> emissions 1390
- nuclear power 640
- policy packages 570
- pollution policies and regulation 271
- renewable energy capacity 627
- renewable feed-in tariffs 1736
- research, development, and innovation (RDI) 1217
- technological change 257
- technology transfer and cooperation 1502
- transport 567, 1061, 1089–1090
- transport demand 1101–1103, 1102
- transport emissions 252, 1055, 1056
- transport modal trends 1104
- urban expansion 883, 883
- urban green infrastructure 905
- urban land use trends 884
- urban population 870, 883, 883
- urbanisation 768
- voluntary offsets 814
- waste-to-energy and CCS integration 650
- see also Eastern Europe and West-Central Asia; Europe and Eurasia; European Union (EU); specific countries
- Europe and Eurasia**
- buildings emissions 964, 965, 966, 967, 968
- embodied emissions 978
- reduction potential 970
- buildings energy demand 971, 972–973, 973
- buildings mitigation potential 991
- per capita floor area 969
- European Union (EU)**
- accelerated mitigation pathways 435, 436, 437, 438, 439, 440, 441
- AFOLU emissions 254
- AFOLU mitigation pathways 806, 807, 807
- AFOLU mitigation potential 810–811, 810
- agriculture subsidies 816
- bioenergy policies 818
- buildings 439, 440, 990, 993, 994
- carbon border adjustment mechanism (CBAM) 1213–1214, 1500
- carbon pricing policies 1385–1386
- circular economy 442
- climate policies and governance 1365, 1405
- coal use and phase-out 624, 625
- consumption-based emissions 243–244
- Emissions Trading System (ETS) 270, 628, 1089, 1365, 1383, 1384, 1385, 1386, 1393, 1396, 1475–1476, 1484, 1488
- energy-related CO<sub>2</sub> emission pathways 434
- energy sector 437, 439
- energy transition policies 700
- finance mechanisms for renewables 1013
- food system 804
- forest and forest sector 782–783
- household carbon footprint 520
- household emissions 260
- industry 441
- international cooperation 1501
- international trade and consumption 520
- marginal/abandoned/degraded land 800
- mid-century emission pathways 433, 434
- mitigation policies 1390, 1398
- net zero energy buildings 440
- net zero targets 432, 436, 1465
- non-CO<sub>2</sub> emissions 1390
- Paris Agreement 1462, 1463, 1465
- payment for ecosystem services (PES) 815
- policy impacts 270
- REDD+ 1503
- renewable energy policies 270
- retirement of fossil fuel power plants 1743–1744
- transition strategies 1657
- voluntary agreements 1392
- evolutionary economic theories** 182
- exergy\*** 527, 534–535
- exnovation** 256, 1397
- extended producer responsibility (EPR)** 1220
- Extinction Rebellion** 556, 1508
- extraction-based emissions (EBEs)** 239
- extreme weather events\*** 753, 864, 877, 1751, 1752
- building impacts 997
- economic costs 877
- energy systems 669, 670

- perception of risk 547  
risk pooling and insurance 1594–1596
- F**
- fairness\*** 170, 473  
accelerated mitigation 412  
carbon pricing 568, 569  
Nationally Determined Contributions (NDCs) 423, 473, 1468
- FAOSTAT emissions data** 756, 758, 760, 764, 765
- Faster Innovation Case (FIC)** 1201, 1202
- feasibility\*** 44, 144–147, 187, 188, 1407  
AFOLU mitigation 751, 753, 777, 789, 826  
assessment 146–147, 187, 1837–1838, 1837  
buildings sector 994, 1005–1006, 1006, 1017  
carbon dioxide capture and storage (CCS) 438  
carbon dioxide removal (CDR) 1272, 1273  
energy system mitigation 629, 630, 663, 664  
long-term goal compatible mitigation pathways 301  
low-carbon transition and pathways 378–382, 380  
mitigation scenarios 145, 147, 1876–1877, 1877  
model solvability 379  
rapid energy transitions 218–219  
renewable electricity generation 436  
socio-technical transitions 382  
urban mitigation 867, 911, 917, 918
- feasibility frontier** 378–379
- feasible potential** 774, 782, 803, 804
- feed-in tariffs** 1013–1014, 1387, 1388, 1587, 1676, 1736
- feedstocks** 1164, 1185–1186, 1192, 1193, 1198  
biochar 789, 790  
for biofuels 1066, 1066, 1068, 1182  
for plastics 1194  
production 789, 790, 1183
- fertilisers** 771, 772, 789, 794
- Fiji** 1293, 1501
- final energy\*** 342, 691–692, 692  
buildings 251, 337, 342–343, 343, 513, 955, 957, 970–971  
industry 337, 345–346, 345, 1171, 1199, 1199, 1200, 1200, 1203  
projections 313–315, 314  
total final energy consumption (TFC) 622–623, 622  
transport 251, 337, 343–345, 344, 1108–1109, 1108
- finance** *see* investment and finance
- finance flows** 13, 47–48, 169, 462–463, 956, 1554–1555, 1562–1567, 1576–1579  
alignment (with Paris Agreement) 1549, 1610  
innovative financial products 1598, 1600  
near-term 1556  
subnational 1597
- financial institutions** *see* banks and financial institutions
- financial markets and regulation** 1586–1587
- financing gaps** 159, 169, 1549, 1555, 1574–1579, 1580, 1610
- financing needs** 1549, 1567–1574, 1597
- fine particulate matter** 441
- Finland** 1296–1297, 1363
- fintech applications** 1607
- fire management** 783–784
- fire regimes** 770
- flexibility (demand and supply)\*** 650, 651–652, 985, 987–988
- floods\*** 374, 1752  
impact on energy system 670  
perception of climate risk 547  
stormwater management 876, 907–908  
urban green and blue infrastructure 907–908  
urban impacts 877
- fluorinated gases (F-gases)** 6n, 217, 221  
annual global emissions 223  
atmospheric lifetime 1831  
CO<sub>2</sub>-eq emissions 224, 229  
contribution to warming 225  
costs and potentials 1253, 1257, 1258, 1260  
emission pathways 17, 24  
emissions datasets 1831, 1832  
emissions growth 228–229, 229  
emissions sources 1832  
emissions trends 6, 7, 160, 224, 228  
food system emissions 1281, 1281, 1282  
global warming potential (GWP) 1831  
ozone layer protection policies 271  
residual emissions 328  
uncertainties in emissions 222, 224, 225
- flywheel energy storage (FES)** 655
- food-based dietary guidelines (FBDGs)** 1294
- food loss and waste\*** 254, 528–529, 803–804, 825, 1285, 1290, 1294, 1750–1751
- food nexus approaches** *see* water-energy-food nexus
- food security\*** 373–374, 795, 1279–1280, 1283–1285, 1284, 1302  
risk 1829
- food systems\*** 111–113, 802–804, 1250, 1279–1296, 1296–1297, 1322  
carbon footprint 520–521  
cross-sectoral implications 1313, 1749  
demand-side measures 528–529, 530  
diet and dietary shifts 254, 528–529, 530, 547  
emerging food technologies 1286, 1288–1289, 1290, 1321  
emissions 110, 1247, 1280–1285, 1281, 1282, 1283, 1284  
emissions trends and drivers 254  
GHG intensities of food commodities 1282–1283, 1283, 1288–1289  
governance 1248, 1295–1296, 1296–1297  
impacts/risks/co-benefits of land occupation by mitigation options 1306–1307  
mitigation and sustainable development 373–374  
mitigation opportunities 112, 1285–1291, 1286–1287  
mitigation potential 530, 1247, 1279  
novel and future foods 1247, 1286, 1288–1289, 1294  
policy instruments 113, 1291–1295, 1291, 1296–1297
- processing and packaging 1287, 1289–1290  
projections of food consumption 314, 315  
regional differences 111, 111, 1284–1285  
storage and distribution 1287, 1290–1291  
supply chain management 818  
sustainability 373–374, 1283–1285, 1284, 1292–1295  
transformation 1248, 1285, 1291, 1292  
urban 910  
waste 254, 528–529, 803–804, 825, 1285, 1290, 1294, 1750–1751  
*see also* water-energy-food nexus
- Foreign Direct Investment (FDI)** 1656, 1681
- forests\*** 750, 760–761, 779–784, 782–783  
afforestation 272, 323, 471, 751, 766, 767, 780–781, 825–826  
afforestation/reforestation (A/R) 766, 780–781, 1264, 1265, 1273–1274, 1276, 1277, 1300–1302  
carbon storage 804, 805, 826  
climate-smart forestry (CSF) 782, 782–783, 800, 1309  
community forest management (CFM) 817–818, 817  
costs and potentials 1257, 1258, 1258, 1259  
demand-side measures 750–751  
emissions 760, 762  
fire management 783–784  
fire regimes 770  
forest certification programs 818  
forestry and other land use (FOLU) CH<sub>4</sub> emissions 764  
forestry industry 1195  
global area and regional distribution 767–768  
governance 1510  
international cooperation 1503–1504  
logging and harvesting 770–771, 782, 818, 1300  
management 781–784, 782–783, 804–805, 816–818, 817, 826, 1274, 1276, 1300  
New York Declaration on Forests (NYDF) 1504  
policies 1382  
regulatory measures 816–818, 818–820  
sub-national and non-state actors/actions 430  
subsidies 751  
supply-side measures 751, 753  
sustainable management 804–805  
technological changes 773  
urban and peri-urban 903, 903–904, 905, 905–907, 910  
wood products and material substitution 804–805, 995–996  
zero deforestation pledges 272–273  
*see also* deforestation\*; REDD+
- fossil fuels\*** 169, 646–648  
business and corporations 557, 558  
climate litigation 1376–1377  
corporate actors in climate policy 1374  
media access 1378  
stranded assets 1744–1745  
carbon taxes 1386  
civil society campaigns against 1509  
climate-related financial risk 1581, 1582, 1584

- coal use and phase-out 624–625, 625–626  
 costs 168  
 electricity production costs 647  
 emissions 1182  
   energy sector emissions 619–620, 619, 620  
   from existing and planned infrastructure 16, 265–268, 266, 267, 1743–1744  
   fossil fuel and industry related (CO<sub>2</sub>-FFI) 6, 6n, 7, 7, 8, 9, 10–11, 159, 159n, 160, 161, 163, 217, 218, 223, 225, 228, 229, 229, 230–231, 233  
   fugitive emissions 28, 620, 647, 796  
   future CO<sub>2</sub> emissions 16, 219, 265–268, 266, 267  
   residual CO<sub>2</sub> emissions 268–269, 268  
 energy return of investment (EROI) 647  
 energy with CCS 24–25, 615, 646, 647, 648, 693, 699, 700, 1743  
 energy without CCS 24–25  
 enhanced recovery 642  
 environmental impacts 647  
 extraction costs 647  
 fossil fuel-dependent countries 624–625, 1746, 1747, 1748, 1771  
 fuel switching 1182  
 hydrogen production 647  
 infrastructure 219, 265–269, 615, 693, 697, 698, 1743–1744, 1743, 1771  
 international cooperation 1505–1506, 1593–1594  
 investment and finance 615, 694, 697, 1409, 1566–1567  
 levelised costs of electricity (LCOE) 662  
 long-term goal compatible mitigation pathways 299  
 low-carbon energy transition 647, 698–700  
 methane emissions and mitigation 646, 647  
 net-zero energy systems 672–674  
 phase-out 16, 624–625, 625–626, 647, 693, 699, 705, 1567, 1593–1594, 1742–1749, 1743, 1771  
   international cooperation 1593–1594  
   scenarios and pathways 309, 312, 313  
 public support 648  
 removal of subsidies 1387–1388  
 resource rich countries 1769–1770  
 resources and extraction 646–647, 698, 1394  
 revenues 1746, 1747, 1748  
 scenarios and pathways 267, 309, 312, 313, 323–324, 341, 438, 625–626, 698–700  
 stranded assets 615, 647, 1744–1745, 1747  
 subsidies 465–466, 629, 629, 648, 1359, 1383, 1387–1388, 1388, 1567  
 substitution 751  
 technology and innovation 647, 1655  
 transport 251  
 see also coal; stranded assets\*
- France** 256, 432, 436, 438, 990, 995, 1090, 1373, 1503
- frequently asked questions (FAQs)**  
 1.1: What is climate change mitigation? 194  
 1.2: Which greenhouse gases (GHGs) are relevant to which sectors? 194  
 1.3: What is the difference between ‘net zero emissions’ and ‘carbon neutrality’? 194  
 2.1: Are emissions still increasing or are they falling? 274  
 2.2: Are there countries that have reduced emissions and grown economically at the same time? 274  
 2.3: How much time do we have to act to keep global warming below 1.5 degrees? 274  
 3.1: Is it possible to stabilise warming without net negative CO<sub>2</sub> and GHG emissions? 385  
 3.2: How can net zero emissions be achieved and what are the implications of net zero emissions for the climate? 385  
 3.3: How plausible are high emissions scenarios, and how do they inform policy? 386  
 4.1: What is to be done over and above countries’ existing pledges under the Paris Agreement to keep global warming well below 2°C? 477  
 4.2: What is to be done in the near term to accelerate mitigation and shift development pathways? 477  
 4.3: Is it possible to accelerate mitigation in the near term while there are so many other development priorities? 477  
 5.1: What can every person do to limit warming to 1.5°C? 572  
 5.2: How does society perceive transformative change? 572  
 5.3: Is demand reduction compatible with growth of human well-being? 572  
 6.1: Will energy systems that emit little or no CO<sub>2</sub> be different than those of today? 707  
 6.2: Can renewable sources provide all the energy needed for energy systems that emit little or no CO<sub>2</sub>? 707  
 6.3: What are the most important steps to decarbonise the energy system? 707  
 7.1: Why is the Agriculture, Forestry and Other Land Uses (AFOLU) sector unique when considering GHG mitigation? 831  
 7.2: What AFOLU measures have the greatest economic mitigation potential? 831  
 7.3: What are potential impacts of large-scale establishment of dedicated bioenergy plantations and crops and why is it so controversial? 831  
 8.1: Why are urban areas important to global climate change mitigation? 927  
 8.2: What are the most impactful options cities can take to mitigate urban emissions, and how can these be best implemented? 927  
 8.3: How do we estimate global emissions from cities, and how reliable are the estimates? 927  
 9.1: To which GHG emissions do buildings contribute? 1018  
 9.2: What are the co-benefits and trade-offs of mitigation actions in buildings? 1018  
 9.3: Which are the most effective policies and measures to decarbonise the building sector? 1018  
 10.1: How important is electromobility in decarbonising transport and are there major constraints in battery minerals? 1120  
 10.2: How hard is it to decarbonise heavy vehicles in transport like long-haul trucks, ships and planes? 1120  
 10.3: How can governments, communities and individuals reduce demand and be more efficient in consuming transport energy? 1121  
 11.1: What are the key options to reduce industrial emissions? 1224  
 11.2: How costly is industrial decarbonisation and will there be synergies or conflicts with sustainable development? 1224  
 11.3: What needs to happen for a low-carbon industry transition? 1224  
 12.1: How could new technologies to remove carbon dioxide from the atmosphere contribute to climate change mitigation? 1322  
 12.2: Why is it important to assess mitigation measures from a systemic perspective, rather than only looking at their potential to reduce GHG emissions? 1322  
 12.3: Why do we need a food systems approach for assessing GHG emissions and mitigation opportunities from food systems? 1322  
 13.1: What roles do national play in climate mitigation, and how can they be effective? 1413  
 13.2: What policies and strategies can be applied to combat climate change? 1413  
 13.3: How can actions at the sub-national level contribute to climate mitigation? 1413  
 14.1: Is international cooperation working? 1517  
 14.2: What is the future role of international cooperation in the context of the Paris Agreement? 1517  
 14.3: Are there any important gaps in international cooperation, which will need to be filled in order for countries to achieve the objectives of the Paris Agreement, such as holding temperature increase to well below 2°C and pursuing efforts towards 1.5°C above pre-industrial levels? 1517  
 15.1: What’s the role of climate finance and the finance sector for a transformation towards a sustainable future? 1610  
 15.2: What’s the current status of global climate finance and the alignment of global financial flows with the Paris Agreement? 1610  
 15.3: What defines a financing gap, and where are the critically identified gaps? 1610  
 16.1: Will innovation and technological changes be enough to meet the Paris Agreement objectives? 1701  
 16.2: What can be done to promote innovation for climate change and the widespread diffusion of low-emission and climate-resilient technology? 1701

- 16.3: What is the role of international technology cooperation in addressing climate change? 1701
- 17.1: Will decarbonisation efforts slow or accelerate sustainable development transitions? 1772
- 17.2: What role do considerations of justice and inclusivity play in the transition towards sustainable development? 1772
- 17.3: How critical are the roles of institutions in accelerating the transition and what can governance enable? 1772
- Fridays for Future** 1375, 1508, 1765
- frugal innovations** 1648
- fuel poverty\*** 1001–1002, 1003
- fuels** 1052, 1053
- alternative fuels 677–678, 679, 1064–1068, 1064, 1066, 1067
  - ammonia 1052, 1068, 1094–1095, 1096
  - carbon-based 677
  - carbon taxes 270
  - costs 1088, 1148
  - diesel 1068, 1074, 1078, 1079, 1080
  - emissions factors 1145–1146, 1145
  - final energy demand per fuel 970–971, 971
  - fuel efficiencies 1146–1147
  - fuel switching 1188
    - co-benefits for SDGs 1211
    - industry scenario analysis 1203
    - policy approaches and strategies 1213
    - policy packages for cooking fuels 569
  - fuelwood harvest 770–771, 782
  - household and cooking 548, 559, 567, 569, 622–623, 623–624, 629, 705, 1000–1001, 1003–1004
  - hydrogen (and derivatives) 1053, 1184
    - fuel cells 656, 1070–1071, 1079, 1088
    - liquid hydrogen (LH<sub>2</sub>) 1088–1089
    - shipping fuel 1094–1095, 1096
  - methanol 1095
  - mitigation potential 1094–1095, 1096
  - natural gas 1065, 1082, 1095
  - net-zero emission fuels 677–678, 679
  - power to fuels (PtX) 656, 675, 1184
  - regional variation in fuel type use 622–623
  - sustainable aviation fuels (SAFs) 1087–1088
  - synthetic fuels 1052, 1068, 1071, 1080, 1088, 1094
  - traditional biomass 622–623, 623–624, 629, 644, 970–971, 972
  - transport 1052, 1064–1073, 1075, 1080, 1081
    - aviation 1087–1089, 1113, 1118–1119
    - road and rail freight 1083, 1084–1085, 1085
    - shipping 1094–1095, 1096, 1113, 1118–1119
- see also biofuels\*; fossil fuels\*; gas
- fugitive emissions (oil and natural gas systems)\*** 28, 620, 647, 796
- G**
- gap indicators** 425–426
- see also emissions gap; implementation gap
- gas** 646, 647–648
- energy sector emissions 247, 619–620, 620
  - final energy demand per fuel 970–971, 971
  - liquefied natural gas (LNG) 623, 647, 1065, 1080, 1095, 1098
  - liquefied petroleum gas (LPG) 458, 548, 559, 569, 624, 629, 1005, 1399
  - low-carbon transition 699, 699
  - production and demand trends 622, 622
  - replacing coal 624
- gasification** 647, 657
- gender equity\*** 465, 507, 525–527, 1003–1004, 1609–1610, 1748
- general-purpose technologies (GPT)** 1249–1250, 1314, 1321
- geoengineering** 168, 1488
- geothermal energy\*** 648–649, 648
- buildings on-site energy generation 981
  - costs and potential 648
  - final energy demand per fuel 970–971, 971
  - levelised costs of electricity (LCOE) 662
  - synergies and trade-offs with SDGs 1761
  - trends in electricity generation 627
- Germany**
- accelerated mitigation pathways 436, 438, 440
  - buildings mitigation potential 989, 990
  - climate governance and institutions 1367
  - climate laws 1363
  - coal use and phase-out 626
  - energy sector 436, 628
  - energy system 1743
  - energy transition policies 700
  - industrial waste management 1180
  - industry policy 1215, 1215–1216
  - low emission strategies 433, 434
  - net zero energy buildings 440
  - net zero targets 432
  - REDD+ 1503
  - renewable electricity generation 437
  - renewable energy policies 569
  - solar power 557, 1387
  - sufficiency 990, 995
  - technological change 257
  - transport 440, 1060
  - urban green infrastructure 905
  - urban population 870
- Ghana** 828–829, 1746, 1755
- GHG Content Certifications** 1219
- Global Carbon Budget (2020)** 240–242, 241, 242, 243, 760
- Global Climate Action** 158
- Global Climate Litigation Report: 2020 Status Review (UNEP 2020)** 172
- global commons** 156–157
- Global Energy Assessment (GEA)** 1485
- global energy intensity** 8
- Global Environment Facility (GEF)** 1471, 1484
- global innovation systems (GIS)** 1660–1661
- global mean surface air temperature (GSAT)\*** 1880, 1890
- global mean temperature** 316–318, 317
- global models** 417, 418, 750, 752, 760–762, 761, 762–763
- global multiregion input-output (GMRIO)** 239
- Global North** 251, 457, 534, 914, 1296
- Global Roadmap scheme** 769
- Global South**
- buildings sector emissions 251
  - climate change policies 1405
  - electrification 900
  - emissions embodied in trade 245
  - energy efficiency 534
  - investment and finance 1603
  - transnational networks 914, 1296
- Global Stocktake** 415, 693, 762, 762–763
- global temperature change potential (GTP)** 226–228
- global transport energy models (GTEM)** 1098–1099, 1100, 1101, 1103, 1106, 1110–1111, 1853, 1854
- global value chains** 1248, 1318–1319
- global warming\***
- economic benefit of limiting to 2°C 37
  - exceeding 1.5°C 14
  - individual contribution to limit to 1.5°C 572
  - likelihood of limiting 14–16, 18–20, 21, 21–22, 23–24
  - limiting to 2°C 6–7, 14–16, 28, 1322, 1742
  - limiting with system transformations 17–39, 18–20, 21–23, 26–27
  - projected outcomes 17–24, 18–20
  - scenarios 21–23
  - scenarios and pathways 316–318, 317, 325, 326, 327, 328, 329, 329, 330–332
- global warming levels (GWLs)** 307, 307, 1881–1882
- global warming potential (GWP)\*** 6n, 217n, 222, 226–228, 319, 1089, 1830, 1831, 1833, 1833
- governance\*** 154, 190, 1729
- accelerating mitigation and shifting development pathways 461–462, 465
  - accelerating sustainable transitions 1735–1736, 1767–1768, 1772
  - actors and agency in public process 1373–1375
  - adaptation and mitigation 468, 1404–1405
  - AFOLU sector 773, 825, 828–829, 1750
  - bioeconomy 1310–1311
  - buildings sector 956, 1015–1016
  - carbon dioxide removal (CDR) 1248, 1277–1279, 1277–1278, 1488, 1495
  - community climate action plans 1511
  - critical minerals 1116–1117
  - cross-sector social partnerships (CSSPs) 1510–1511
  - cross-sectoral 1248, 1295–1296, 1296–1297
  - demand-side measures/mitigation 521–525, 564
  - developing countries 956, 1767 and digitalisation 1654
  - economic 1501
  - enabling environments for climate finance 1586

- enabling shifting development pathways and accelerated mitigation 412
- energy system 700–701, 1504–1506, 1747
- food systems 1248, 1295–1296, 1296–1297
- framework laws 1361, 1363
- global energy governance 1504–1506
- integrated governance 1405, 1406
- international technology cooperation 1685–1688, 1689
- and just transitions 1747
- land-based mitigation 1248
- land-related impacts of mitigation options 1303–1304
- local autonomy 912
- local governments 879–880, 1370, 1510–1511
- low-emission technology in developing countries 1685
- mega-regional trade agreements 1501
- national climate strategies 1363–1365
- networks 1378–1379
- participatory governance\* 461–462, 525, 556, 564, 1304, 1406
- policy effectiveness 569
- political change 468
- political systems 1371–1372
- polycentric governance 1304
- positive feedbacks 522
- public-private partnerships (PPPs) 1509–1510
- renewable energy 1304
- solar radiation modification (SRM) 1493–1494, 1494–1495
- structural factors 1370–1373
- sub-national 1367
- sub-national actors 1378–1381
- sub-national institution building 1369–1370
- sustainability transitions 1767–1768
- sustainable development and land-use 1750
- technological change 1691, 1696
- transnational governance 914
- urban systems 879–880, 896, 898, 911–917
- see also climate governance\*; multilevel governance\*
- Gradual Strengthening (IMP-GS)** 309–313, 310–312, 334, 334, 357, 1200, 1200, 1201, 1877–1879
- characteristics 175, 331, 338
- cross-cutting implications 893
- level of ambition and scenario features 174–175, 174
- physical and transition risk 1585
- quantitative scenario selection 1879
- storyline 175, 1878
- warming levels 307, 309, 331
- grasslands** 783–785, 788–789
- grassroots innovations** 1648
- green bonds** 915–916, 1484–1485, 1550, 1579, 1598–1600, 1605, 1606
- green certificates** 1004, 1013, 1677, 1680
- Green Climate Fund (GCF)\*** 158, 169, 1471, 1484, 1487, 1503
- green economy** 177–178
- green growth** 177
- green industrialisation** 1754
- green infrastructure\*** 1403, 1404
- and active transport 908
- adaptation co-benefits 903, 903–904, 905
- co-benefits 875, 876, 877, 878
- economic co-benefits 876
- green roofs, green walls and greenways 907–908
- SDG linkages 903, 903–904
- urban trees and forests 905, 905–907
- green labelling** see standards and labelling
- Green New Deals** 474, 1408–1409
- green paradox** 1319–1320
- green public procurement** 1213, 1294, 1392, 1673
- green quantitative easing (QE)** 1586
- green stimulus packages** 1408–1409
- greenhouse gas emission metric\*** 6n, 63–64, 222, 225–226, 226–228, 319, 417, 1824, 1825, 1830, 1831
- greenhouse gas neutrality\*** 329, 1363
- greenhouse gases (GHGs)\*** 217–219, 221–238
- AFOLU emissions 753, 771, 799, 821–822
- AFOLU emissions and removals 755–766, 756, 757, 758, 759, 761, 762–763, 764, 765
- AFOLU regional emissions 806–807, 806
- AFOLU total net GHG flux 756–758, 756, 757
- atmospheric lifetime 1831
- buildings emissions 955, 957, 963–967, 963–964, 966, 1018
- climate legislation and emissions 1362, 1363, 1364
- contribution to warming 225, 226, 226–228
- COVID-19 pandemic and emissions 511–512
- current policies and emissions 219, 298
- defining 220n
- demand for GHG intensive products 513
- development pathways and emissions 452–453
- digitalisation, impact on emissions 1652–1654
- economic development and emissions 178–180, 179
- emission pathways 17, 18–20, 26–27, 298
- emissions datasets 1831–1837, 1832–1833, 1834–1836
- emissions growth rates 6, 8
- emissions inventories 221–222
- emissions modelling methods 1849
- energy sector emissions 28–29, 620, 620, 685
- FAQs 194
- food system emissions 1280–1285, 1281, 1282, 1283, 1284
- global emissions 863, 885
- buildings 955, 957, 963, 965
- regional contributions to 9, 10–11
- transport 1055–1056, 1055
- trends 153, 155, 159, 160, 228–232, 229, 230, 231, 274
- global warming potential (GWP) 1831
- historical emissions 231–232, 231
- household emissions 9, 531–532, 532
- hydropower emissions 671, 1303
- Illustrative Mitigation Pathways (IMPs) 26, 811
- industrial emissions 1163, 1165–1176, 1166, 1167, 1168, 1170, 1173, 1174, 1175
- inventories 65, 329, 750, 752, 756, 758
- land-atmospheric GHG fluxes 754, 755
- lifecycle GHG emissions 1193
- buses and passenger rail 1079–1080, 1081
- light-duty vehicles (LDVs) 1074, 1075, 1076, 1077
- long-term emissions savings 1178
- mitigation policies and emissions 1479–1481
- Nationally Determined Contributions (NDCs) 416
- net emissions 6n
- non-CO<sub>2</sub> warming contribution 349–350, 350
- per capita emissions 863, 885, 885, 1283–1285, 1284
- production-based emissions 9, 10–11
- projected emissions 14–17, 14, 15–16
- reducing energy sector emissions 28–29
- regional emissions 806–807, 806, 863, 885, 886
- contributions to global emissions 9, 10–11
- transport 1055–1056, 1055
- trends 159–162, 161, 233–236, 234–235, 236, 238
- residential energy emissions 967–968
- sectoral emissions 8
- sectoral emissions trends 236–237, 237, 238
- sectoral estimates for emission reduction potentials 1258
- short-term emissions savings 1178
- sources 755, 1831–1837, 1832–1833, 1834–1836
- territorial emissions 167, 221–238, 239, 1283–1285, 1284
- uncertainties with emissions 222–226, 229
- urban emissions 885, 885
- forecasts 890–894, 890, 891, 892
- reduction 897–899
- transport 1058–1059, 1058, 1059
- trends 881, 884–886, 887
- urbanisation and emissions 887
- US agricultural emissions 816
- well-being metrics and emissions 512–514
- see also specific gases
- grey infrastructure\*** 878
- gross domestic product (GDP)\*** 1562, 1562
- and accelerated mitigation 411
- development pathways and emissions 452
- energy sector emissions 622
- impact of mitigation 442–445, 443, 444
- impact on climate finance 1557
- in mitigation pathways 359
- projections 313, 314
- scenarios and pathways 37, 300, 308, 309
- gross domestic product (GDP)**
- decoupling and 242–244, 242, 243
- emissions trends and drivers 217, 245–246, 247, 251
- gross-fixed capital formation (GFCF)** 1562, 1563
- gross national income (GNI)** 868
- ground-based albedo modifications (GBAM)** 1489, 1490, 1492
- groundwater** 1301, 1754
- Guyana 816, 821
- GWP star (GWP\*)** 226, 227

## H

- habitat conservation** 1497
- halocarbons\*** 955, 963, 1496, 1831
- harmonisation** 1875, 1879, 1889
- hazard** 1828, 1829
- health** 513
- and air pollution 233, 368, 376–377, 1002, 1755–1756
  - climate change impacts 376
  - co-benefits model assessment 1741–1742
  - co-benefits of urban mitigation 873, 875, 898, 905, 908, 1755–1756
  - COVID-19 pandemic 925–926
  - and diet 802–803, 1279–1280, 1284–1285, 1284, 1292–1295
  - economic quantification of co-benefit 368
  - energy/fuel poverty 1001–1002
  - impacts of building mitigations 1000–1002
  - impacts of solar radiation modification (SRM) 1491–1492
  - indoor environmental quality 1001–1002
  - lack of access to clean energy 1000–1001, 1001
  - mitigation pathways and sustainable development 375–377, 376
  - policy instruments 1292–1295
  - regional differences 1284–1285, 1284
- heat demand** 650–651, 899, 1194, 1206–1207
- heat policy instruments** 1382
- heat production** 1181
- heat pumps** 257, 259, 974, 981, 995, 1181
- heating and cooling networks** 650, 898–899, 1206–1207
- heating and cooling systems** 650, 683, 974–975
- heating emissions** 513
- heavy-duty vehicles (HDVs)** 1056, 1070, 1082, 1083, 1084–1086, 1085, 1120
- hindcasting** 1870n
- historic cumulative emissions** 6–7, 9, 233, 235, 239
- Historical Index of Human Development (HIHD)** 178, 179
- holistic planning** 1769–1770
- household air pollution** 548
- see also indoor air quality
- household carbon footprint\*** 260–265, 466, 520–521, 979–981, 980, 1561, 1747
- household income** 520
- housing** 466–467, 543
- see also buildings
- human behaviour\*** 546–549
- behavioural contagion 556
  - buildings mitigation options 983
  - changing preferences 513
  - collective 513
  - habits 1766
  - interventions 506, 548–549, 549–554
  - lifestyle, energy demand and emissions 219, 260–265, 983
  - social influencers and thought leaders 506
  - social norms 555–556
  - willingness/reasons to adopt mitigation solutions 984, 985–988, 986
- see also behavioural changes
- Human Development Index (HDI)** 178n, 704, 705
- human rights\*** 1464
- human systems\*** 365, 1490, 1491
- hybrid approaches** 417
- hybrid energy storage (HES) systems** 1070
- hydro-climate** 1751–1752, 1753
- hydrochlorofluorocarbons (HCFCs)** 221, 224, 229, 1832
- hydrofluorocarbons (HFCs)** 439, 1832
- atmospheric lifetime 1831
  - emissions 221, 224, 229, 1496
  - emissions reduction policies 1390
  - global warming potential (GWP) 1831
  - ozone layer protection policies 271
- hydrogen** 91–92, 657–660, 1188
- accelerated mitigation pathways 441
  - ammonia production 1184, 1192
  - biomass-based 645
  - blue 657, 679
  - costs 1080
  - cross-sectoral mitigation 1314, 1315–1316
  - energy carriers 658, 972
  - final energy demand per fuel 970–971
  - fuel cells 656, 1070–1071, 1079, 1088
  - green 657, 679
  - hydrogen-based fuels 1184
  - in industry 1183–1184, 1184, 1189, 1190, 1192, 1200–1201, 1203
  - infrastructure 1073, 1073
  - liquid hydrogen (LH<sub>2</sub>) aviation fuel 1088–1089
  - net-zero energy systems 677–678, 679, 684
  - production 647, 656, 657–658, 657, 1184, 1315
  - costs 645, 677–678, 679
  - emissions 1076, 1080
  - technologies 679
  - reversible hydrogen fuel cells (RHFCs) 656
  - scenarios and pathways 342, 342, 1200–1201, 1203
  - storage 659–660
  - trade 684
  - transporting 658–659, 679
  - value chain 659
- hydrogen economy** 167, 679, 1184
- hydrogen fuel cell vehicles (HFCVs)** 1070–1071, 1073, 1075, 1076, 1077, 1079
- buses and passenger rail 1080, 1081, 1082
  - emissions 1075, 1076, 1081
  - freight trucks and rail 1082, 1083, 1084–1085, 1085
  - fuel cell technologies 1070–1071, 1079
  - hydrogen infrastructure 1073
  - lifecycle costs (LCCs) 1078, 1079, 1080, 1082
- hydrological cycle** 1301
- hydropower\*** 638–639, 638, 1752, 1758
- climate change impacts 665, 666–667
  - costs 639, 662
  - energy storage 628, 639
  - environmental and societal impacts 639
  - impact on climate 671
  - land occupation, impacts and risks 1303, 1304
  - levelised costs of electricity (LCOE) 639, 662
  - public support 639

- pumped hydroelectric storage (PHS) 654
- synergies and trade-offs with SDGs 1761
- trends in electricity generation 627

## I

- Iceland** 648–649, 1501
- ideas, values and beliefs** 170, 182–183, 507, 548, 661–662, 1372–1373, 1737, 1765, 1766
- IEA Sustainable Development Scenario** 1743
- Illustrative Mitigation Pathways (IMPs)** 24–25, 26–27, 77–78, 174–176, 174, 175, 298, 302–303, 303, 309–313, 310–312, 1877–1879, 1879
- AFOLU sector** 811–812, 811
- bioenergy** 811, 812
- building sector** 334, 337
- CDR deployment** 1264, 1264
- cross-cutting implications** 893, 894
- demand/supply-side mitigation** 336, 337
- development pathways and mitigative capacity** 453
- emissions** 311–312, 315
- and energy 338
  - reductions indicators 340
  - and warming 330–332
- energy systems** 312, 333–334, 333, 334, 337, 338, 617–618, 689–691, 1200–1201
- global warming levels** 309, 330–332
- industry** 334, 337, 1200–1201, 1200
- mitigation strategies** 309, 312, 332–334, 334
- net zero emissions** 334, 334
- physical and transition risk** 1584–1585, 1585
- reference pathways** see Current Policies (CurPol); Moderate Action (ModAct)
- storylines/narratives** 309, 1878, 1878
- transport sector** 334, 337, 344–345, 1109–1110, 1110–1111
- urban areas** 893, 894
- vetting criteria** 1883–1884, 1883
- see also specific IMPs
- illustrative pathways (IPs)** 175, 175, 303, 309, 310, 1585, 1585, 1877–1878, 1878, 1879
- see also Current Policies (CurPol); Illustrative Mitigation Pathways (IMPs); Moderate Action (ModAct)
- IMAGE-Lifestyle-Renewable (LiRE)** 964–965, 965–967, 968–974
- impacts\* (of climate change)** 157, 525–526, 1207
- avoided along mitigation pathways 365–367, 370, 371, 373, 374, 375, 376, 377, 378
  - avoided in long-term mitigation pathways 87–88, 365–367
  - on buildings 996–998
  - economic benefits from avoiding 87–88, 365–367, 367, 369
  - on ecosystems 826
  - on electricity system vulnerability 670
  - on energy consumption 669, 997
  - on energy supply 666–668
  - on energy systems 616, 663–670, 665, 669, 1752–1753
  - on forests 782, 783

- losses and damages 1562  
 on mitigation potential 335  
 on peatlands 785  
 on transport sector 1057, 1759  
 on urban poor 876  
 on urban systems 876, 877–878  
 on water resources 1751–1753
- implementation gap** 14, 14n, 358, 411, 412, 414, 422–423
- IN4Climate NRW** 1215–1216
- income**  
 and consumption-based emissions 520–521  
 and emissions reductions 505–506  
 emissions trends and drivers 251, 254, 260, 261–262, 262  
 and energy demand 983  
 and energy use 516–517, 516  
 inequality 264–265, 372, 514, 517, 520–521, 524, 1746–1747  
 and mitigation 661–662  
 projections 313  
 and transport choices 1059–1060  
 and urbanisation 868, 868, 887
- income-based emission (IBE)** 239
- incumbent industries** 170
- India**  
 accelerated mitigation pathways 435, 437, 438, 439, 440, 441  
 agricultural sector mitigation scenarios 799  
 ASI behaviour 548  
 carbon dioxide capture and storage (CCS) 438  
 climate governance and institutions 1366–1367  
 coal use and phase-out 625, 626  
 cooking energy/technology 559, 569  
 decoupling 244  
 Deep Decarbonisation Pathways Project (DDPP) 1740  
 development pathways and emissions 452, 453  
 diet 254  
 economic growth 247  
 electrification 705  
 emissions  
   food system emissions 803  
   household emissions 262  
   non-CO<sub>2</sub> emissions 1390  
   transport emissions 1101  
 emissions trends and drivers 247, 1481  
 energy intensity 1747  
 energy-related CO<sub>2</sub> emission pathways 434  
 energy sector 437, 439  
 energy use 517, 623  
 EV uptake 567–568  
 geologic CO<sub>2</sub> storage potential 641  
 industry 441, 1176  
 inequality 517  
 local capital markets 1606  
 low emission strategies 434  
 LPG use for cooking fuel 629  
 manufacturing PV 1747–1748  
 mining and deforestation 770  
 mitigation and adaptation financing 871  
 national development plans 452, 453  
 net zero targets 1465
- Paris Agreement 1462–1463, 1465  
 renewable energy support measures 1500  
 retirement of fossil fuel power plants 1743–1744  
 services for well-being 515  
 solar energy 630, 1505  
 standards and labelling programme 1662, 1662–1663  
 sustainable water management 1754  
 technology transfer and cooperation 1502, 1685  
 transport 440, 542, 558–559, 1060, 1101, 1103, 1104, 1117, 1766  
 urban emissions mitigation 875  
 urban land expansion 888  
 urban land use trends 884  
 wind energy 636
- indigenous knowledge\*** 526, 1016, 1697–1698
- indigenous peoples and groups** 817, 1374–1375
- indigenous resurgence** 525
- indirect drivers** 767, 773
- indirect emissions\*** 1836–1837  
 buildings sector 250, 513, 955, 957, 963, 991, 995  
 carbon dioxide (CO<sub>2</sub>) 957, 963, 1836–1837  
 electricity and heat generation 248  
 industry 1172–1174, 1173, 1174, 1175  
 transport 251, 1055–1056, 1055  
 urban and national scale 886  
 urban/rural households 263
- individual actions** 572, 1765
- Indonesia**  
 coal use and phase-out 625, 626  
 end-use technologies transitions 256  
 energy-related CO<sub>2</sub> emission pathways 434  
 fire regimes 770  
 green-city initiatives 1756  
 household emissions 260, 262  
 land management 1750  
 LPG use for cooking fuel 629  
 national development plans 451  
 net zero targets 1465  
 Paris Agreement 1465  
 peatland conversion 785  
 REDD+ 1503, 1504  
 urban emissions mitigation 875  
 zero deforestation pledges 272
- indoor air quality** 705, 875, 960, 1002
- industrial clusters** 1207, 1682–1683
- industrial parks** 1179–1180
- industrial revolution\*** 179
- industrial symbiosis** 1179–1180, 1207
- industrialised (developed\*) countries** 697, 1207, 1676, 1687–1688  
 see also Developed Countries/developed countries\*
- industry** 104–107, 1161–1224  
 abatement costs 1190, 1191, 1196, 1197–1198  
 accelerated mitigation pathways 435, 441  
 accelerating mitigation 1410  
 accelerating transition, and sustainable development 1754–1755  
 adaptation and mitigation 1758, 1771
- aluminium and other non-ferrous metals 1181, 1194–1195, 1197, 1218, 1220  
 carbon sources 1185–1186  
 CCS and CCU 1185–1186  
 cement and concrete 430, 902, 1164, 1190–1191, 1197, 1204, 1205, 1208  
 chemical 1179, 1181, 1183, 1191–1193, 1194, 1197, 1204, 1205  
 climate change and adaptation 1207  
 climate policy and carbon pricing 1164, 1209–1210, 1213–1214, 1223  
 co-benefits for SDGs 1210–1211, 1754  
 construction 901–902  
 costing analysis 1222  
 costs and potentials 38–39, 1163–1164, 1189–1196, 1197–1198, 1202, 1205, 1206, 1252, 1253, 1256, 1257, 1257, 1258, 1258, 1260  
 COVID-19 pandemic and emissions 230  
 cross-sectoral implications 1188–1189, 1206–1207, 1216, 1313  
 deep decarbonisation 1164, 1180, 1187, 1195–1196, 1197–1198, 1206, 1222–1223  
 and deforestation 768, 769–770  
 demand for electricity 1183  
 demand for materials 1176–1177, 1177  
 demand-side measures 530  
 development patterns 1175–1176  
 digitalisation 1652–1653  
 electrification 441, 677, 694, 1163, 1182–1183, 1187, 1191, 1192, 1194, 1203, 1207, 1211, 1213  
 electrification and fuel switching 1182–1184  
 emissions 8, 66, 1165–1167  
   CO<sub>2</sub> emissions 1189, 1190, 1192, 1193, 1194, 1199, 1200, 1201n, 1208  
   direct emissions 1173, 1174, 1175, 1189, 1190, 1191, 1195  
   energy sector CO<sub>2</sub> emissions 620, 620  
   food system GHG emissions 1281, 1281, 1282  
   GHG emissions trends 236–237, 237, 238  
   indirect emissions 1172–1174, 1173, 1174, 1175  
   net-zero CO<sub>2</sub> emissions 29, 1163, 1203  
   net-zero greenhouse gas emissions 29, 1166, 1167, 1184, 1196, 1754  
   non-CO<sub>2</sub> emissions 1201n  
 emissions growth 218  
 emissions-intensive and trade-exposed (EITE) 1213  
 emissions mitigation policies 1390  
 emissions sources 1165–1166, 1173, 1174, 1832  
   methane (CH<sub>4</sub>) 1832, 1833, 1834–1836  
 emissions trends and drivers 246, 248–250, 249, 902, 1163, 1165–1176, 1166, 1167, 1168, 1170, 1173, 1174, 1175, 1201, 1207–1209  
 energy use 1194, 1200–1201, 1200  
 energy use and efficiency 1171–1172  
 extraction of materials 1169, 1170  
 FAQs 1224

- feedstocks and fuels 677, 1164, 1183, 1185–1186, 1192, 1193, 1194, 1195, 1198
- final energy 345–346, 345
- forestry 1195
- hydrogen in 1183–1184, 1184, 1189, 1190, 1192, 1200–1201, 1203
- infrastructure 1207–1209, 1208, 1222
- international cooperation 1213, 1514
- international trade and supply chains 1056, 1176, 1178, 1206
- investment 1206, 1208, 1216–1217
- investment and finance 1206, 1208, 1216–1217, 1569
- iron 1197
- knowledge gaps 1223
- light industry 1164, 1194
- low-GHG materials and products 1217, 1219–1220
- manufacturing 1164, 1179, 1194, 1197
- mining 769–770
- mitigation pathways 1188, 1198–1206
- mitigation potential 530, 1189–1196
- mitigation strategies and options 1163, 1167, 1176–1187, 1188, 1199, 1204, 1205, 1209–1210, 1212, 1223, 1224
- carbon dioxide capture and storage (CCS) 1185–1186, 1187, 1189, 1190, 1191, 1193, 1195, 1211, 1213
- carbon dioxide capture and utilisation (CCU) 1185–1186, 1187, 1189, 1192, 1192, 1193, 1195–1196, 1211, 1213
- circular economy 1179–1180, 1187, 1192–1193, 1192, 1210, 1213
- electrification 1163, 1182–1183, 1187, 1191, 1192, 1194, 1211, 1213
- energy efficiency 1180–1182, 1181, 1187, 1191, 1211, 1213
- fuel switching 1182–1184, 1186, 1187, 1191, 1192, 1211, 1213
- interactions and integration 1186–1187, 1188–1189, 1206–1207
- long-term mitigation options 1260
- material demand reductions 1176–1177, 1210
- material efficiency (ME) 1168–1171, 1177–1179, 1178, 1190, 1191, 1210, 1213
- sector-specific 1189–1196, 1197–1198
- synthetic fuels 1184, 1186, 1189
- models/modelling methods 1854–1855, 1854, 1892
- net-zero energy systems 680, 683
- plastics 1163, 1179, 1186, 1192, 1194, 1204
- policies 1382
- policy approaches 1164, 1209–1210, 1211–1223, 1212, 1224
- circular economy policy 1220–1221
- extended producer responsibility (EPR) 1220
- financial incentives 1219–1220
- GHG Content Certifications 1219
- GHG prices and GHG markets 1213–1214
- knowledge and capacity 1221
- market pull policies 1217–1220
- policy coherence and integration 1221–1222
- procurement 1217–1219
- research, development, and innovation (RDI) 1216–1217
- roles of different actors 1222, 1222–1223
- standards and codes 1219
- transition planning and strategies 1214–1215
- pulp and paper 1164, 1195–1196, 1197
- regional supply chains 1175–1176
- renewable resources distribution 1164
- residual fossil fuel emissions 268–269, 268
- resource extraction 902
- roles of different actors 1188, 1222–1223
- scenario analysis 1198–1206
- scenarios and pathways 29, 345–346, 345, 1892
- sector-specific mitigation 1189–1196, 1197–1198
- service delivery efficiency 533–535, 533
- small and medium enterprises (SMEs) 1179, 1180
- societal pressure on 1207
- steel 533, 902, 1164, 1180, 1181, 1181, 1183, 1189–1190, 1197, 1204, 1204, 1205, 1208–1209
- sub-national and non-state actors/actions 427–428, 429, 430
- supply chains 1056, 1175–1176, 1178, 1206
- and sustainable development 1210–1211, 1224, 1754–1755
- synergies and trade-offs with SDGs 41–42, 1224, 1729–1730, 1754–1755, 1762, 1763, 1764, 1770, 1771
- technological developments 1163–1164, 1176–1187, 1192, 1195
- technology standards 1389
- transformation pathways 1198–1206
- transformational change 1203–1204
- transport emissions 1056
- waste and waste management 1169–1170, 1179, 1180, 1186, 1189, 1192, 1210
- working conditions 1755
- inequality\*** 43, 162, 163, 517, 517–518, 566
- carbon inequality 264
- climate change impacts 369
- development pathways and emissions 453
- digital divide 1654
- economic 1741
- and emissions 254–255, 273, 453
- energy use 1747
- gender, race and intersectionality 525–527
- global regional distribution of costs and benefits 1747–1748
- household consumption and behavioural choices 264–265
- income inequality 264–265, 372, 514, 517, 520–521, 524, 1746–1747
- inequity within countries 1561
- pathways and scenarios 372–373
- structural 1745
- technological change and governance 1696
- inertia** 351, 472, 696
- infilling** 1879–1880, 1889
- informal economy** 564–565, 870, 910
- informal sector** 925, 1694
- informal settlements** 864–865, 884
- information and communication technology (ICT)** 652, 924–925, 1062, 1652, 1760
- information initiatives** 1750–1751
- information technology (IT)** 168, 440, 1730–1731, 1735
- informative policy instruments** 1294–1295
- infrastructure\*** 919–925
- access to services 517–518
- agriculture 455
- barrier to innovation 1767
- blue infrastructure\* 875, 876, 877, 878, 902–903, 903–904, 920
- and climate change 1057
- climate governance 1405
- demand-side mitigation and transformative change 559, 560
- design and use 530
- development 768, 769
- district energy networks 981
- energy systems 693, 697
- fossil fuel infrastructure 219, 265–269, 615, 693, 697, 698, 1743–1744, 1743, 1771
- grey infrastructure\* 878
- hydrogen 1073
- industry 1207–1209, 1222
- investment 467, 559, 1392, 1605
- lock-in related to 265, 268
- policies 565–566
- provision and investment 559
- refuelling and EV charging 1071–1073
- road construction 768, 769
- stock evolution 265
- transport 768, 769, 1057, 1058–1059, 1071–1073
- urban 268, 378, 863–864, 878, 890, 1755–1756
- urban energy systems 899–901
- urban infrastructure gap 921
- waste and waste management 909–910
- see also green infrastructure\*
- innovation** 136–138, 464
- demand-side innovation 1740
- demand-side transitions 561
- disruptive innovation 1057–1058
- frugal innovations 1648
- global innovation systems (GIS) 1660–1661
- grassroots innovations 1648, 1697
- green innovations 1690
- inclusive innovation 1696
- mitigation potential 505
- model assessment 1740
- radical 561
- recombinant innovations 1651
- responsible innovation 1696
- service provisioning systems 505
- social innovation 170–171, 1647, 1688, 1690, 1696, 1766–1767
- and sustainable development 1696
- sustainable innovations 1690
- and sustainable transitions 1735

- traditional innovations 1690  
 transition phases 561–562  
 see also technological innovations; technology and innovation
- innovation policy instruments** 1644, 1647, 1670, 1671  
 demand-pull (market-pull) instruments 1650, 1669, 1670, 1675–1677  
 distributional impacts 1672, 1674, 1676, 1677, 1678, 1679–1680  
 economic and financial instruments 1670, 1672–1676, 1674–1675  
 efficiency regulations 1677–1678  
 impact on competitiveness 1672, 1673–1674, 1675–1677, 1678, 1679–1680, 1682–1683  
 impact on innovation 1672–1673, 1672, 1675–1679, 1680–1683, 1680  
 regulatory instruments 1677–1678, 1679  
 soft instruments 1678–1680  
 technology-push instruments 1650, 1669, 1670, 1672–1675  
 demonstration funding schemes 1675  
 public procurement 1669, 1672–1674, 1673  
 public R&D funding 1644, 1669, 1672, 1673, 1674–1675, 1674–1675  
 R&D incentives 1672
- innovation systems** 1644, 1645, 1660–1661, 1660, 1669, 1688, 1699
- institutional barriers and opportunities** 825
- institutional capacity\*** 825, 917, 1368, 1685  
 accelerated mitigation and shifting development pathways 412, 461–462, 465  
 adaptation and mitigation 468  
 buildings sector 956, 1016  
 and climate finance flows 1578  
 developing countries 956  
 and energy sector policy 628  
 intellectual property rights (IPR) regimes 1644–1645  
 sustainability transitions 1767–1768  
 urban planning 898
- institutional change** 681–682, 682
- institutional factors** 171–173, 186–187  
 accelerating sustainable transitions 1735–1736, 1767–1768, 1772  
 international cooperation 172–173  
 legal framework and institutions 172  
 low-carbon societal transition 153  
 policy impacts 171–172
- institutional requirements** 1383–1384, 1383
- institutional strength** 1460, 1460, 1475, 1478, 1513, 1515
- institutions\*** 46, 172, 1360–1361, 1411  
 addressing climate governance challenges 1367–1368  
 AFOLU emissions drivers 773  
 energy sector international cooperation 1505  
 financial 1582–1583, 1584  
 forms of climate institutions 1365–1367  
 international cooperation 1499  
 national 1365–1368, 1366  
 policy oversight 1221  
 role in industrial decarbonisation 1222–1223
- sub-national institution building 1369–1370  
 technology and innovation 1669, 1671  
 transformative changes 411, 412  
 urban systems and other settlements 911–917
- insulation** 439
- insurance** 1558, 1581–1582, 1594–1596
- integrated assessment\*** 153–154
- integrated assessment models (IAMs)\*** 173–174, 180–181, 385, 1844, 1857–1862  
 AFOLU CO<sub>2</sub> fluxes 761–762, 761, 762–763  
 AFOLU marginal abatement costs 807–809  
 AFOLU mitigation 346–347  
 applications 1853–1854  
 bioenergy and BECCS 801–802  
 bioenergy deployment 341  
 building sector models 1850–1851, 1850–1851  
 CDR deployment 305, 1264–1265, 1264  
 climate-related financial risk 1583  
 climate system component 1859  
 comparison with national GHG inventories 65, 299  
 cost-benefit analysis IAMs 366–367, 367  
 cost-benefit IAMs 1858, 1875  
 costs and potentials 1257–1260, 1258, 1259  
 data gaps 384  
 demand-side measures 535–538  
 energy-economy component 1858  
 energy technologies 1658, 1659  
 energy-water-land nexus approach 1859  
 feasibility 382  
 fuel and technology shifts 1108–1109, 1108  
 global IAMs 1857  
 industry sector 346, 1854–1855  
 investment and finance 1569–1570  
 land-based mitigation 774–775, 777, 801–802, 805–812  
 land system component 1855, 1858–1859  
 limitations 1861–1862  
 NDCs and SDGs 1739  
 policy analysis 1859–1861  
 process-based IAMs 1857, 1858, 1875  
 residual fossil fuel emissions 268–269, 268  
 role of carbon dioxide removal (CDR) 1267, 1268, 1273, 1274, 1275–1276  
 role of hydrogen 1315–1316  
 role of land-based mitigation 1298  
 sectoral analysis 336, 337  
 socio-technical inertia 351  
 solar radiation modification (SRM) 1491–1492  
 sustainable development impacts 1859, 1860  
 sustainable development pathways 1740–1741  
 technological change 259  
 technology assumptions 1875–1876  
 transitions 1729  
 transitions to low-carbon pathways 1742  
 transport 1098–1099, 1100, 1101, 1110–1111  
 transport demand 1103–1104  
 transport energy and carbon efficiency 1106, 1107  
 transport modal trends 1105, 1106  
 types of 1858  
 utility 304–305
- integrated production systems** 796–798
- integrated spatial planning** 864, 865, 896–899, 909, 911, 920, 921, 1304
- integrative land-use models (ILMs)** 805–806
- intellectual property rights (IPR)** 1644–1645, 1657, 1681–1682, 1687–1688, 1699
- Intended Nationally Determined Contributions (INDCs)** 415, 416, 1574
- inter-generational equity\*** 1748
- interdependence** 182–183
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)** 866
- international agreements** 158–159, 773, 1455, 1460–1463, 1482, 1496–1497, 1499–1508, 1513, 1515  
 see also Kyoto Protocol; Paris Agreement; United Nations Framework Convention on Climate Change (UNFCCC)\*
- international assessments** 1732–1734
- International Civil Aviation Organization (ICAO)** 1506
- international cooperation** 48, 132–133, 156–157, 172–173, 1451–1517  
 accelerated action pathways 356–358  
 accelerating mitigation 471, 1410  
 accelerating transition in sustainable development context 1732–1734, 1735, 1736  
 adaptation 1497–1498, 1686  
 adaptation and mitigation 1404–1405, 1497–1498  
 administrative capacity 1460  
 barriers to mitigation 1457  
 bilateral cooperation 1483, 1487, 1488  
 building blocks 1459, 1488, 1495  
 capacity building 1473–1474, 1487–1488, 1502, 1505, 1686, 1687  
 changing nature of 1513  
 civil society groups and social movements 1508–1509  
 climate change and sustainable development 1732–1734  
 climate clubs 356–358, 1453, 1458–1459, 1458, 1495, 1501, 1505  
 cooperative approaches 1470–1471  
 critical minerals 1116–1117  
 development pathways and accelerated mitigation 471  
 early warning systems 1686  
 effect of solar radiation modification (SRM) 1492  
 effectiveness 1475–1478, 1479–1481, 1513, 1514–1516, 1515  
 effectiveness assessment criteria 1459–1460, 1460, 1515  
 distributive outcomes 1460, 1460, 1477, 1515  
 economic performance 1459, 1460, 1477–1478, 1515  
 environmental outcomes 1459, 1460, 1515  
 institutional strength 1460, 1460, 1475, 1478, 1513, 1515

- transformative potential 1460, 1460, 1475, 1515
- emissions targets 1517
- energy sector 1504–1506
- equity context 1454
- evaluating 1456–1460
- equity framework 1458
  - global commons framing 1456–1457, 1458
  - political framework 1457
  - transformation framing 1457, 1458
  - transitions framing 1457–1458
- FAQs 1517
- forestry, land use and REDD+ 1503–1504, 1510
- fossil fuel phase out 1593–1594
- free-riding 1456–1457, 1458
- governance
- climate governance 1481–1482, 1482
  - multi-level, multi actor 1453, 1495–1513, 1515
  - sectoral level 1503–1508, 1514
  - of SRM and CDR 1278–1279, 1488, 1493–1494, 1494–1495
- human rights 1499
- indicators of progress 1457–1458
- industry 1213, 1514
- international assessments 1732–1734
- investment agreements 1499, 1501
- investment and finance 47–48, 1320, 1558–1559
- climate finance 1471–1472, 1482–1485, 1485
- leadership 257, 1463, 1467
- litigation 1499
- loss and damage 1498
- low-emission technologies 1683–1685
- market-based mechanisms 1475–1476, 1488
- mitigation and sustainable development 1498–1499
- multilateral environmental agreements (MEAs) 1496–1497, 1515
- Nationally Determined Contributions (NDCs) 1466–1468, 1467
- networks 1756
- non-state actors 1485–1486, 1494–1495, 1513
- policy implementation 1015
- polycymaking processes 1732–1734
- regional cooperative structures 1487
- regional policy costs 362–363
- science, technology and innovation 1485–1487, 1689, 1701
- climate technology 1689
  - research and development (R&D) 1656, 1675, 1685, 1687–1688
  - technological change and energy transition 219, 256–257, 1687–1688
  - technology development and transfer 257, 1457, 1472–1473, 1645, 1656, 1683–1689
  - technology investment 1505
- sectoral agreements and institutions 1503–1508, 1514
- shifting development pathways 459
- South-South cooperation (SSC) 1501–1502
- spillover effects and competitiveness 1318–1320
- at sub-national and city levels 1512–1513
- sustainable development 1453, 1454, 1497–1499, 1501–1502, 1732–1734, 1735, 1736
- threats to multilateral cooperation 165
- trade agreements 1499–1501
- transnational business partnerships 1511
- transnational networks and partnerships 1378–1379, 1380, 1381, 1515
- transnational non-state actors 1494–1495
- transnational public-private partnerships 1506, 1509–1512
- transport sector 529, 531, 1116–1117, 1506–1508
- triangular cooperation (TrC) 1501–1502
- UN climate change regime 1453, 1460–1463, 1471, 1486–1487
- see also* Paris Agreement
- international cooperative initiatives (ICIs)** 411, 426–430, 427–428, 912–913, 1485–1486
- International Energy Agency (IEA)** 1176, 1179, 1184, 1201, 1505
- emissions dataset 1836–1837
  - reference scenarios 1251–1252
  - scenarios 1201–1203, 1202, 1204, 1206
  - World Energy Outlook 165, 995, 1179, 1203, 1251–1252, 1741
- International Maritime Organization (IMO)** 1506
- International Renewable Energy Agency (IRENA)** 1505
- International Shipping and Aviation** 1824, 1824
- see also* aviation; shipping
- international trade**
- bioeconomy 1311
  - climate clubs and building blocks 1459
  - and consumption 520
  - emissions 166–167, 773
    - embodied in trade 217–218, 244–245, 244
    - industry emissions 1176, 1206
    - transport emissions 1056
  - food system policies 1293
  - geographical shifts 245
  - hydrogen and biomass 684–685
  - modelling methods 1846
  - net emission transfers 245
  - spillover effects and competitiveness 1318–1320
  - trade agreements 1499–1501
- internationally transferred mitigation outcomes (ITMOs)** 1470, 1478
- internet of things (IoT)\*** 440, 924–925, 979–980, 1062, 1735
- intersectionality** 525–527, 1769
- investment and finance** 47–48, 133–136, 158–159, 163, 168–169, 465–466, 1547–1610
- accelerating transition in context of sustainable development 1734–1735
  - access to finance 1321, 1549, 1550
  - adaptation and mitigation 426, 469, 1759
  - adaptation finance 915–916, 1550, 1554, 1555, 1564, 1566, 1573–1574, 1578
- alignment (with Paris Agreement) 1549, 1553–1554, 1555–1556, 1560, 1579–1580, 1586, 1610
- barriers 1574
- blended finance 1560, 1588, 1603, 1608
- bonds 1563, 1606
- gender bonds 1609
  - green bonds 915–916, 1484–1485, 1550, 1579, 1598–1600, 1605, 1606
- carbon dioxide removal (CDR) 1278
- carbon finance/pricing instruments 465–467, 1012
- climate investment trap 1569
- Climate Policy Relevant Sectors (CPRS) 1582
- climate-related financial risk 169, 1549–1550, 1555–1556, 1580–1585, 1590
- assessments 1567, 1580
  - risk pooling and insurance 1594–1596
- collective actions 1561
- for conditional NDCs 423
- COVID-19 recovery packages 164, 1550, 1557–1559, 1590–1591, 1591–1592
- credit risks 1557
- creditworthiness 915–916
- cross-border climate financing 1558, 1560
- cross-sectoral considerations 1248
- cross-sectoral implications 1320–1321
- crowdfunding 1012
- current financial flows assessment 1562–1567
- de-risking tools 1603–1605
- definitions 1552–1553, 1552, 1554, 1567–1569, 1574–1575
- disaster risk reduction finance 1554, 1566
- early-stage 1578, 1656
- effect of COVID-19 pandemic 512
- enabling environments 1586–1590, 1589
- enabling shifting development pathways and accelerated mitigation 412, 460, 462–463, 465–466, 467
- engagement of financial sector in Climate Agenda 1555–1556
- ESG (environmental, social, and governance) financial products 1550, 1600–1601
- FAQs 1610
- financial accounting standards 1391
- financial markets and regulation 1586–1587
- financing gaps 1549, 1555, 1574–1579, 1580, 1610
- financing needs 1549, 1567–1574, 1597
- food system transitions 1293
- foreign direct investment 1318
- fossil fuel-related and transition 1566–1567
- grants, loans and guarantees 1012, 1560, 1589, 1590, 1593, 1605, 1676
- green stimulus packages 1408–1409
- home bias 1577
- incentives 219
- infrastructure investments 467, 1605, 1756
- innovation and technology 219, 1216–1217, 1578, 1644, 1645, 1649, 1651, 1655, 1656, 1664–1665, 1664
- innovative financing approaches 1550, 1598–1600, 1600–1601

- insurance 1558, 1594–1596  
integrated financial solutions 1320  
international agreements 1499  
international cooperation 1482–1485, 1485, 1558–1559, 1602  
international transfers 363  
investment away from fossil fuels 1509  
investment needs 363–364, 363, 364, 1567  
investors 1602–1604  
just transitions 1549, 1603  
land-based funding 916  
local capital markets 1602–1606, 1609  
losses and damages 1579  
low-carbon investment 462  
macroeconomic factors 1550, 1556–1559, 1584, 1591–1592  
misalignment 1550, 1566–1567  
mitigation finance 1554  
in mitigation pathways 363–364, 363, 364  
mobilising capital 1602–1606  
modelling methods 1845–1847  
multilateral initiatives 1588–1589  
nature-based solutions 1607–1609  
new business models 1550, 1607–1610  
new markets and technologies 1578, 1587  
nuclear power 641  
parallel investments 1550, 1578  
Paris Agreement 158–159, 1470, 1471–1472, 1474  
pathways and scenarios 300  
policy options 1550–1551, 1567, 1602  
policy packages 1587–1588  
private sector finance 1484–1485, 1564, 1565, 1566, 1589–1590, 1597, 1602, 1603, 1608–1610, 1665  
public finances and debt 1550, 1557, 1579, 1590–1591, 1592–1593, 1597  
public pricing and taxation 1561  
public-private cooperation 1550, 1589–1590  
public-private partnerships (PPPs) 1510, 1511–1512, 1597  
public procurement 1213, 1217, 1294, 1392, 1672–1673, 1673  
public sector finance 163–164, 1550, 1565, 1588, 1589–1594, 1664, 1664, 1665  
R&D funding 1664, 1664, 1665  
REDD+, support for 1470  
regional analysis 1564, 1571–1573, 1571, 1574, 1575, 1577  
research, development, and innovation (RDI) 1216–1217  
risk 1829–1830  
scenarios and pathways 158–159, 300, 363–364, 1550, 1566–1567, 1569–1574, 1570–1571, 1576, 1583–1585, 1585, 1592–1593  
sector studies 1572–1574, 1573, 1576–1577  
service-based business models 1607  
sub-national and non-state actors/actions 429–430  
sustainability transitions 1767  
sustainable finance 1550, 1552, 1578, 1600, 1600–1601, 1767  
technical assistance/partnerships 1603, 1604–1605, 1606  
transnational cooperative action by investors 1511–1512  
transparency 1550, 1584, 1586, 1598–1599, 1600, 1606  
urban mitigation and adaptation 879–880, 912, 915–916  
venture capital (VC) 1665  
see also banks and financial institutions; climate finance\*; finance flows; *specific sectors*  
**IPCC First Assessment Report (FAR)** 1732  
**IPCC Second Assessment Report (SAR)** 1732  
**IPCC Third Assessment Report (TAR)** 1732  
**IPCC Fourth Assessment Report (AR4)** 1732  
**IPCC Fifth Assessment Report (AR5)** 156–157, 866  
AFOLU emissions 753, 754, 755, 764, 766, 771  
AFOLU mitigation measures 775, 780, 784, 789, 790, 792, 793, 794, 796, 800, 803, 804, 805, 821  
buildings 975  
changes since 153  
climate-resilient pathways 1401  
global mitigation pathways 1871  
international cooperation 1455  
investment and finance 1554  
land-use change (LUC) 768  
leakage 821  
mitigation pathways 415  
sustainable development 468, 1732  
**IPCC Sixth Assessment Report (AR6)** 157  
**IPCC Special Report on Climate Change and Cities in AR7** 867  
**IPCC Special Report on Climate Change and Land (SRCCL)** 156, 1456  
adaptation and mitigation 468  
AFOLU drivers 771  
AFOLU emissions 764, 765, 766, 771  
AFOLU mitigation measures 753–754, 755, 775, 780–782, 783, 784, 785, 786, 787, 788, 789, 790, 792, 793, 794, 795–796, 796–798, 800, 803, 804, 805, 822  
cities and human settlements 866  
food systems 1279  
governance 1750  
land use and mitigation 1297–1298  
**IPCC Special Report on Global Warming of 1.5°C (SR1.5)** 155, 156, 157, 158–159, 187, 1456, 1477  
adaptation and mitigation 468  
AFOLU mitigation measures 789, 790, 792, 800, 821, 823, 824, 825  
buildings 992  
investment and finance 1554–1555  
land use and mitigation 1297  
low energy demand scenario 508, 509  
mitigation pathways 415  
multilevel governance 912  
Nationally Determined Contributions (NDCs) 1466  
near to mid-term mitigation and development pathways 414  
sustainable development 468, 1732  
urban systems and other settlements 866  
**IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)** 787, 788, 1456  
Ireland 439–440, 1363  
irrigation 766, 793, 1753, 1758  
Italy 438, 990
- J**
- Japan  
accelerated mitigation pathways 435, 437, 438, 439, 440  
buildings 439, 440, 989, 990  
coal use and phase-out 625  
consumption-based emissions 243  
Deep Decarbonisation Pathways Project (DDPP) 1740  
eco-industrial parks 1755  
energy-related CO<sub>2</sub> emission pathways 434  
energy sector 437, 439  
green-city initiatives 1756  
household emissions 260, 262  
hydrogen transport 658  
industry 1207, 1221  
low emission strategies 433–434  
net zero energy buildings 440  
net zero targets 432  
non-CO<sub>2</sub> emissions 1390  
Paris Agreement 1462  
R&D funding 1674  
solar PV 557  
urban population 870  
voluntary agreements 1392  
see also Australia, Japan, and New Zealand  
**Joint Implementation** 1462, 1475  
**Jordan** 1317–1318  
**just transitions\*** 43, 47, 75–76, 154, 178, 189–190, 472–474, 1729  
academic literature 433  
accelerated mitigation and shifting development pathways 412, 413, 414, 415, 472–474, 474, 475  
and carbon leakage 1745  
and climate finance 1549, 1559–1562, 1604  
coal and fossil fuel phase-out 625, 1745–1749  
commissions, task forces and dialogues 159, 474, 475, 1367–1368, 1407  
employment 1560–1561  
national development plans 453  
to net zero 328–329  
organisations and movements 469, 473, 474, 474  
private investors 1603  
and stranded assets 1745–1749  
sustainability transitions 1768–1769  
transformative justice 1407  
**justice\*** 153, 1746, 1748, 1768–1769, 1771, 1772  
climate justice\* 43, 1368, 1370, 1370, 1407, 1508–1509, 1559  
distributive justice 1405, 1407, 1746, 1748

energy justice 1368, 1768  
 integrated governance 1359, 1405, 1406  
 procedural justice 1368, 1370, 1405, 1746, 1748  
 recognition justice 1370  
 stranded regions 1410  
 transformative justice 1407

## K

**Kaya identity\*** 246, 256  
 AFOLU sector 253  
 buildings sector 250  
 energy systems 248, 693  
 industry 249, 1165–1166, 1166  
 transport 252  
**Kenya** 434, 649, 1361, 1367, 1685, 1757  
**Korea** 434, 1361, 1389  
**Kuwait** 256  
**Kyoto Protocol** 13, 48, 173, 812, 813, 1460–1462, 1461, 1513  
 adaptation and mitigation 1497–1498  
 Clean Development Mechanism (CDM) 1394, 1475–1476, 1484, 1568  
 AFOLU projects 812, 813  
 and Paris Agreement 1470, 1471, 1488  
 technology transfer 1645, 1684, 1686–1687  
 effectiveness 1453, 1475–1476, 1477, 1480–1481, 1515  
 impact on emissions 269, 1453, 1475, 1480–1481  
 International Emissions Trading 1462, 1475  
 international shipping and aviation emissions 1092, 1506  
 Joint Implementation 1462, 1475  
 offset credits 1386, 1394

## L

**labelling** *see* standards and labelling  
**land and property rights** 773, 817–818, 825, 828, 916  
**land-based mitigation** 751, 753, 755, 774–805, 1275–1276  
 and adaptation 469–471, 1757–1758  
 afforestation/reforestation 780–781, 1273–1274, 1276, 1277, 1300–1302  
 agricultural emissions reduction 792–796  
 agroforestry 790–791, 791–792  
 biochar 789–790, 1273–1274, 1276, 1277, 1299, 1301–1302  
 biodiversity and ecosystems, impacts on 377–378  
 bioenergy and BECCS 799–802, 801–802  
 co-benefits and risks 775, 778, 786–787, 788–789, 790, 791, 1299–1304, 1306–1307  
 costs and potentials 1253, 1254–1255  
 demand-side measures 778, 802–805  
 farming system approaches 796–798  
 fire management 783–784  
 forest management 781–784, 782–783, 804–805, 816–818, 817, 826, 1274, 1276, 1300  
 governance 1248, 1303–1304  
 investment 1576–1577  
 Land Degradation Neutrality (LDN) and managing trade-offs 1304–1306  
 land occupation and consequences 1297–1304, 1306–1307  
 land restoration 470–471, 780–781, 786, 787–788  
 mitigation potential 774–777, 776, 778–779  
 models/modelling methods 1856  
 reducing degradation and conversion 779–781, 784–787  
 scenarios and pathways 323, 324, 346–348, 346, 347  
 soil carbon management 788–789, 1273–1274, 1276, 1277  
 synergies and trade-offs with SDGs 40–41, 41–42, 1749–1751, 1762  
**land cover change\*** 347, 766, 806–807, 807, 1274, 1301  
**land degradation\*** 769, 770, 800, 827–828  
 land-based mitigation 1299, 1300–1301, 1302  
 managing trade-offs 1302, 1304–1306, 1503–1504  
 reducing 779–781, 784–786  
 shifting development pathways to sustainability 469–471  
 use of degraded land for biomass production 1302  
**Land Degradation Neutrality (LDN)** 1302, 1304–1306, 1503–1504  
**land efficiency** 253, 254  
**land management\*** 754, 755, 1749–1750  
 agroforestry 790–791, 791–792  
 biophysical effects 766  
 forest 781–784, 782–783, 804–805, 816–818, 817, 826, 1274, 1276, 1300  
 regulatory measures 816–818  
 soil carbon management 788–789  
 sustainable 1302, 1747  
**land occupation** 1247, 1250, 1297–1299, 1321  
 afforestation/reforestation (A/R) 1300–1302  
 biomass-based systems 1299–1302  
 conversion for solar energy 632  
 hydropower 1303  
 non-land-based mitigation options 1302–1303  
 nuclear power 640, 1303  
 risks, impacts and opportunities 1299–1304  
 solar power 1302–1303  
 wind power 1302  
**land rehabilitation\*** 1300–1301, 1304–1306  
**land restoration\*** 470–471, 1276, 1300–1301, 1304–1306  
 coastal wetlands 470, 787–788, 1274, 1276  
 costs and potentials 1274  
 peatlands 786, 1274, 1276, 1750  
**land use\*** 760–761, 809, 1304, 1307–1311, 1404  
 and CDR 1262–1263  
 emissions drivers 767–771  
 global trends 772  
 marginal/abandoned/degraded land 800  
 monitoring, reporting and verification 760–761  
 projections 314, 315

regulations 816–818  
 SDG linkages 1302  
 urban 880–884, 881, 882, 883, 887  
*see also* land occupation  
**land-use change (LUC)\*** 767–771, 827, 828, 1301  
 afforestation/reforestation (A/R) 1300, 1302  
 bioenergy and BECCS 801–802, 825  
 biofuels 1066  
 biomass production 1301, 1302  
 conversion of natural ecosystems 784–787  
 Illustrative Mitigation Pathways (IMPs) 811, 812  
 land availability 825–826  
 modelling methods 1855  
**land use, land-use change and forestry (LULUCF)\*** 812  
 CO<sub>2</sub> emissions 160, 161  
 CO<sub>2</sub> fluxes 760–761, 761, 762  
 economic mitigation potential 809  
 emissions and removals 756  
 Nationally Determined Contributions (NDCs) 421  
**land-use models (LUMs)** 1855–1856, 1858–1859  
**land-use pathways** 1297–1298  
**Latin America and Caribbean** 1823, 1824  
 accelerated mitigation pathways 435, 438  
 adaptation and mitigation 1402  
 AFOLU emissions 252–253, 253, 254, 756, 756, 759, 759, 765  
 AFOLU mitigation pathways 806, 807  
 AFOLU mitigation potential 777, 778, 780, 781, 782, 787, 793, 810–811, 810  
 bioenergy 438  
 buildings emissions 250, 964, 965, 966, 968, 978  
 buildings energy demand 971, 973, 973  
 buildings mitigation potential 989, 991  
 climate change impacts on energy supply 668  
 climate-related economic losses 1594  
 climate-risk pooling and insurance 1594, 1595, 1596  
 climate-smart villages (CSV) 795  
 coal use and phase-out 697  
 consumption-based emissions (CBEs) 241, 242  
 deforestation 759  
 distributional effects of mitigation 445  
 emissions and land dynamics 806–807  
 emissions embodied in trade 244  
 emissions projections 335  
 emissions trends and drivers 233, 234–235, 236, 238, 246, 248, 249  
 energy investment needs 1571, 1571  
 energy sector emissions 248, 620, 621  
 financial flows and stocks 1562, 1563  
 forest 817  
 fossil fuel-dependent countries 1746  
 IMP for energy system transformation 689, 691  
 industry emissions 248, 249  
 land-based emissions/removals 806  
 land cover change 807  
 local capital markets 1606  
 payment for ecosystem services (PES) 815  
 per capita emissions 218  
 per capita floor area 969

- REDD+ 1402  
 services for well-being 515  
 technology transfer and cooperation 1502  
 timing of net zero emissions 324  
 transport demand 1102  
 transport emissions 252, 1053, 1055, 1056, 1100, 1101  
 urban adaptation and mitigation 1758  
 urban emissions 863, 885, 885, 886  
 urban emissions scenarios 891, 892  
 urban land expansion 863, 888, 888, 889  
 urban population and urban expansion 883, 883  
 urbanisation scenarios 888, 888, 889, 891, 892  
 voluntary offsets 814  
*see also specific countries*
- leakage\*** 166–167, 1393–1394, 1393  
 AFOLU sector 813, 820, 821  
 cross-sectoral effects 1248, 1318–1319  
 energy sector 628, 700–701, 1319–1320  
 industry sector 1164, 1176, 1214, 1221  
 and just transitions 1745  
 measures addressing 466, 1500
- leapfrogging\*** 563, 900, 921, 922, 1654, 1746
- Least Developed Countries (LDCs)**  
 adaptation and mitigation 1759  
 capacity building 1473–1474, 1687  
 climate finance 1564  
 cumulative historical emissions 9  
 energy investment needs 1572  
 energy use 516  
 finance gap 1549  
 financial flows and stocks 1562, 1563  
 GHG emissions 233, 235  
 informal settlements 884  
 local capital markets 1606  
 low-emission technology deployment 1684–1685  
 Paris Agreement 1462–1463  
 per capita GHG emissions 9  
 regulatory approaches 816  
 urbanisation 869, 871
- levelised cost of conserved carbon (LCCC)** 1827  
**levelised cost of conserved energy (LCCE)** 1827  
**levelised cost of energy/electricity (LCOE)** 12, 662–663, 662, 663, 1254, 1589, 1826–1827  
 bioenergy 662  
 EV batteries 258  
 fossil energy 662  
 geothermal energy 648, 662  
 hydropower 638, 639, 662  
 nuclear power 640, 662  
 renewable energy technologies 258  
 solar energy 168, 258, 630–632, 631, 662, 663  
 wind energy 168, 258, 636, 636, 662
- leverage points** 1410, 1411
- lifecycle assessment (LCA)\***  
 biofuels 1066  
 building materials 977  
 buildings 995  
 direct air carbon dioxide capture and storage (DACCS) 1266  
 food commodities 1282–1283, 1283, 1289  
 food processing and packaging 1290  
 light-duty vehicles (LDVs) 1074–1079, 1075, 1078  
 modelling approaches 1844  
 novel and future foods 1289  
 nuclear power 640  
 ride-hailing 542  
 solar PVs 632  
 transport 1074–1080, 1075, 1078, 1081, 1082, 1145–1146
- lifecycle costs (LCCs)**  
 buses and passenger rail 1080, 1082, 1148  
 electric vehicles (EVs) 1078, 1079, 1080, 1082, 1148–1149  
 hydrogen fuel cell vehicles (HFCVs) 1078, 1079, 1080, 1082  
 light-duty vehicles (LDVs) 1078, 1079, 1148  
 trucks and freight rail 1084–1085, 1085, 1148–1149
- lifecycle GHG emissions**  
 buses and passenger rail 1079–1080, 1081  
 chemical products 1193  
 light-duty vehicles (LDVs) 1074, 1075, 1076, 1077
- lifestyle** 219, 260–265, 983  
*see also* behavioural changes; human behaviour\*
- light-duty vehicles (LDVs)** 1069–1070, 1074–1079, 1075, 1076–1077, 1078, 1085–1086, 1106, 1108–1109
- lighting** *see* appliances and lighting
- likelihood\*** 4n, 317, 1876, 1882
- liquefied natural gas (LNG)** 623, 647, 1065, 1080, 1095, 1098
- liquefied petroleum gas (LPG)** 458, 548, 559, 569, 624, 629, 1005, 1399
- liquid air energy storage (LAES)** 655
- livelihoods\*** 824–825, 828–829, 875, 1309, 1750
- livestock production** 768, 771, 772, 792–793
- local governments** 879–880, 1370, 1510–1511
- lock-in\*** 154, 188, 189, 355–356, 696  
 buildings 697, 956  
 and climate finance 879  
 developing countries 1745  
 energy systems 615, 696, 697, 1743, 1745  
 fossil resources and phase-out 355, 697, 1743, 1745  
 industry sector 697, 1207, 1208–1209  
 institutional 189, 696, 1768  
 and path dependence 696, 697–698, 1770  
 related to infrastructure 265, 268  
 and social inertia 472, 696  
 technology deployment and diffusion 1649  
 transport 894, 1059  
 and urban land expansion 863  
 urban systems 268, 697, 879, 894–896, 895–896, 899, 911, 1059
- long-term goal compatible mitigation pathways** 77–88, 295–386  
 accelerated action 356–358, 357  
 assessment methods 302–303, 310, 383–384  
 avoided climate impacts 365–367, 367, 369, 370, 371, 373, 374, 375, 376, 377, 378  
 co-benefits, synergies and trade-offs 301, 368, 369–378, 376  
 CO<sub>2</sub> and GHG, role of 318–324, 318, 320–322, 323  
 cross-sector linkages 336–341, 337  
 economic implications 300, 358–369  
 benefits of avoided climate impacts 365–367, 367  
 co-benefits and trade-offs 368  
 costs and benefits 359, 360–363, 362, 365–367, 367  
 distributive effects 369  
 economy wide 359, 360–364  
 investments 363–364, 363, 364  
 structural change and employment 368–369  
 emissions reductions 299, 329, 337, 349–351, 350  
 emissions trajectories 318–329, 318, 320–322, 330–332  
 climate change impacts 335  
 mitigation strategies 332–334  
 net zero emissions 324, 325–329, 329  
 socio-economic drivers 313–315, 314  
 temperature categories 315–318, 315, 329, 330–332  
 enabling factors 382–383  
 FAQs 385–386  
 feasibility 378–383, 380  
 impact of COVID-19 pandemic 316  
 implications of near-term emission levels 351–356, 352, 353  
 mitigation strategies 332–334  
 model comparison/assessment 299  
 and near- to medium-term emissions reductions 349–351, 350  
 pathway types and modelling 303–313  
 peak warming 299, 351, 352, 353  
 regional 334, 335, 337, 362–363, 362  
 sectoral analysis 299, 336–348, 336  
 sustainable development 301, 369–378, 370, 371  
 temperature outcomes 315–334, 315, 317, 320–322, 323, 330–332  
 timing of mitigation action 347, 349–358, 357, 362  
 timing of net zero emissions 322, 324, 325–329, 329, 337, 339, 352, 354
- Loss and Damage\*** 1498
- losses and damages\*** 37, 1562, 1594, 1595
- low-carbon development pathways** 1740–1742
- low-carbon energy transition** 28, 255–259, 685–706, 707  
 acceptability 701–702  
 assessment and indicators 693  
 behaviour and societal integration 701–703  
 carbon capture technologies 641–643, 692–693  
 critical strategic minerals 637–638  
 cross-sector integration 616  
 definitions 619  
 economic outcomes 616, 703–704  
 encouraging mitigation action 701–702  
 energy carriers 691–692, 692  
 energy demand reduction 692

- energy system emissions 685–688, 685, 686, 687
- financial risks 1581, 1582–1583, 1584
- fossil fuels 698–700
- Illustrative Mitigation Pathways (IMPs) 259, 689–691
- industry energy use 1180, 1193
- integrated whole-system approaches 650–651
- investment 615, 693–695, 694, 695
- lock-in and path dependence 696, 697–698
- policy and governance 700–701
- primary energy and electricity production 688–689
- renewable energy penetration and fossil fuel phase-out 1742–1744, 1743, 1745–1749
- residual emissions 692–693
- resilience 669
- scenarios and pathways 259, 689–691, 1740–1741, 1742
- societal and institutional inertia 696
- speed 66, 256–259, 562–564
- strategies 688–689, 691–693
- sustainable development context 616, 698, 703–706, 1739–1742
- technology 259, 641–643, 692–693
- low carbon materials** 442, 986, 987, 1193, 1219
- low-carbon scenarios** 378–382, 1101
- low-carbon societal transition** 153, 154, 513
- behaviour change 170–171
- economic and technological drivers and constraints 153
- economic factors 153, 165–169
- institutional factors 153, 171–173
- socio-political issues 153, 169–171
- technology and innovation 167–168
- Low-Carbon Society (LCS) assessments** 1740–1741
- low-carbon technology** 153, 165, 218–219, 255
- investment 67, 1568
- policies 256
- rapid progress 67
- see also technology; technology and innovation
- low-carbon transitions** 1746–1749
- feasibility frameworks 378–379
- policies 461, 568
- socio-economic context 871
- see also transition\*
- Low Demand (IMP-LD)** 309, 310–312, 333, 333, 334, 336, 337, 824, 825, 1200, 1200, 1877–1879
- characteristics 175, 330, 338
- cross-cutting implications 893
- level of ambition and scenario features 174–175, 174
- physical and transition risk 1585
- quantitative scenario selection 1878
- storyline 175, 1878
- transport sector 1109–1110, 1110–1111
- warming levels 307, 309, 330
- low-emission development pathways** 30
- low-emission pathways** 30, 1700, 1741, 1743
- low-emission technologies** 11, 12
- enhancing uptake in developing countries 1684–1685
- innovation 46
- international cooperation 1683–1685
- technology transfer 1683–1685
- transport 32
- low-emissions development strategies (LEDS)** 431, 431–432, 433
- Low Energy Demand (LED) scenario** 375, 441, 508, 509, 535, 536, 970, 1202, 1203, 1735, 1740
- ## M
- macroeconomics** 1556–1557
- impact of COVID-19 pandemic 1557–1559, 1591–1592
- implications of technological transition 1584
- macroeconomic effects of mitigation 359, 360–364
- macroeconomic models 1729, 1740
- model frameworks 1845
- Madagascar** 1365
- mainstreaming** 177, 1370
- maladaptive actions (maladaptation)\*** 922
- Malaysia** 785, 871, 1747
- malnutrition\*** 1279–1280
- mangroves** 470, 768, 770, 786, 787, 788, 1271
- manufacturing** 1164, 1194
- manure management** 795–796
- marginal abatement cost of carbon** 359, 360, 360
- marginal abatement costs** 807–809, 1259, 1735
- marine cloud brightening (MCB)** 1489, 1490, 1491, 1492, 1493–1494
- marine ecosystems** 377
- marine energy** 627, 649, 665
- market-based policies** see economic/market-based policy instruments
- market failures\*** 1650, 1657
- market mechanisms** 1359, 1384–1386, 1475–1476, 1488
- marketing regulations** 1293
- Marrakech Partnership for Global Action** 426
- mass timber** 902
- material demand** 248–249, 1176–1177, 1177
- industry scenario analysis 1206
- lithium-ion batteries (LIBs) 1053, 1069
- photovoltaics (PV) 632
- policies 1209
- reductions, co-benefits for SDGs 1210
- urban areas 923, 923
- material efficiency (ME)** 531, 1168–1171, 1170, 1172, 1177–1179, 1178, 1188
- buildings 911, 977, 978–979
- cement and concrete 1191
- co-benefits for SDGs 1210
- policy approaches and strategies 911, 1209, 1213, 1223
- scenarios 892, 1178–1179, 1203, 1204, 1205, 1206
- steel sector 1190
- material intensity** 1163, 1165, 1169
- material recycling** 901, 1170–1171
- material substitution\*** 633, 804–805, 977, 978–979
- Mauritius** 1320–1321
- Measurement, Reporting and Verification (MRV)\*** 221–225, 239–240, 750, 1278, 1297, 1304
- media** 1358, 1377–1378
- medium-duty vehicles** 1082, 1083, 1085
- megacities\*** 542, 558–559, 869, 870, 870, 900–901, 913, 1767
- megatrends** 538–546, 558–559, 877–880, 1061–1063, 1654
- mercury emissions** 1497
- methane (CH<sub>4</sub>)\***
- accelerated mitigation pathways 441–442
- accounting methods 756
- AFOLU emissions 750, 751, 753, 764–766, 764, 765, 771, 792–793, 821, 1832, 1833, 1835–1836
- AFOLU emissions reduction 346, 346, 789
- AFOLU mitigation potential 808, 809, 810–811, 810
- AFOLU net GHG emissions 756–758, 756, 757
- AFOLU regional emissions 765–766, 806–807, 806
- air pollution 232, 233
- ammonia production 1184
- annual global emissions 223
- atmospheric lifetime 1831
- buildings emissions 955, 963
- coal, oil and gas emissions 646, 647
- coastal wetlands/ecosystems emissions 470, 788
- contribution to warming 159, 225, 226
- conversion into CO<sub>2</sub> 1833
- costs and potentials 1253, 1257, 1258, 1260
- emission metrics 227, 1830
- emissions datasets 1831, 1832–1833, 1833, 1834–1836
- emissions growth 228–229, 229
- emissions reduction policies 1390
- emissions trends 6, 7, 159, 160, 228
- emissions trends and drivers 221, 232, 233
- emissions uncertainties 222, 224–225
- energy emissions 28
- enteric emissions 253, 771, 789, 792–793, 806–807, 806
- fire emissions 783
- food system emissions 1281, 1281, 1282, 1283
- global warming potential (GWP) 1831, 1833, 1833
- hydropower emissions 1303
- Illustrative Mitigation Pathways (IMPs) 26, 811, 812
- international cooperation 1511
- manure emissions 795–796
- mitigation options for coal, oil and gas 646
- mitigation potential 751
- peatland emissions 785, 786
- production 1184, 1186
- pyrolysis 658
- residual emissions 328
- rice cultivation emissions 793

- scenarios and pathways 17, 23–24, 299, 318, 319
- sources\* and sinks\* 755, 1831, 1832–1833, 1833, 1834–1836
- timing of net zero emissions 324
- transport emissions 1065, 1146
- urban emissions 863, 885, 885, 886
- warming contribution 350
- see also biomethane
- methanol** 1184, 1186
- methanol fuel cells** 1071
- Mexico**
- accelerated mitigation pathways 440
  - climate laws 1361, 1363
  - diet 254
  - energy-related CO<sub>2</sub> emission pathways 434
  - geologic CO<sub>2</sub> storage potential 641
  - international cooperation 1501
  - net zero energy buildings 440
  - public trust 555
- Middle East** 1823, 1824
- AFOLU emissions 253, 756, 759, 765, 766
  - AFOLU mitigation pathways 806, 807, 807
  - AFOLU mitigation potential 777, 778
  - buildings emissions 250, 964, 966, 968
    - embodied emissions 978
    - reduction potential 968
  - buildings energy demand 970, 971, 972–973, 973
  - buildings mitigation potential 989, 991
  - consumption-based emissions (CBEs) 241, 242
  - emissions and land dynamics 806–807
  - emissions embodied in trade 244
  - emissions projections 335
  - emissions trends and drivers 233, 234–235, 236, 238, 246
  - energy investment needs 1571, 1571
  - energy sector emissions 248, 620, 621
  - energy systems emissions scenarios 685, 686
  - financial flows and stocks 1562, 1563
  - geologic CO<sub>2</sub> storage potential 641, 641
  - industry emissions 249
  - land-based emissions/removals 806
  - land cover change 807
  - per capita floor area 969
  - services for well-being 514, 515
  - transport demand 1101–1103, 1102
  - transport emissions 252, 1053, 1055, 1056, 1099, 1100, 1101
  - urban emissions 863, 885, 885, 886
  - urban emissions scenarios 891, 892
  - urban land expansion 863, 888, 888, 889
  - urban population and urban expansion 883, 883
  - urbanisation scenarios 888, 888, 889, 891, 892
- migration (of humans)\*** 452, 453, 773, 1303, 1559
- mining and extraction** 1169, 1170, 1755
- coal 1743
  - and deforestation 769–770
  - enhanced weathering 1267, 1268
  - rare metals for batteries 1744
  - reducing 704
- Mission Innovation** 1687–1688
- mission-oriented innovation systems (MIS)** 1661
- mitigation costs** 155, 156, 170, 359, 361–362, 444, 446, 446, 538
- long-term 616, 703–704
  - marginal 444–445
  - model assessment 1740
  - regional 362–363, 362
- mitigation finance** 1554
- mitigation measures\*** 1322
- cross-sectoral interactions and integration 1249, 1313
  - cross-sectoral perspectives 1313–1314, 1314, 1315–1316
  - novel and emerging 830
  - see also demand-side measures\*; supply-side measures\*; specific sectors
- mitigation (of climate change)\*** 153–194, 1413
- accelerating see accelerating mitigation
  - and adaptation 468–471, 1359, 1403–1405, 1403–1404
  - barriers 144, 144
  - broadening and deepening 412–413, 456–459
  - changing global context 55–58
  - climate governance 190
  - conclusions and knowledge gaps 191–192
  - in context of COVID-19 pandemic 162, 162–164
  - in context of emissions trends 159–162, 160–161
  - in context of multilateral agreements 158–159
  - in context of sustainable development 141–147, 170, 176–180
  - cross-sectoral implications 1311–1321
  - delaying 170, 506
  - drivers and constraints 165–173, 191
  - enabling conditions 144, 144, 187, 188
  - equity, fairness and inequality 170, 265
  - feasibility 144–146, 145, 146–147, 187, 188
  - framing and context 153–194
  - impacts of trade agreements 1499–1501
  - implementation and enabling conditions 125–140
    - innovation, technology development and transfer 136–140
    - international cooperation 132–133
    - investment and finance 133–136
    - policy and institutions 125–131
    - social aspects of mitigation 133
  - institutions and governance 172, 1358
  - knowledge gaps and future research 191–192
  - long-term economic benefits 87–88, 365–367, 367
  - multi-dimensional assessment 187–190
  - non-climate impacts 1312–1313, 1312
  - opportunities 164
  - overlaps, synergies and conflicts 1497–1499
  - Paris Agreement relevance to mitigation 1463–1474, 1463, 1474–1475
  - policy impacts 171–172
  - potential for net co-benefits 187
  - progress and continuing challenges 57–58
  - public support 1358–1359
  - scenarios and pathways 173–176
  - subsidies for 1386–1387
  - synergies 1400–1403
  - systemic change 1408
  - understanding mitigation response strategies 180–187
  - see also Illustrative Mitigation Pathways (IMPs); land-based mitigation; specific sectors
- mitigation options\*** 123, 124
- adaptation and mitigation 40, 42, 1307–1311
  - costs and potentials 37, 38–39, 1251–1260, 1254–1256, 1257
  - cross-sectoral perspectives 1311–1314, 1314, 1315–1316
  - feasibility assessment 1837–1838, 1837
  - with high potential 1253
  - land related impacts, risks and opportunities 1297–1304, 1304–1311
  - representation of in models/modelling methods 1849–1850, 1854–1855, 1856
  - synergies and trade-offs with SDGs 1761–1764, 1762, 1838
  - see also specific sectors
- mitigation pathways\*** 24–25, 26–27, 43, 383–384, 476
- AFOLU sector 806–807
  - cost-effective 1875
  - cumulative CO<sub>2</sub> emissions 320–322
  - established cities 921–922
  - high efficiency low demand 505
  - innovation process in 1657–1658, 1658–1659
  - national 411, 431
  - net-zero CO<sub>2</sub> emissions 320
  - new and emerging cities 922–925
  - rapidly growing cities 922
  - role of carbon dioxide removal (CDR) 1262–1263, 1264–1265, 1267, 1268, 1274, 1275–1276
  - transformative changes 411
  - using reconciled anthropogenic land CO<sub>2</sub> fluxes 762–763
- mitigation potential\*** 37, 38–39, 1247
- for 2030 per sector 1247, 1252–1260, 1254–1256, 1257
  - AFOLU sector 750–751, 752, 753, 774–777, 776, 778–779, 796, 799–800, 799, 804
  - aggregated 1256–1260, 1257
  - aviation decarbonisation 1087–1090
  - Avoid, Shift, Improve (ASI) 505
  - bioenergy 644–645
  - bioenergy and BECCS 799–800, 801
  - buildings sector 343, 955, 957, 988–996, 989, 990, 991
  - circular economy 545
  - climate change impacts on 335
  - coastal wetland preservation 787
  - coastal wetland restoration 788
  - commitments by sub-national actors 1380–1381
  - cross-sectoral 1249–1250, 1256
  - cross-sectoral implications 1313
  - demand-side measures 505, 514, 516, 528–529, 530, 532, 541, 543, 545, 1257
  - digitalisation 541

- electric vehicles (EVs) 1074, 1076  
 electrification 900, 1257  
 estimation methods 774–775  
 food system 111, 803, 804, 1247, 1279, 1291  
 fuels 1094–1095, 1096  
 global AFOLU potential 775–777, 778  
 green and blue infrastructure 905, 907–908  
 hydropower 638, 638  
 industry 345–346, 530, 1163–1164, 1189–1196  
 informal settlements 884  
 innovation 505  
 land-based mitigation 774–777, 776, 778–779  
 methane (CH<sub>4</sub>) 751  
 net zero emissions targets 1408  
 peatland conservation 785–786  
 regional 777, 778, 955, 990–992, 991  
 sectoral analysis and IAMs comparison 1257–1260, 1258, 1259  
 service provisioning systems 505  
 sharing economy 505, 543, 544  
 shifting to sustainable healthy diets 803  
 sub-national and non-state actions and policies 426–430, 427–428  
 technology 1196, 1197–1198, 1249–1250  
 transport sector 345, 530, 1087–1090, 1094–1097, 1096  
 uncertainty 780, 1253  
 of urban subnational actors 913–914  
 urban systems 884, 890, 893, 897, 899, 905, 905–907, 907–908, 910, 913–914, 920, 921  
 waste and waste management 910  
 see also economic potential\*; technical potential\*
- mitigation scenarios\*** 304  
 contributing models 1863–1864, 1866–1869  
 design choices and assumptions 1873–1876  
 feasibility 1876–1877, 1877  
 global mitigation scenarios 1871  
 types of climate change scenarios 1870–1872
- mitigation targets** 411, 415–416, 423, 430–432, 431–432
- mitigative capacity** 412, 452–453, 454, 455, 464, 468–469
- Mobility as a Service** 1062
- models/modelling methods** 1843–1862  
 accounting models 1853, 1854  
 applications 1853, 1853  
 bottom-up models 1847, 1849, 1850, 1852, 1855  
 building sector models 1848–1851, 1852, 1892  
 characteristics 1863–1864  
 climate model emulators 1856–1857, 1859, 1880  
 comparison of mitigation and removal measures 1866–1869  
 economic frameworks 359, 1845–1847  
 energy system models 1847–1848, 1892  
 evaluated GHG emissions 1865  
 exploratory models 1853  
 general equilibrium models 1844, 1845  
 geographical coverage 1844  
 hybrid models 1848, 1849  
 industry sector models 1854–1855, 1854, 1892
- land-use modelling 1855–1856, 1858–1859  
 model types and approaches 1843–1845, 1849, 1853, 1854  
 multi-model studies 1871  
 multi-regional models 1846  
 optimisation models 1843, 1853, 1854  
 partial equilibrium models 1844, 1845, 1854  
 quantifying macroeconomic effects of mitigation 359  
 recursive-dynamic models 1843–1844  
 representation of demand 1849, 1854, 1854, 1855–1856  
 representation of GHG emissions 1849  
 representation of GHG emissions reductions 1856  
 representation of mitigation options 1849–1850, 1854–1855, 1856  
 representation of SDGs 1742, 1850, 1860  
 sectoral modelling 1847–1856, 1866–1869, 1892  
 simulation models 1843, 1847, 1853  
 top-down models 1847–1848, 1849, 1854–1855  
 transport models 1851, 1853–1854, 1853, 1892
- Moderate Action (ModAct)** 309, 310–312, 313, 337, 811, 812, 1100, 1102, 1200, 1200  
 cross-cutting implications 893  
 emissions and energy characteristics 338  
 emissions and warming characteristics 331  
 level of ambition and scenario features 174, 175  
 physical and transition risk 1585, 1585  
 quantitative scenario selection 1879  
 storyline 175, 1878, 1878  
 warming levels 307, 309, 331
- monetary unit conversion** 1826
- monitoring, reporting and verification** 760–761, 826, 1406
- Montreal Protocol** 173, 271, 1459, 1496
- Morocco** 1505
- Mozambique** 1747
- multi-dimensional assessment** 187–190
- multi-level perspective (MLP)** 183, 1111, 1112, 1661
- multilateral development banks (MDBs)** 1320, 1483–1484, 1505, 1560, 1588, 1595, 1605
- multilateral environmental agreements (MEAs)** 1459–1460, 1496–1497
- multilevel governance\*** 153–154, 190, 461, 524, 1015, 1735, 1756  
 coordinating climate governance 1367  
 international cooperation 1453, 1495–1513, 1515  
 international sectoral agreements 1503–1508  
 sustainability transitions 1767–1768  
 urban mitigation 912–913, 913
- multiplier effect** 1319
- Myanmar** 770
- N**
- Namibia** 1770
- narratives\*** see storylines\*
- National Adaptation Plans (NAPs)** 1401, 1574
- national and sub-national policies and institutions** 13, 47, 269–271, 426–435, 427–428, 1355–1413  
 accelerating mitigation 414–415, 435–446, 1358, 1359, 1406–1411, 1412  
 accelerating transition 1735–1736, 1764–1770  
 actors, influence of 1373–1381, 1411  
 adaptation and mitigation 1359, 1400–1405, 1401, 1402, 1403–1404, 1406  
 barriers 1399–1400  
 buildings 1015–1016  
 capacity building 1368  
 climate finance and investment 1596–1598  
 climate laws 1360, 1361–1363, 1362  
 climate litigation 1375–1377, 1376  
 co-benefits and trade-offs 1359  
 coal phase-out 625–626  
 coordinating climate governance 1410–1411  
 coordination 1412  
 cross-sectoral and economy-wide system change 1358, 1359, 1406–1411, 1412  
 deforestation control 818–819  
 development objectives 442–446  
 development pathways and accelerated mitigation 414–415  
 economy-wide approaches 1359, 1407, 1408–1409  
 emissions targets 1363–1365, 1364, 1407–1408  
 enabling conditions 1359, 1398, 1399–1400  
 FAQs 1413  
 food systems policies and governance 1291, 1292–1296, 1296–1297  
 GHG mitigation commitments 1378–1379, 1379, 1381  
 institutions and governance 1358, 1360–1370, 1411  
 integrated climate-development action 1400–1405, 1401, 1402, 1403–1404, 1406  
 integrated policy packages for mitigation and multiple objectives 1359, 1394–1398, 1399–1400  
 international interactions 1359, 1393–1394  
 investment and finance 1321, 1561–1562  
 just transitions 474, 475, 1561–1562  
 land-use planning 1379–1380  
 low-carbon sustainable transition 1395–1397, 1409–1410  
 national development plans 451, 452, 453, 453–454, 1739  
 national low emission strategies 430–435, 431–432  
 Nationally Determined Contributions (NDCs) 1363–1365  
 net zero energy buildings 440  
 net zero targets 1363, 1407–1408  
 networks 1369, 1378–1379, 1381, 1736, 1756, 1758, 1770  
 participatory planning 1406  
 partnerships 1380, 1381, 1406, 1736, 1770  
 policy instruments and evaluation 1379–1380, 1381–1394, 1412, 1413

- policy performance and effectiveness 1380–1381, 1382–1384, 1385–1386, 1397
- polycymaking and sustainable development 1733–1734
- public procurement and investment 1392
- public support 1369, 1372–1373
- sector transitions 1398, 1399–1400
- shaping climate governance 1358, 1370–1378, 1411
- shifting development pathways 1397–1398, 1399–1400, 1409
- strategies 1360–1361, 1363–1365, 1413
- structural factors 1370–1373
- sub-national actors 1358, 1367, 1369, 1378–1381, 1405, 1413
- sub-national institution building 1369–1370
- sub-national policies 271–272, 1378–1381, 1405
- sustainable development 1397–1398, 1400–1405, 1401, 1402, 1403–1404, 1406, 1733–1734, 1735–1736, 1764–1770
- systemic responses 1408, 1410
- technology and innovation 1669, 1682–1683
- transnational networks 1378–1379, 1380, 1381
- national development plans** 451, 452, 453, 453–454, 1739
- national innovation systems (NIS)** 1660
- national transition scenarios/pathways** 1871–1872, 1891, 1891–1892
- national transport-energy models (NTEM)** 1098–1099, 1100, 1101, 1110–1111, 1853, 1854
- Nationally Determined Contributions (NDCs)** 14–15, 153, 156, 158, 165, 411, 698, 813, 1363–1365, 1453, 1464, 1474–1475, 1478, 1732–1733, 1739
- adaptation and mitigation 1402
- adaptation gap 426, 1574
- AFOLU sector 470
- conditional 411, 416, 422, 423, 1454, 1467, 1467
- current policies, NDCs and projected emissions 14–15, 14, 15–16, 70, 411, 416–423, 419–420, 421–422, 424–426
- economic impacts 170
- emissions gap 70, 411, 414, 422, 763, 1466–1467
- equity assessment frameworks 423
- evaluating 1466–1467
- fairness and ambition 423, 473, 1468
- financing 1472
- global mitigation scenarios/pathways 1871
- health co-benefits 376–377
- implementation gap 411, 414, 422–423
- implementing and achieving 422–423
- Intended Nationally Determined Contributions (INDCs) 415, 416, 1574
- internationally transferred mitigation outcomes (ITMOs), use of 1470, 1478
- investment and finance 1603–1604
- land-based mitigation 753, 755
- LULUCF contributions 424
- mitigation targets 415–416
- Moderate Action (ModAct) IMP 309, 337, 338, 893, 1200, 1200, 1585, 1585
- new and updated 421–422, 422
- Paris Agreement temperature goal 1465
- projected emissions 416–423, 419–420, 422, 424–426
- scenarios and pathways 309, 327, 349, 351, 355–356, 358
- sectoral strategies 418, 421
- trade-related measures 1500
- unconditional 416n, 422, 1467
- nature-based solutions\*** 469, 751, 774, 830, 902–903, 1309–1310, 1403
- investment and finance 1607–1609
- see also blue infrastructure\*; green infrastructure\*
- near- to mid-term mitigation and development pathways** 69–76, 409–477
- adaptation and mitigation 468–471
- assessing pathways 454–455
- assessing projected emissions 416–418
- capacity building 468–469
- costs 444–445, 446, 446, 447
- costs and potentials 1252–1260, 1254–1256, 1257
- COVID-19 pandemic 421, 472
- development objectives 442–446, 451, 452, 453, 453–454
- distributional implications 445–446, 472
- effects of NDCs and current policies 416–424, 424–426
- emissions and mitigation capacity 452–453, 454, 455
- emissions projections 418–424, 419–420, 424–426
- enabling conditions 459–464, 460
- equity and just transitions 415, 445–446, 472–474, 474, 475
- FAQs 477
- impact on economic growth 442–445, 443, 464–465
- impact on employment 445, 464–465
- implementation gap 422–423
- interaction with long-term pathways 349–358, 350, 352, 353
- and long-term temperature goals 424–426, 431, 477
- mid-century emission pathways 430–435, 434
- national development plans 451, 452, 453, 453–454, 1739
- national low emission strategies 430–435, 431
- net zero targets 430–432, 431–432, 433–435
- obstacles to accelerated mitigation 446–447, 446, 447
- policies 444, 455–459, 455, 460–463, 464–468
- policy integration 450, 457, 458, 461, 465–468
- risks and uncertainties 471–472
- scenario analysis 448–449, 448
- sectoral emissions reduction potential 427–428, 433–435
- sectoral mitigation potentials 1252–1260, 1254–1256, 1257
- SLCF reductions 439, 441–442
- socio-technological pathways 441
- structural change 452, 463–465
- sub-national and non-state plans and policies 426–430, 427–428
- systemic solutions 442
- uncertainties 429–430
- see also accelerating mitigation; shifting development pathways\*
- Nepal** 244, 434, 451, 1766
- net negative emissions**
- land/forest restoration and 1504
- net negative CO<sub>2</sub> emissions 385
- and CDR 1261, 1262–1263, 1277
- long-term goal compatible mitigation pathways 299, 349
- modelled pathways 23–24
- overshoot and 354–355
- net negative GHG emissions\* 323–324, 328, 385, 432
- and CDR 1261, 1262–1263, 1277
- timescales 1262–1263
- targets 1277
- Net Negative Emissions (IMP-Neg)** 309, 310–312, 333, 333, 334, 334, 336, 337, 825, 1200, 1200, 1201, 1877–1879
- characteristics 175, 330, 338
- cross-cutting implications 893
- level of ambition and scenario features 174–175, 174
- limiting warming to 2°C (IMP Neg-2.0) 323, 333, 618, 811, 812, 823, 1879, 1879
- physical and transition risk 1585
- quantitative scenario selection 1878, 1879
- storyline 175, 1878
- warming levels 307, 309, 330
- net-zero emissions** 86–87, 194, 1363
- net-zero CO<sub>2</sub> emissions\* 327–329, 385, 430–432, 431–432, 433–435, 441, 914–915
- energy systems 28, 671–672
- industry 29, 1163, 1203
- Paris Agreement 1465–1466
- pathways and scenarios 18–20, 23–24, 23, 25, 27
- remaining carbon budgets and temperature goals 320–322
- renewable energy penetration and fossil fuel phase-out 1742–1744, 1743
- sectoral emissions strategies 337, 339
- timescales 1262–1263
- timing of 322, 324, 337, 339, 352, 354
- transport 1109–1110
- net-zero GHG emissions\* 162, 174, 191, 325, 327–329, 430–432, 431–432, 433, 435, 441, 914–915
- buildings 31
- carbon dioxide capture and utilisation (CCU) 1186
- degree to which possible 1260
- energy systems 671–672
- hydrogen, role of 1184
- industry 29, 1166, 1167, 1184, 1196, 1754
- long-term goal compatible mitigation pathways 299, 385

- need for CDR to achieve 1247, 1261, 1262–1263, 1277, 1277–1278, 1322  
Paris Agreement 1465–1466  
pathways and scenarios 23–24  
sectoral emissions strategies 339, 340  
timescales 1262–1263  
timing of 324, 339, 340  
transport 1109–1110  
urban systems 30  
pathways 1204, 1206  
scenarios 535, 536  
sectoral and regional aspects 328–329  
targets 328–329, 430–432, 431–432, 433–435, 1359  
timing 322, 324–329, 325–329, 330–332, 337, 339, 340, 352, 354, 686, 687–688
- Net Zero Emissions by 2050 Scenario (NZE)** 964–965, 965–967, 968–974, 995, 1201, 1202, 1203
- net-zero energy (NZE) buildings** 440, 981, 982
- net-zero energy systems** 615, 617–618, 671–684, 678  
100% renewable 674, 675–676  
alternative fuels 677–678, 679  
barriers 677–678  
carbon dioxide removal (CDR) 681  
characteristics 672, 673–674  
costs 677–678, 704  
definitions 619  
difficult-to-electrify sectors 677–678, 678  
electricity emissions 674–675  
electrification of end uses 676–677  
energy efficiency and demand reduction 679–680  
fossil fuels 672–674  
governance and institutions 681–682, 682  
hydrogen 677–678, 679, 684  
Illustrative Mitigation Pathways (IMPs) 689–691  
integrated energy systems 680–681  
regional factors 682–684, 684–685  
timing of net-zero emissions 686, 687–688
- net-zero energy targets** 439–440, 440
- Netherlands**  
accelerated mitigation pathways 438  
ASI behaviour 548  
bioenergy policies 818  
buildings 994–995  
climate litigation 1376, 1376, 1377  
consumption-based emissions 243  
energy supply transitions 256  
Green Public Procurement (GPP) 1673  
services for well-being 515
- networks** 914, 1369, 1378–1379, 1381, 1512–1513, 1736, 1756, 1758, 1770
- New Zealand**  
carbon markets 813–814  
carbon trading 815  
food system emissions 803  
geothermal energy 648  
international cooperation 1501  
*see also* Australia, Japan, and New Zealand
- nexus approaches** 866, 1317, 1317–1318, 1402–1403, 1751, 1769–1770
- energy-growth nexus 512–514  
energy-water-land nexus 1859  
*see also* water-energy-food nexus
- Niger** 820
- nitrogen fertiliser** 771, 772, 789
- nitrogen oxides (NO<sub>x</sub>)** 441, 1086–1087, 1089, 1093, 1094  
air pollution 232, 233  
contribution to warming 225  
emissions trends and drivers 232, 233  
energy sector emissions 623
- nitrogen trifluoride (NF<sub>3</sub>)** 221, 224, 229, 1390, 1831
- nitrous oxide (N<sub>2</sub>O)\***  
accounting methods 756  
AFOLU emissions 750, 751, 753, 764–766, 764, 765, 771, 793–794, 795–796, 806–807, 806, 821  
AFOLU emissions reduction 346, 346  
AFOLU mitigation potential 808, 809, 810, 811  
AFOLU net GHG emissions 756–758, 756, 757  
agricultural emissions 771, 789, 794, 795–796, 821  
annual global emissions 223  
atmospheric lifetime 1831  
buildings emissions 955, 963  
coastal wetland emissions 788  
contribution to warming 225  
emission trends 7, 160, 794  
emissions datasets 1831, 1832–1833  
emissions growth 228–229, 229  
emissions reduction policies 1390  
emissions trends 160, 228  
emissions trends and drivers 221  
emissions uncertainties 222, 224  
fire emissions 783  
food system emissions 1281, 1282, 1283  
global warming potential (GWP) 1831  
Illustrative Mitigation Pathways (IMPs) 26, 811, 812  
manure emissions 795–796  
peatland emissions 785, 786  
residual emissions 328  
rice cultivation emissions 793  
scenarios and pathways 17, 24, 318, 319  
soil emissions 789, 790, 794  
sources 755, 1832–1833  
timing of net zero emissions 324
- non-Annex I countries** 1823
- non-economic loss and damage (NELD)** 1498
- non-governmental organisations (NGOs)** 186, 1508
- non-methane volatile organic compounds (NMVOC)** 225, 232–233, 232
- non-OECD countries** 245, 247, 251, 254, 1176
- non-overshoot pathways\*** 14–17, 14, 15–16, 18–19, 23–25
- Non-State Actor Zone for Climate Action (NAZCA) *later* Global Climate Action** 158
- non-state actors (NSAs)** 4, 411, 426–430, 427–428, 912–913
- North America** 1823, 1824  
accelerated mitigation pathways 435
- AFOLU emissions 253, 756, 756, 759, 765, 766  
AFOLU mitigation potential 781, 782, 784  
AFOLU removals 760  
buildings emissions 250, 250, 251, 964, 965, 966, 968  
embodied emissions 978  
reduction potential 970  
buildings energy demand 971, 973, 973, 974  
buildings mitigation potential 955, 988, 989, 989, 991  
climate change impacts on energy supply 667, 668  
coal use and phase-out 624, 626  
consumption-based emissions 243  
emissions embodied in trade 245  
emissions trends and drivers 233, 234–235, 236, 238, 246  
energy investment needs 1571  
energy sector emissions 248, 620, 621, 622  
energy system 246, 247  
fire regimes 770  
forest and forestry 767, 770, 817  
grassland conversion 784  
industry emissions 248, 249  
nuclear power 640  
per capita floor area 969  
renewable energy capacity 627  
transport 251  
transport demand 1101–1103, 1102  
transport emissions 252, 1055, 1056  
transport modal trends 1104  
trends in energy use 623  
urban land use trends 883, 884  
urban population and urban expansion 883, 883  
voluntary offsets 814  
*see also* Canada; United States of America (USA)
- North-South technology transfer and cooperation (NSTT)** 469, 1502
- Norway** 256, 270, 1373, 1501, 1503, 1766
- nuclear power** 438–439, 639–641  
costs 640, 662  
governance and institutions 681  
land occupation, impacts and risks 1303  
levelised costs of electricity (LCOE) 640, 662  
safety risks and public support 640–641  
synergies and trade-offs with SDGs 1761  
trends in electricity generation 627

## O

- ocean acidification** 1269–1270, 1271
- ocean albedo change (OAC)** 1489, 1490, 1493–1494
- ocean alkalisation/ocean alkalinity enhancement\*** 1270–1271, 1275
- ocean-based CDR methods** 1247, 1268–1273, 1272, 1275
- ocean fertilisation\*** 1269–1270, 1272, 1275, 1495
- Oceania** 767, 770, 814
- OECD countries**  
AFOLU mitigation pathways 806, 807, 807  
AFOLU mitigation potential 810–811, 810  
coal use and phase-out 624

- emissions trends and drivers 245, 247, 251, 254, 1176  
 regulatory measures 816  
 supply chains and embodied emissions 1176  
 transport modal trends 1104
- officetel (office-hotel)/officetelschool concept** 956, 960
- offset (in climate policy)\*** 813–814, 814, 914–915, 1089, 1115, 1506–1507
- oil** 647–648  
 energy sector emissions 619–620, 620  
 final energy demand per fuel 970–971  
 international agreements and cooperation 1505  
 low-carbon transition 699, 700  
 production and demand trends 622, 622
- oil companies** 1746
- One-Stop Shop (OSS) approach** 994–995, 1013
- organic carbon (OC)** 225, 232–233, 232, 1269
- organic farming\*** 796–798
- Organisation for Economic Co-operation and Development (OECD)** 1471–1472, 1565
- organisational procurement** 1294
- overshoot pathways\*** 15, 15–16, 17, 18, 307, 327, 353, 354–355, 424–426
- ozone-depleting substances (ODS)** 271, 1496
- ozone (O<sub>3</sub>)\*** 221, 271, 441–442, 1491, 1496
- P**
- Pacific Climate Warriors** 1508–1509
- Pakistan** 1741
- palm oil** 818, 1293–1294, 1295, 1750
- Papua New Guinea** 783
- Paris Agreement** 13, 48, 153, 155, 156, 158–159, 165, 167, 172–173, 1453, 1455, 1462, 1732–1733  
 1.5°C temperature goal 1745  
 accountability 1468–1469  
 agriculture and sustainable development 816  
 ambition cycle 1464, 1465, 1475, 1478  
 arguments for and against 1462–1463, 1513  
 aviation emissions 1092–1093  
 co-benefits 1477  
 compliance 1700  
 context and purpose 1464–1466  
 cooperative approaches 1470–1471  
 differences to Kyoto Protocol and UNFCCC 1461, 1462  
 distributive outcomes 1477  
 economic performance 1477–1478  
 effectiveness 1459, 1476–1478, 1515, 1516  
 engagement of financial sector in Climate Agenda 1555–1556  
 environmental effectiveness 1476–1477  
 equity, fairness and just transitions 423, 474, 1465, 1468  
 FAQs 1517  
 framing concepts for assessing 1456–1458  
 GHG mitigation targets 431, 431–432  
 global stocktake 1469, 1475  
 implementation and compliance 1474  
 institutional strength 1478, 1515
- international shipping and aviation emissions 1506
- investment and financing strategies 1471–1472, 1483, 1484, 1553
- key features 1463–1464, 1463, 1474–1475
- long-term goal 424–426
- loss and damage 1498
- means of implementation and support 1471–1474, 1481, 1482  
 capacity building 1473–1474, 1487–1488  
 finance flows 1471–1472, 1482–1485, 1485, 1487  
 market-based mechanisms 1488  
 technology development and transfer 1472–1473, 1485–1487
- meeting goals 477, 1738–1739, 1771
- mitigation and adaptation 1497–1498
- mobilising capital 1602–1606
- multi-level, multi actor governance 1495–1496
- multilevel governance 912–913
- national net zero targets 1465–1466
- Nationally Determined Contributions (NDCs) 1464, 1465, 1466–1468, 1467, 1474–1475, 1478
- negotiation context and dynamics 1455, 1462–1463
- non-state actors 1508–1509
- Paris Rulebook 1466, 1468, 1469, 1472–1473, 1474, 1478, 1487, 1506
- REDD+ 1503
- supplementary means and mechanisms of implementation 1481–1495  
 and sustainable development 1471  
 technology development and transfer 1701
- temperature goal 1453, 1454, 1464–1465, 1474, 1478, 1489–1490, 1504, 1517
- transformative potential 1477
- transparency framework 1464, 1468–1469, 1472, 1473, 1475, 1478
- transport 1115  
*see also* Nationally Determined Contributions (NDCs)
- Paris Committee on Capacity-building (PCCB)** 1687
- participatory governance\*** 461–462, 525, 556, 564, 1304, 1406
- particulate matter (PM)\*** 441, 873, 1077, 1491, 1740
- path dependence\*** 188, 350–351, 696, 697–698, 1767
- pathways\*** 17–37, 156, 174  
 accelerated action 298, 356–358, 357  
 accelerating sustainable transitions 1739–1742  
 carbon dioxide removal (CDR) in 24–25  
 climate-resilient pathways\* 1401, 1757, 1758  
 cross-sector linkages 336–341  
 following NDCs 298, 327, 349, 351, 352, 353, 355–356, 358  
 immediate action 298, 349, 353, 354, 356, 357, 358, 360–361  
 limiting to 1.5°C 298–299, 300, 324, 325, 326, 327, 328, 329, 332, 337, 349
- limiting to 2°C 236, 298–300, 324, 325, 326, 327, 328, 329, 332, 337, 349, 351
- long-term temperature pathways 424–426
- low carbon development pathways 1739–1742
- low energy and resource demand 535–538, 536–537
- national emission pathways 431, 432, 433–435, 434
- participatory 535
- reference pathways 309
- sectoral analysis 342–348
- sustainable development 178, 179
- sustainable development pathways for decarbonisation 1739–1742
- transition pathways 411, 506, 535, 1729, 1748–1749, 1770  
 distributional effects 412  
 sustainable 705, 1734  
*see also specific sectors*
- payment for ecosystem services (PES)** 815–816
- peak warming** 1874–1875
- peatlands** 785–786  
 carbon emissions 760  
 costs and potentials 1274  
 restoration 786, 1274, 1276, 1750
- perfluorocarbons (PFCs)** 221, 224, 229, 1390
- peri-urban areas\*** 263, 910, 1079
- permafrost thaw** 785
- permanence** 821
- personal carbon footprint (PCF)** 255, 452, 872
- Peru** 785
- Philippines** 262, 452, 626, 905
- plastics** 1163, 1179, 1186, 1192, 1193, 1194, 1204
- Poland** 626, 870
- policies (for climate change mitigation and adaptation)\*** 13–14, 125–131, 156, 269–271, 1358–1359, 1381–1384, 1412  
 accelerating mitigation 412–413, 444, 460, 461  
 accelerating transition 564, 1735–1736, 1764–1770  
 acceptance and support for 446, 466, 556, 1372–1373, 1384, 1389  
 adaptation and mitigation 469  
 adverse side-effects 1383–1384, 1383  
 attribution analysis 1479–1481  
 for behavioural change 565, 566–567, 566  
 behavioural instruments 1295  
 bioenergy 818  
 CDR governance and policies 1277–1279, 1277–1278  
 co-benefits 1359, 1383–1384, 1383, 1385, 1387, 1400–1403  
 for coal transition 1743, 1744  
 coherence 1221–1222, 1733, 1736, 1769  
 complementarity 507  
 comprehensive multinational evaluations 269–270  
 consumption-based emissions policy applications 239, 239–240  
 consumption-oriented instruments 1391  
 coordinated policy approaches 42, 1249  
 costs 362–363  
 coverage 13, 1382, 1382

- cross-sectoral implications 1248, 1316–1317  
cross-sectoral integration 910–911  
cross-sectoral policies 42  
current policies, NDCs and projected emissions 14–15, 14, 15–16, 411, 416–423, 419–420, 421–422, 424–426  
development 45–46, 812–815, 813  
distributional effects 445–446, 1383–1384, 1383, 1386, 1387  
drivers and politics 1670, 1671  
economic *see* economic/market-based policy instruments  
economy-wide approaches 1359, 1408–1409  
effectiveness 1382–1386, 1396–1397, 1397, 1398  
in emissions assessment models 417–418  
enabling food system transformation 1291–1295, 1291, 1296–1297  
energy systems 697  
enforcement 1016  
evaluation and assessment 1381–1394  
    economic effectiveness 1383–1384, 1383, 1385–1386  
    economic instruments 1384–1388  
    environmental effectiveness 1383–1384, 1383, 1385  
    evaluation criteria 1383–1384, 1383  
    regulatory instruments 1388–1391, 1390–1391  
    stringency 1382–1383, 1383  
failure 471  
future policy 701  
and gender equity 525–527  
GHG emission metrics 226–228  
and global emissions 155  
housing policy 466–467  
ideas, values and beliefs 1372–1373  
impacts 171–172  
    on emissions 13, 269–273  
    on GHG mitigation 1479–1481  
    on global mitigation 1380–1381  
    on national development objectives 442–446  
    on stakeholders 1015–1016  
implementation 45–46, 525, 1373–1374  
industrial decarbonisation 1211–1223  
informal sector 564–565  
informative instruments 1010, 1294–1295, 1391–1392  
innovation instruments *see* innovation policy instruments  
institutional requirements 1383–1384, 1383  
integrated *see* policy integration  
interactions 701, 1396–1397, 1396–1397  
    cross-sectoral perspectives 1316–1317, 1317–1318  
    international interactions of national policies 1393–1394  
    sectoral policy interactions 1316–1317, 1317–1318  
international policymaking process 1732–1734  
land-use planning and policy 815–818, 1379–1380  
limiting emissions of non-CO<sub>2</sub> gases 1390  
litigation 1375–1377  
low-carbon technology 256  
low-carbon urban development 913  
market-based instruments *see* economic/market-based policy instruments  
media and policy process 1377–1378  
natural ecosystems 785  
non-climate policies 271–273  
opposition to 1374, 1375  
other policy instruments 1380, 1381, 1391–1392  
packages *see* policy packages  
performance 1380–1381, 1389  
policy analysis with IAMs 1859–1861  
policy design 444, 463, 507, 569  
policy process  
    actors and agency in 1373–1375, 1378–1379  
    approaches to policymaking 1394–1395, 1395, 1398  
    structural factors and 1370–1373  
pollution abatement policies 271–272  
public policies 460, 464, 467–468  
public procurement and investment 1392  
and quality of life 509–510  
resistance to 165, 1397  
sectoral 270–273, 700, 1316–1317  
sequencing 569–570, 1397  
shifting development pathways 412, 450, 455, 455, 456–457, 458, 461, 1359, 1397–1398, 1399–1400  
short-term policies 1397  
social equity and emissions reductions 524–525  
socio-technical transitions 1359  
soft policy instruments 1670, 1671  
stakeholder engagement 1215, 1373–1375, 1378–1379  
at sub-national and city levels 1378–1381, 1512–1513  
sub-national and non-state actors 426–430, 427–428  
and sustainable development 153, 154, 372, 372, 1400–1401, 1406, 1749  
for sustainable low-carbon transition 1395–1397, 1396–1397  
synergies and trade-offs 1316–1317, 1317–1318, 1359, 1400–1403, 1401, 1404, 1406  
systemic transformations 1667–1669, 1667–1668  
for technological change 256, 1386, 1670, 1671  
technology and research and development 1387, 1392, 1394  
technology spillovers 1394  
transformative potential 1383–1384, 1383  
transition support policies 1391  
understanding mitigation response strategies 186–187  
urban mitigation strategies 900  
voluntary actions and agreements 818, 1392  
for well-being 521–524  
*see also* national and sub-national policies and institutions; *specific sectors*
- policy-action gap** 878–879  
**policy attribution** 1479–1481  
**policy classification (scenarios)** 1889, 1891  
**policy integration** 272, 1221–1222, 1248, 1359, 1394–1398, 1399–1400  
    accelerating mitigation 461, 464–468, 471, 1359, 1394  
    accelerating transition 1731, 1733, 1736, 1758, 1759, 1769  
    climate change and sustainable development 1732–1734  
    enabling conditions 412, 460, 461  
    food system transformation 1291, 1292, 1296–1297  
    frameworks 1736  
    implementation 1758, 1759  
    integrated climate-development action 1400–1405, 1401, 1402, 1403–1404, 1406  
    for mitigation and multiple objectives 1359  
    near- to mid-term mitigation and development pathways 450, 457, 458, 461, 465–468  
    for shifting development pathways 412, 461, 464–468  
    and sustainable development 1405, 1732–1734, 1736  
**policy packages** 46–47, 569–570  
    buildings sector 31, 956, 1007–1008, 1017  
    combining climate and development policies 460–461, 464–468, 471  
    economy-wide 46–47  
    innovation and low-emission technology 11  
    investment and finance 1587–1588  
    low-carbon energy transition 700–701  
    mitigation and multiple objectives 1359, 1394, 1397–1398, 1399–1400  
**political actors** 1373  
**political economy\*** 169–170, 186, 1685  
    accelerating sustainable transitions 1735–1736, 1743, 1748, 1768, 1770  
    carbon pricing 189, 467, 628, 1588  
    energy system policy mixes 701  
    fossil fuels and low carbon transition 1567, 1581  
**pollution** *see* air pollution\*  
**polycentric governance** 190, 524, 1015, 1304, 1495, 1513  
**population**  
    global trends 160  
    growth 217, 245–247, 452, 622, 773, 827  
    projections 313, 314  
    scenarios 308, 309  
**Portugal** 803, 908  
**poverty\*** 162, 163, 180, 824–825  
    climate governance 1405  
    COVID-19 pandemic 512  
    development pathways and emissions 453  
    distributional effects of mitigation 445–446  
    just transitions 474  
    pathways and scenarios 372–373  
    urban areas 876  
**power sector**  
    accelerated decarbonisation 436–439, 436–437

- COVID-19 pandemic and emissions 230–231, 230
- decommissioning fossil fuel infrastructures 267, 268–269
- emissions 16, 230–231, 230
- emissions trends and drivers 230–231
- future CO<sub>2</sub> emissions from fossil fuel infrastructure 267
- integration with industry 1206–1207
- integration with transport 1115
- land occupation, impacts and risks 1298, 1302–1303
- net negative emissions 433–434
- policy impacts 270
- thermal power plants 665, 668
- thermoelectric power generation 1752–1753
- power to fuels (PtX)** 656, 675
- primary energy\***
- accounting 1828
  - decarbonising 688–689, 688
  - fossil fuels use and phase-out 698–700
  - Illustrative Mitigation Pathways (IMPs) 333–334, 333, 334
  - scenarios and pathways 341, 342, 342
  - total primary energy supply (TPES) 622, 622, 623
  - transition indicators 693
- private procurement** 1218–1219
- production-based emissions\*** 9, 10–11, 235, 239, 240
- decoupling 242–244, 242, 243
  - electric vehicles (EVs) 1076
  - emissions embodied in trade 244–245, 244
  - internal combustion engine (ICE) vehicles 1076
  - urbanisation and 255
- Property Assessed Clean Energy (PACE)** 1012
- property rights** *see* land and property rights
- prosumers\*** 521, 900, 1014
- psychology** 185–186, 1729, 1736–1737
- public policies** 460, 464, 467–468
- public-private partnerships (PPPs)** 1510, 1511–1512, 1597
- public support/acceptance** 1358–1359
- bioenergy 646
  - carbon capture (CCU and CCS) 642–643
  - fossil fuels 648
  - geothermal energy 649
  - hydropower 639
  - low-carbon technological change 1696
  - mitigation policies 446, 466, 556, 1372–1373, 1384, 1389
  - nuclear power 640–641
  - solar energy 633
  - for sub-national climate institutions 1369
  - wind energy 637
- pulp and paper industry** 1164, 1195–1196, 1197
- pumped hydroelectric storage (PHS)** 654
- pyrolysis** 658, 1301–1302
- R**
- radiative forcing\*** 271, 377, 1872, 1874, 1880
- from aviation 1086, 1087
  - from HFCs 439
  - hydropower and albedo 1303
  - from shipping 1094
  - SLCFs uncertainties 1496
  - solar radiation modification and 1493, 1494
  - urban emissions 875
- rapid energy transitions** 218–219
- rapidly growing economies** 260, 262
- rebound effects\*** 246, 263, 531, 532, 1007
- digitalisation 538, 539–540, 540, 1645, 1760
  - sharing economy 543, 544
  - technology and innovation 1644
- recombinant innovations** 1651
- recycling** 545, 909–910
- batteries 1053, 1069, 1120, 1744
  - building materials 902
  - chemical recycling of plastics 1193
  - electrification technology 901
  - extended producer responsibility (EPR) 1220
  - industrial sector 1170–1171, 1179, 1193
  - material recycling 901, 1170–1171
  - photovoltaic (PV) modules 632–633
  - wastewater 876
  - see also* circular economy\*
- REDD+ (Reducing Emissions from Deforestation and Forest Degradation)\*** 812–813, 815–816, 1404
- biodiversity and ecosystem co-benefits 1497
  - co-benefits and trade-offs 1402, 1402, 1497
  - international cooperation 1503–1504
  - investment and finance 1608
  - Nationally Determined Contributions (NDCs) 421
  - Paris Agreement 1469–1470, 1503
  - public-private partnerships (PPPs) 1510
- redox flow batteries (RFBs)** 656
- 'Reduce, Reuse, and Recycle'** 1181–1182
- reduced complexity climate modelling** 316, 317, 1856–1857, 1859
- Reducing Emissions from Deforestation and Forest Degradation** *see* REDD+
- reference scenarios\*** *see* baseline/reference scenarios\*
- Reference Technology Scenario (RTS)** 1201, 1202
- reforestation\*** 323, 780–781, 826
- see also* afforestation/reforestation (A/R)
- Reforming Economies of Eastern Europe and the Former Soviet Union (REF)** 806, 807, 807, 810, 811
- refrigeration** 1280–1281, 1290, 1662–1663
- regenerative agriculture\*** 798
- regional innovation systems (RIS)** 1660
- regreening** 816, 820
- regulatory analysis** 1391
- regulatory carbon markets** 814–815
- regulatory policy instruments** 46, 1008–1010, 1293–1294, 1359, 1379, 1381, 1388–1391, 1390, 1670, 1671
- accelerated action pathways 358
  - energy audits 1009–1010
  - energy policy in developing countries 628
  - fuel efficiency 1677–1678
  - land use regulatory approaches 816–818
  - see also* standards and labelling
- relative decoupling** 242, 243, 243, 247, 452, 512–513, 923
- religion** 557
- remote sensing** 760–761, 826
- renewable energy (RE)\*** 167, 168
- 100% renewable energy systems 332–333, 616, 674, 675–676, 707
  - accelerated mitigation pathways 436, 436–437
  - adaptation and mitigation 1401
  - buildings on-site energy generation 981, 982, 987, 1013–1014
  - climate finance 1564
  - climate governance and institutions 1367
  - co-benefits and side-effects 1743
  - cost reductions 258, 1589
  - costs 165, 168
  - critical minerals 1116, 1116–1117
  - cross-sectoral implications 1317–1318
  - decentralised 1766, 1767
  - district energy networks 981
  - eco-industrial parks 1180
  - for electrification of urban energy systems 873, 875
  - energy system models 1847
  - feed-in tariffs 1013–1014, 1387, 1388, 1587, 1676, 1736
  - and fossil fuel phase-out 1742–1744, 1743, 1745, 1771
  - governance 1304
  - household consumption and behavioural choices 263
  - impact of climate change 1752–1753
  - impact on climate 670–671
  - international cooperation 1500, 1505, 1506, 1510
  - investment and finance 1013–1014, 1505–1506, 1589, 1656
  - investment gap 1576
  - land occupation 1298–1299, 1302–1303, 1304
  - levelised cost of energy (LCOE) 1589
  - novel technologies 1766
  - penetration 675, 676, 1742–1744, 1743, 1745, 1771
  - policies 1387, 1388, 1389, 1682, 1683, 1767
  - policy impacts 171
  - policy implementation 1015
  - policy sequencing and packaging 569
  - production and demand trends 622, 622
  - regulatory instruments 1387, 1388, 1389
  - replacing coal 624
  - rural areas 1769
  - scenarios and pathways 341
  - solar PV 557
  - subsidies 628, 629, 1387
  - technology 623
    - conversion technologies 1752
    - improvement 257, 258, 259
    - international cooperation 1684
    - investment and finance 1568, 1664, 1665, 1665–1666
    - systemic failures 1661, 1662
  - technology and costs 623

- unit costs and adoption 11, 12, 89  
urban systems 899–900  
*see also specific types*
- renewable energy sources (RES)** 981, 987, 1013–1014
- Renewable Portfolio Standards (RPS)** 1013–1014, 1388, 1389, 1677
- renewable resources geographical distribution** 1164, 1184
- Renewables (IMP-Ren)** 309, 310–312, 333, 333, 334, 337, 811, 812, 824, 825, 1200, 1200, 1877–1879
- characteristics 175, 330, 338  
cross-cutting implications 893  
level of ambition and scenario features 174–175, 174  
limiting warming to 2°C (IMP Ren-2.0) 323, 333, 617, 1879, 1879  
physical and transition risk 1585  
quantitative scenario selection 1879  
storyline 175, 1878  
transport sector 1109–1110, 1110–1111  
warming levels 307, 309, 330
- Representative Concentration Pathways (RCPs)\*** 305, 317, 891, 892, 893–894, 1872, 1873, 1874
- research and development (R&D)** 464, 1216–1217, 1472, 1648–1649, 1648, 1650–1651  
AFOLU sector 773, 1684  
block funding 1674  
carbon dioxide removal (CDR) 1277, 1277–1278, 1278  
direct air carbon dioxide capture and storage (DACCS) 1266  
energy sector 700, 1664–1665, 1664, 1672, 1674–1675, 1675  
innovation indicators 1664–1665, 1664, 1665–1666  
international cooperation 1656, 1675, 1684, 1685, 1687–1688, 1689  
policies 700, 1392, 1394  
private funding 1665, 1672  
public funding 1392, 1644, 1664, 1669, 1672, 1673, 1674–1675, 1674–1675  
research subsidies 1387  
solar radiation modification (SRM) 1493–1494  
tax credits and incentives 1672
- research, development and demonstration (RD&D)** 1222–1223, 1664  
CDR methods 1277–1278  
energy-related investment 1664–1665  
impact of public investments 1672, 1675  
international cooperation 1685, 1687–1688, 1689
- research, development, and innovation (RDI)** 1216–1217
- resilience\*** 1400, 1474, 1729, 1757  
buildings sector 997  
ecosystems 1504  
energy systems 652, 653–654, 669  
investment and finance 1578–1579  
national development plans 451  
urban systems and other settlements 877–879, 880
- resource cascade\*** 527, 533–534, 533
- resource processing systems** 533–535, 533
- response capacities** 1729, 1730
- reversible hydrogen fuel cells (RHFCs)** 656
- rice cultivation** 771, 789, 793, 806, 1698
- risk\*** 1828–1830  
carbon dioxide removal (CDR) 1266–1267, 1268, 1269, 1270–1271, 1274, 1275–1276  
climate change 42, 169, 180–181, 547  
climate-related financial risk 169, 1549–1550, 1555–1556, 1580–1585, 1590  
assessments 1567, 1580  
risk pooling and insurance 1594–1596  
perception of 547  
shifting development pathways and accelerating mitigation 471–472  
socio-economic risks of mitigation land occupation 1299–1304  
solar radiation modification (SRM) 1489, 1490–1493, 1494–1495
- risk assessment\*** 157, 1580, 1581–1583
- risk management\*** 157, 1595, 1596, 1829
- road construction** 768, 769
- road transport** *see* transport
- rural communities/households** 795, 1001, 1003–1004, 1654
- Russia**  
accelerated mitigation pathways 437  
AFOLU mitigation potential 781  
energy-related CO<sub>2</sub> emission pathways 434  
energy sector 437, 1320  
forest and forestry 767, 782  
non-CO<sub>2</sub> emissions 1390  
Paris Agreement 1462  
stranded assets 355
- Rwanda** 1113, 1697
- S**
- Saudi Arabia** 434, 443, 658
- savannas** 770, 780, 783–785
- scenarios\*** 173–174, 175, 175, 303–304, 995, 1739–1742, 1870–1892  
100% renewable 332–333  
aviation 1090–1092, 1091, 1092  
connecting with WGI and WGII assessments 1879–1882  
data gaps 383–384  
databases 305–309  
*see also* AR6 scenario database  
deep decarbonisation 1740  
demand for services 508, 509  
design choices and assumptions 1873–1876  
determining costs and potentials 1251–1252, 1252  
development pathways 448–449, 448  
emissions *see* emissions scenarios\*  
energy investment 693–695, 694, 695  
energy scenarios 1741, 1743–1744  
feasibility 145, 147, 378–382, 380, 381, 1876–1877, 1877  
following NDCs 351, 352, 353, 354  
future urban GHG emissions 863, 890–894, 890, 891, 892, 926  
future urbanisation 887–890, 888, 889  
global mitigation scenarios 1871, 1883–1889, 1883, 1884–1888, 1890, 1891  
global warming levels 21–23  
harmonisation 1879, 1889  
high-end emissions 317, 323, 385  
immediate action 351, 352, 353, 354  
industry 1188, 1198–1206  
infilling 1879–1880, 1889  
International Energy Agency (IEA) scenarios 964–965, 965–967, 968–974, 1101, 1201–1203, 1202, 1204, 1206, 1251–1252, 1252, 1741  
limiting to 1.5°C 32, 330, 332, 431, 433–435, 1742  
timing of net zero emissions 324, 325–327, 328, 329  
limiting to 2°C 330–331, 332, 1247, 1258, 1261, 1875  
timing of net zero emissions 324, 325–327, 328, 329  
long-term mitigation 535, 536–537  
low carbon scenarios 378–382, 1101  
low demand scenarios 535–538, 536–537  
Low Energy Demand (LED) 375, 441, 508, 509, 535, 536, 970, 1202, 1203, 1735, 1740  
Resource Efficiency and Climate Change-Low Energy Demand (RECC-LED) 964–965, 965–967, 968–974  
material efficiency (ME) in 892, 1178–1179, 1203, 1204, 1205, 1206  
mid-century emission pathways 433–435, 434  
mitigation scenarios 304  
model limitations 538  
national transition 1871–1872, 1891, 1891–1892  
no-climate-policy reference scenarios 303–304  
policy assumptions 1875  
policy categories 307, 309  
policy scenarios 1099, 1101  
projected emissions assessment 417  
purpose of scenarios 1870  
reduction rates 236, 236  
reference scenarios *see* baseline/reference scenarios\*  
regional 1891, 1891–1892  
scenario frameworks 1872–1873  
sector transition 1872, 1892, 1892  
service provisioning 570  
service transition 1872  
shipping 1097–1098, 1098  
socio-economic drivers of emissions 313–315, 314  
SRM deployment 1489–1490, 1492  
SSP-RCP urban emissions 891, 892, 893–894  
storylines 175, 309, 1658, 1873, 1875, 1878, 1878  
sustainable development 1740–1741  
technology focused sector-based 1188, 1198–1199, 1201–1206

- temperature classification 306–307, 307, 310  
 temperature outcomes 1886, 1886–1887, 1889, 1890  
 temperature overshoot 305  
 top-down-oriented 1188, 1198–1201  
 types of climate change scenarios 1870–1872  
 uncertainty 1876  
*see also* AR6 scenario database; Illustrative Mitigation Pathways (IMPs); *specific scenarios*; *specific sectors*
- science-based targets (SBTs)** 1218
- seagrass** 786, 787, 788, 1271
- sectoral assessment** 37, 774–775, 1247, 1252–1256, 1254–1256  
 comparison with IAMs 1256–1260  
 emission pathways until 2050 1260, 1260  
 uncertainties 1253
- sectoral innovation systems (SIS)** 1660
- sectoral transitions** 1398, 1399–1400  
 scenarios/pathways 1872, 1892, 1892  
 shifting development pathways 458
- sequestration\*** 167, 823, 1403–1404  
 AFOLU sector 1749  
 biomass production 1300–1301  
 blue carbon 787, 788, 1271  
 coastal wetlands 788  
 cropland soils 794  
 forest 781, 1301  
 grasslands 784–785  
 land-based mitigation 788–791, 791–792, 1274  
 soil carbon sequestration (SCS)\* 788–789, 794, 1273–1274, 1276, 1277  
 through CDR methods 168, 1264, 1265, 1268, 1269, 1270, 1271, 1273, 1274, 1300–1301  
 urban green and blue infrastructure 864, 905, 905–907
- sequestration potential\*** 647, 785, 789, 1268, 1276
- SER (Sufficiency, Efficiency, Renewables) framework** 955, 956, 957–959, 967–970, 968, 1849–1850
- service delivery systems** 533–535, 533
- service provisioning\*** 514–516, 515, 527–535, 528  
 digitalisation 539–541, 539  
 effect of COVID-19 pandemic 511–512  
 low energy demand 520  
 mitigation potential 505
- service transition scenarios** 1872
- services\*** 166  
 access to 514, 515, 516–517, 517–518  
 mobility services 509, 514, 567  
 scenario modelling 570  
 for well-being 514–516, 515, 519
- shadow cost of carbon** 1391
- Shared Socio-economic Pathways (SSPs)\*** 78, 298, 305, 454, 1873, 1874  
 aviation emissions scenarios 1090–1092, 1091, 1092  
 baseline scenario 1861  
 development pathways and mitigative capacity 453  
 harmonisation 1875
- land-based mitigation 806  
 socio-economic drivers of emissions 313–315, 314  
 urbanisation and GHG emissions 887–890, 888, 889, 891, 892, 893–894
- sharing economy\*** 538, 539, 541–543, 544, 558–559, 924, 1760, 1761  
 accelerated mitigation pathways 440  
 IT and internet of things (IoT) 440  
 mitigation potential 505, 543, 544  
 shared mobility 263–264, 271, 541–543, 558–559, 1061, 1103  
 transport 1061
- shifting development pathways\*** 72–73, 411, 414, 447, 448–459, 449, 456–459, 476, 477, 1409  
 and accelerating mitigation 414–415, 459–468, 471–472  
 adaptation and mitigation 468–471  
 development priorities 451–454  
 enabling conditions 74, 412, 447, 458–459, 459–464, 460  
 non-marginal shifts 453–454  
 policies 74, 455, 455, 456–457, 458, 460, 461, 464–468, 471  
 policy packages 1359, 1394, 1397–1398, 1399–1400  
 risks and uncertainties 471–472  
 socio-technical shifts 455  
 to sustainability\* 43, 45, 46, 412–413, 414, 453–459, 456–459, 468, 469–471, 1739–1740  
 city infrastructure and transport 1755–1756  
 enabling conditions 460  
 and SDGs 449–450, 449, 451  
 technological change 1735  
 transition dynamics 1694
- Shifting Pathways (IMP-SP)** 309, 310–312, 333, 333, 334, 336, 337, 370, 371, 811, 812, 825, 1200, 1200, 1877–1879  
 characteristics 175, 330, 338  
 cross-cutting implications 893  
 level of ambition and scenario features 174–175, 174  
 physical and transition risk 1585  
 quantitative scenario selection 1879  
 storyline 175, 1878  
 transport sector 1109–1110, 1111  
 warming levels 307, 309, 330
- shipping** 251, 1052, 1053, 1056, 1065, 1068, 1070, 1093–1098, 1105, 1120  
 alternative fuels 1118–1119  
 Arctic 1506  
 emissions 1093–1094, 1093, 1506, 1507  
 emissions trends and drivers 237, 251  
 energy efficiency 1507  
 energy sector CO<sub>2</sub> emissions 620, 620  
 fuel 1113  
 governance 1097, 1115, 1115–1116  
 international cooperation 1506, 1507–1508
- short-lived climate forcers (SLCFs)\***  
 accelerated mitigation pathways 439, 441–442  
 AFOLU emissions 766
- and aviation 1086–1087, 1089  
 contribution to warming 225, 232, 349–350, 350  
 efficient cooling and refrigeration 439  
 emission metrics 226, 227  
 emissions scenarios and pathways 319  
 emissions trends and drivers 232–233  
 emissions uncertainties 225  
 international cooperation 1496  
 targets 441–442
- Siberia** 770
- Singapore** 1390
- sinks\*** 8n  
 AFOLU sector 755, 760, 761, 762–763  
 anthropogenic 755, 762–763  
 capacity 760  
 effect of solar radiation modification (SRM) 1492  
 enhancement through restoration 1504  
 forestry sector 1504  
 natural land sink 757, 758, 760, 826  
 Paris Agreement 1469–1470
- small and medium-sized enterprises (SMEs)** 1179, 1180, 1569
- Small Island Developing States (SIDS)\***  
 adaptation and mitigation 1401, 1686  
 agroecology 1697–1698  
 capacity building 1473–1474, 1686, 1687  
 cumulative historical emissions 9  
 early warning systems 1686  
 GHG emissions 233, 235  
 local capital markets 1606  
 loss and damage 1498  
 Paris Agreement 1462–1463  
 per capita GHG emissions 9
- smart charging strategies** 1072–1073
- smart energy systems** 899, 900, 1182, 1760, 1761
- smart grids\*** 660, 900
- smart mobility** 1062–1063, 1062, 1653
- smart packaging** 1290
- smart technology** 565–566, 1062, 1062
- social aspects of mitigation** *see* demand, services\*, and social aspects of mitigation
- social contagions** 1737
- social cost of carbon (SCC)\*** 157, 365, 455
- social costs\* and benefits** 661–662
- social discount rate** 1846–1847
- social-ecological system\*** 1737–1738, 1757
- social inclusion\*** 1729
- social influence/influencers** 506, 547, 702
- social innovation** 170–171, 1647, 1766–1767
- social movements** 463, 556–557, 1508–1509, 1765  
 climate activism 525, 1375  
 climate populism 524  
 collective action 506  
 divestment movement 1744–1745  
 influence on climate policy 1374–1375  
 just transitions 473, 474  
 youth movements 506, 525, 557, 1375, 1508–1509, 1765
- social networks** 1765
- social norms** 263–264, 463, 506, 555–556

- social tipping interventions (STI)** 1411
- socio-economic barriers and opportunities** 824–825
- socio-economic equity** 521–525, 525–527
- socio-economic impacts indicators** 1856
- socio-political issues and mitigation approaches** 153, 166, 169–171, 186–187
- socio-technical transitions\*** 447, 558–559, 560–564, 1691–1693, 1738, 1754, 1766
- feasibility 382
- policy packages 1359, 1395–1397, 1395
- socio-technical systems 183–185
- synergies and trade-offs 1696
- soft costs** 1577–1578
- soft technologies** 1647
- soil**
- biochar application 789–790, 1301–1302
- carbon stocks 347
- conservation 820–821
- crop nutrient management 794
- emissions 789, 790, 794, 806
- enhanced weathering 1267–1268
- erosion 1299
- soil carbon sequestration (SCS)\*** 788–789, 1273–1274, 1276, 1277
- soil organic carbon\*** 828
- soil organic matter\*** 789, 1274, 1299
- solar energy\*** 11, 12, 630–633, 631, 634, 1752
- adoption and barriers 633
- buildings on-site energy generation 981
- capacity and generation 615, 627, 627
- climate change impacts 665, 667–668, 997
- concentrating solar power (CSP) 12, 258, 627, 630–632, 631, 633, 634, 1302–1303
- costs and potential 630–632, 631
- direct solar heating 439, 630, 1182, 1194
- electricity prices 615
- environmental impacts 632
- impact on climate 670
- international cooperation 1505
- land occupation, impacts and risks 1298, 1302–1303
- levelised costs of electricity (LCOE) 630–632, 631, 662, 663
- low-carbon energy transition 689
- net-zero energy systems 674
- off-grid solar 1697
- public support 633
- and regional inequalities 1747–1748
- solar photovoltaics (PV) 627, 630–633, 631, 1299
- adoption 557, 569
- alternative PV materials 633
- costs 165, 168, 258, 1667–1668
- critical strategic minerals 637–638
- land occupation, impacts and risks 1298, 1302–1303
- technology improvement 257, 259
- solar thermal 439, 633, 970–971, 971, 1299
- synergies and trade-offs with SDGs 1697, 1761
- trends 627, 627
- solar radiation modification (SRM)\*** 168, 340, 1488–1495, 1489–1494, 1514
- source\*** 755, 1831–1837, 1832–1833, 1834–1836
- South Africa**
- accelerated mitigation pathways 436, 437, 440
- buildings 440
- carbon pricing policies 1385
- climate change impacts on energy supply 668
- climate governance and institutions 1366, 1367, 1370
- coal use and phase-out 626, 1746, 1748
- cooking energy/technology 559
- decoupling 244
- Deep Decarbonisation Pathways Project (DDPP) 1740
- diet 254
- Durban local government and climate change 1370
- energy regulatory policy 1389
- energy-related CO<sub>2</sub> emission pathways 434
- energy sector 436, 437
- energy use 517
- green industrialisation 1754
- household emissions 262
- inequality 517
- low emission strategies 433
- monitoring and evaluation system 1368
- national development plans 453–454
- Paris Agreement 1462–1463
- vulnerability 1754
- water availability and management 1741, 1754
- South America**
- AFOLU mitigation potential 780, 783
- climate change impacts on energy supply 667, 668
- electromobility 1113
- fire regimes 770
- forest and forestry 767, 770
- road building and deforestation 769
- see also Latin America and Caribbean
- South and Central America** 641, 1101–1103, 1481
- South-East Asia and Pacific** 1823, 1824
- accelerated mitigation pathways 435
- AFOLU emissions 252–253, 253, 254, 756, 759, 759, 765, 766
- AFOLU mitigation potential 780, 787
- buildings emissions 250, 964, 966, 968
- embodied emissions 978
- reduction potential 968
- buildings energy demand 970, 971, 973, 973
- buildings mitigation potential 989, 991
- climate-smart villages (CSV) 795
- coal use and phase-out 626
- electromobility 1113
- emissions trends and drivers 233, 234–235, 236, 238, 246, 1481
- energy investment needs 1571
- energy sector emissions 248, 620, 621, 622
- energy system 247
- industry emissions 249
- infrastructure development 769
- per capita floor area 969
- transport 251
- transport emissions 252, 1055, 1056
- urban land use trends 884
- urban population and urban expansion 883, 883
- South Korea**
- accelerated mitigation pathways 439
- air pollution reduction health benefits 377
- buildings 1015
- coal use and phase-out 625
- eco-industrial parks 1180, 1755
- energy sector 439
- energy transition 1768
- net zero targets 432
- officetel* (office-hotel)/*officetelschool* concept 956, 960
- urban green infrastructure 905
- urban population 870
- South-North technology transfer and cooperation (SNTT)** 257, 1502
- South-South technology transfer and cooperation (SSTT)** 257, 1487, 1501–1502, 1685
- South-South trade** 245, 257
- Southern Asia** 254, 1823, 1824
- AFOLU emissions 253, 756, 759, 765, 765, 766
- buildings emissions 250, 250, 964, 966, 968
- embodied emissions 978
- reduction potential 968, 970
- buildings energy demand 971, 973, 973, 974
- buildings mitigation potential 989, 991
- climate-smart villages (CSV) 795
- cooking energy/technology 548
- emissions trends and drivers 233, 234–235, 236, 238, 246, 1481
- energy investment needs 1571
- energy sector emissions 248, 620, 621, 622
- industry emissions 249
- inequality 264
- per capita floor area 969
- transport 251
- transport emissions 252, 1055, 1056
- urban population and urban expansion 883, 883
- Spain** 440, 548, 803, 905, 1385
- Special Drawing Rights (SDR)** 1558, 1561
- specific energy consumption (SEC)** 1171–1172, 1180–1181
- spill-over effects\*** 47, 471, 1248, 1318–1320, 1393–1394
- of CDR methods 1267, 1268, 1270, 1271, 1274, 1275–1276, 1277
- energy sector 628, 700–701, 1319–1320
- of green bonds 1600
- sources of leakage 1393
- technology/knowledge spillovers 1394, 1651, 1656, 1684
- see also leakage\*
- standards and labelling** 1219, 1388–1389, 1677–1680, 1679, 1680
- air conditioning 1662–1663, 1679
- building codes, certificates and labels 956, 1004, 1009, 1010, 1011, 1012, 1013, 1219, 1677, 1679, 1680
- carbon labelling 1765
- energy efficiency 1011, 1012, 1391, 1662–1663, 1677–1678, 1679

- energy labelling schemes 1010, 1662–1663, 1678, 1679
- financial products 1598, 1599–1600, 1606
- food labels, guidelines and regulation 1292, 1293–1295
- green labels 1598, 1599–1600, 1606, 1679
- low-carbon fuel standards (LCFS) 270, 1388
- minimum energy performance standards 956, 1010, 1678
- sustainability standards 1293–1294
- technology standards 1389
- tradable green certificates (TGCs) 1013, 1677, 1680
- tradable white certificates (TWCs) 1011, 1677, 1680
- vehicles 1388–1389, 1677–1678
- voluntary approaches 1293–1294, 1679–1680
- state-owned enterprises (SOEs)** 170, 1588
- Stated Policies Scenario (STEPS)** 1203, 1741
- Stated Policies Scenario (WEO-2020)** 1251–1252, 1252
- steel industry** 533, 902, 1164, 1180, 1181, 1181, 1183, 1189–1190, 1197, 1204, 1204, 1205, 1208–1209
- stimulus packages** 1359, 1407, 1408–1409, 1558
- COVID-19 recovery 163–164, 1550, 1557–1559, 1590–1591, 1591–1592
- Green New Deals 474, 1408–1409
- stormwater management** 907–908
- storylines\***
- climate narratives 555
- scenario storylines\* 175, 309, 1658, 1873, 1875, 1878, 1878
- stranded assets\*** 28, 90, 615, 647, 697, 698, 1730, 1744–1745, 1747, 1771, 1829
- financial risk assessment 1581, 1582
- impacts for public sector 1593–1594
- scenarios and pathways 355–356
- strategic interaction** 1846
- stratospheric aerosol interventions (SAI)** 1489, 1490, 1491–1492, 1494, 1494
- structural change** 452, 463–465, 506, 507, 1845
- Structural Decomposition Analysis** 243
- sub-Saharan Africa**
- carbon pricing instruments 466
- distributional effects of mitigation 445
- energy access 623
- energy investment needs 1603–1604
- energy use 517, 623
- fertiliser use 794
- grassland 784
- green industrialisation 1754
- inequality 264
- infrastructure development 769
- sustainable water management 1754
- subnational actors\*** 4, 411, 1378–1381
- middle actors 506, 558
- mitigation potential 913–914
- subsidies** 1386–1388
- agriculture and forestry 751, 815–816, 821–822
- buildings sector 1011, 1012, 1013
- for energy efficient products 1679
- energy subsidies 628, 629, 1767
- feed-in tariffs 1013–1014, 1387, 1388, 1587, 1676, 1736
- food-based 1292–1293
- fossil fuel 465–466, 648, 1387–1388, 1388
- Renewable/Energy Portfolio Standards (RPSs) 1013, 1388
- suburbanisation** 466–467
- sufficiency\*** 955, 957–959, 995
- buildings sufficiency measures 955
- developing countries 989–990
- SER framework 956, 957–959
- untapped sufficiency potential 968
- sulphur dioxide (SO<sub>2</sub>)** 441
- contribution to warming 225
- emissions trends and drivers 232–233, 232
- energy sector emissions 623
- sulphur hexafluoride (SF<sub>6</sub>)** 221, 224, 229, 1390, 1831, 1832
- sulphur oxides (SO<sub>x</sub>)** 1093, 1094
- supercapacitors** 656
- supply chains** 1056, 1175–1176, 1178, 1206, 1222
- emissions 253, 981, 1056
- management 818
- net-zero emissions 901–902
- warehouses 981
- supply-side measures\***
- AFOLU sector 751, 753, 775, 776–777, 779–802
- models/modelling methods 1867
- scenarios and pathways 336, 337
- sustainability\*** 817
- consumption and production 514
- food systems 1283–1285, 1284, 1292–1295
- integrated sustainability 1734
- strong sustainability 1734
- urban sustainability experiments 1694
- voluntary sustainability standards 1293–1294
- water management systems 1754
- weak sustainability 1734
- sustainable development\*** 4, 40–43, 156, 510, 1772
- adaptation and mitigation 1404
- and climate change 1732–1734
- cross-sectoral approaches to mitigation 1248
- industrial transformation 1754–1755
- integrated governance 1405
- integrated policy approaches 1736
- long-term mitigation pathways 369–378, 370, 371
- low-carbon energy transition 616
- mitigation in context of 141–147, 170, 176–180
- mitigation linkages 1498–1499
- model assessment 1739–1742
- national development plans 451, 452, 453, 453–454
- Paris Agreement 1471
- policies 372, 372
- policies for transformation in context of 171
- and public-private partnerships (PPPs) 1511–1512
- role of digitalisation 1759–1761
- rural development 795
- shifting development pathways 412
- synergies and trade-offs 1743
- technology and innovation trade-offs 1644
- and technology transfer 1644
- vulnerability and climate risks 42
- see also accelerating transition in sustainable development context
- Sustainable Development Goals (SDGs)\*** 141, 142–143, 155, 158, 178–180, 179, 1455–1456, 1732–1733, 1738–1739
- and accelerating mitigation 141, 411
- access to technology and service infrastructure 517
- achieving climate mitigation and 176, 177, 177
- and adaptation 1757, 1758
- biodiversity 377–378
- cities and infrastructure 378, 866, 903, 903–904
- and climate policies 153
- climate policy integration 1405
- co-benefits 376, 1312–1313, 1312, 1742, 1754
- of CDR 1268
- of energy systems mitigation 698, 704–706, 705
- of industry mitigation 1210–1211, 1754
- long-term mitigation pathways 369–378, 370, 371, 376
- of urban mitigation 867, 873–875, 874, 903, 903–904
- cross-sectoral perspective 1312–1313, 1312
- demand-side measures 523
- digitalisation 11
- energy and energy access 375, 623–624, 705, 705
- equity and fairness 170
- evaluating climate action in context of sustainable development 40–41, 41–42
- food and food security 373–374, 1292
- health 375–377, 376
- implementation gaps 1690
- integrated assessment models (IAMs) 1729, 1739, 1859, 1860
- international cooperation 1501–1502
- investment and finance 1554, 1739
- linkages with AFOLU 810, 827, 829
- linkages with land use 1302
- linkages with urban green and blue infrastructure 903, 903–904
- long-term mitigation pathways co-benefits and trade-offs 369–378, 370, 371
- low-carbon energy transition 616, 698, 704–706, 705
- meeting 11, 956, 998, 999–1000, 1000, 1739
- models/modelling methods 1742, 1850, 1860
- national development plans 451
- and NDCs 1739
- scenarios and pathways 375, 1850, 1860
- shifting development pathways 449–450, 449, 456–457
- sustainable development pathways 179
- synergies and trade-offs 369–378, 370, 371, 1729–1730
- AFOLU sector 41–42, 775, 810, 1309–1311, 1730, 1749–1751, 1757–1758, 1761–1763, 1762, 1764, 1770–1771
- assessment 1838

- bioenergy 645, 705, 1749, 1761  
 buildings 41–42, 956, 998, 999–1000, 1000, 1762, 1763, 1764, 1770  
 carbon capture (CCS and CCU) 705–706, 1755, 1761  
 cross-sectoral co-impacts 1312–1313, 1312  
 energy systems 41–42, 698, 704–706, 705, 1761, 1762  
 industry 41–42, 1224, 1729–1730, 1754–1755, 1762, 1763, 1764, 1770, 1771  
 land-based mitigation 40–41, 41–42, 1749–1751, 1762  
 solar energy 1697, 1761  
 technology and innovation 1644, 1695–1697, 1697–1698, 1698  
 transport 41–42, 1054, 1055, 1762, 1763, 1764  
 urban systems and other settlements 41–42, 1762, 1763, 1764  
 technological change 1690–1691  
 water 374–375  
 water-energy-food nexus 1751–1754  
 well-being 513, 829  
**sustainable development pathways** 179, 1359, 1739–1742, 1769–1770  
**Sustainable Development Scenario (SDS)** 375, 964–965, 965–967, 968–974, 1101, 1201, 1202, 1203, 1204, 1206, 1741  
**sustainable energy** 1766–1767  
**sustainable entrepreneurs** 1766  
**sustainable finance** 1550, 1552, 1578, 1600, 1600–1601, 1767  
**sustainable forest management\*** 347–348  
**sustainable intensification (of agriculture)\*** 751, 822–823, 828–829, 1286, 1288, 1757  
**sustainable land management\*** 1747  
**sustainable potential** 774, 775–776  
**sustainable transition** 29, 558, 1729, 1730, 1734  
**sustainable transition pathways** 705, 1734  
**Sweden**  
 accelerated mitigation pathways 438  
 carbon taxes 466  
 end-use technologies transitions 256  
 energy supply transitions 256  
 hydropower 639  
 industrial waste heat 1206–1207  
 industry 1209  
 mitigation policies 1397  
 policy impacts 270  
 transport 1060  
**Switzerland** 990, 1116, 1501  
**synergies** 40–41, 41–42, 153, 156, 1729–1730  
 adaptation and mitigation 468, 1400–1403, 1401, 1756–1759  
 AFOLU sector 1749–1751, 1762  
 assessment methodology 1838  
 buildings sector 41–42, 1762, 1763, 1764, 1770  
 cross-sectoral mitigation approaches 1248, 1249, 1730, 1761–1764, 1762, 1770  
 cross-sectoral transitions 1749–1761  
 development pathways 453, 456–457  
 energy systems 41–42, 698, 704–706, 705, 1761, 1762  
 energy technologies 1695–1696  
 fossil fuel phase-out/renewables deployment sustainable development 1743–1744  
 industry 1180, 1192, 1224  
 long-term mitigation pathways synergies and trade-offs 369–378, 370, 371, 376  
 policy impacts 171  
 for sustainable development 1729–1730, 1738, 1740, 1743, 1749–1751, 1761–1764, 1762  
 technology and innovation 1644, 1695–1697, 1697–1698, 1698  
 transport 41–42, 1054, 1055, 1762, 1763, 1764  
 urban systems 867, 873–875, 874, 903, 903–904, 1730  
**synthetic alcohols** 1184, 1186  
**synthetic fuels** 1052, 1068, 1071, 1080, 1088, 1094  
**synthetic hydrocarbons** 658, 1184, 1186  
**synthetic nitrogen fertilisers** 771, 772  
**systemic approaches** 1644, 1645, 1660–1669, 1683  
**T**  
**tariffs**  
 feed-in tariffs 1013–1014, 1387, 1388, 1587, 1676, 1736  
 trade 1458–1459, 1500–1501  
*see also* carbon taxes  
**Task Force on Climate-related Financial Disclosures (TCFD)** 159  
**taxes** 1292–1293  
*see also* carbon taxes  
**technical potential\*** 774, 1251  
 afforestation/reforestation (A/R) 1274  
 AFOLU measures 750, 775, 776, 776, 780, 781, 784–794, 796, 800, 802, 804, 805  
 agroforestry 1274  
 BECCS 800  
 biochar 1274  
 bioenergy and BECCS 802, 1273–1274  
 buildings sector 988  
 direct solar energy 630  
 food systems 1279  
 geothermal energy 648  
 hydropower 638  
 improved forest management 1274  
 Indian agriculture 799  
 marine energy 649  
 peatland and coastal wetland restoration 1274  
 reduced food waste and dietary shifts 528–529  
 soil carbon sequestration (SCS) 1274  
 wind energy 634–635  
**techno-economic costs** 447  
**technological barriers and opportunities** 826  
**technological change** 273, 1646–1647, 1655–1657  
 AFOLU sector 773  
 carbon pricing policies 1386  
 emissions trends and drivers 255–259, 260  
 scenarios 535  
 and sustainable development 1645, 1735  
 systemic perspective 1644, 1645  
**technological frontier** 1656, 1656, 1695–1696  
**technological innovation systems (TIS)** 183, 1660  
**technological innovations** 441, 442, 464, 1698–1699, 1766–1767  
 agricultural 374, 1285, 1286, 1288  
 policy instruments 1670, 1672–1680  
 processes 1660–1667  
 service provisioning 505  
 sustainability transitions 1766–1767  
 synergies and trade-offs with SDGs 1696–1697  
 and systems transitions 1698  
 trade instruments 1681–1683  
 transport 1064–1073, 1111  
*see also* technology and innovation  
**technological leadership** 684  
**technological transitions** 1661  
**technology** 167–168, 773  
 for accelerated mitigation 412–413, 440, 447, 460, 464  
 access to 517–518  
 adoption 257–259, 557, 561, 567–568, 570, 700  
 adoption rates 259  
 availability 447  
 batteries 1069–1070  
 buildings 440, 961, 975, 992, 994  
 carbon capture, use and storage 642–643  
 consumer choice and behaviour 1391  
 cost reductions 257, 258, 259, 994  
 cross-sectoral considerations 1314, 1315–1316  
 demand-side measures 505, 559  
 development and transfer *see* technology transfer\*  
 early adoption 1204, 1206  
 emerging mitigation technologies 773  
 agricultural innovation 1285, 1286, 1288  
 food technologies 1247, 1285, 1286, 1288–1289, 1321  
 general-purpose technologies 1314  
 solar energy 633  
 enabling shifting development pathways 460, 464  
 end-use technology adoption 530  
 energy sector 167, 623, 660, 682, 692–693, 1505, 1752  
 fossil fuel extraction 647  
 general-purpose technologies (GPT) 1249–1250, 1321, 1652  
 geothermal energy 649  
 granularity 257–258, 505, 562, 563  
 improvements 257–258  
 for land-based freight 1084  
 learning rates 257–258, 259  
 mitigation policies 1396–1397, 1479–1481  
 mitigation potential 1196, 1197–1198, 1249–1250  
 new energies 167  
 nuclear power 640  
 Paris Agreement 1472–1473, 1477  
 policies 700  
 shifts in cooking energy/technology 548, 567

- solar energy 633  
 spill-over effect 1394  
 subsidies 1387  
 technical solutions and climate justice 1370  
 transformative changes 411  
 wind energy 635–636  
*see also* technology and innovation
- technology-adjusted consumption-based emission accounting (TCBA) 239**
- technology and innovation** 11, 136–139, 167–168, **1641–1701**, 1650  
 adaptation 1686, 1699  
 adaptation and mitigation 469  
 barriers and enablers 1644–1645, 1646–1647, 1646, 1652, 1654, 1658, 1696, 1766–1767  
 carbon-intensive technologies 1651  
 climate-resilient technology 1701  
 co-benefits 1671, 1695  
 costs 623, 1196, 1197–1198, 1650, 1651, 1655, 1657, 1658–1659  
 deployment 305, 442, 464, 1651, 1657–1658, 1658–1659, 1688  
 diffusion 305, 1657–1658, 1688, 1693, 1701  
 digital technologies 140, 1645, 1652, 1652–1654, 1700  
*see also* digitalisation  
 direction of technological change 1655–1657  
 drivers of innovation 1647, 1650–1651  
 early stage financing 1578  
 enabling conditions 1645, 1693–1694, 1698–1699  
 energy efficiency technological developments 1180–1182  
 energy technologies 1649, 1657–1658, 1658–1659  
 environmental impacts 1646  
 FAQs 1701  
 fossil-fuel technologies 1651  
 frugal innovations 1648  
 general-purpose technologies (GPTs) 1249–1250, 1321, 1652  
 grassroots innovations 1648, 1697  
 green innovations 1690  
 impact of energy prices 1655  
 inclusive innovation 1696  
 indicators for innovation 1644, 1645, 1664–1667, 1665–1666  
 industry technological developments 1163–1164, 1176–1187, 1188, 1196  
 informal sector 1694  
 information and communication technology (ICT) 652, 924–925, 1062, 1652, 1760  
 innovation cooperation 1645, 1649, 1688–1689, 1698  
 innovation policy packages 11  
 innovation processes 1644  
 innovation systems 1644, 1645, 1660–1661, 1660, 1669, 1688, 1699  
 intellectual property rights (IPR) 1644–1645, 1657, 1681–1682, 1687–1688, 1699  
 international cooperation 1457, 1472–1473, 1485–1487, 1502, 1645, 1656, 1683–1689, 1689, 1698, 1701  
 investment and finance 1486–1487, 1505, 1578, 1645, 1649, 1651, 1655, 1656, 1664–1665, 1664  
 knowledge gaps 1699–1700  
 knowledge spillovers 1651, 1656, 1657  
 leapfrogging 563  
 learning by doing 1650–1651, 1678  
 learning by research 1657  
 lock-in 1649  
 low-carbon innovation 441, 696, 700  
 low-emission technologies 11, 12, 1651, 1701  
 meeting Paris Agreement objectives 1701  
 model assessment 1742  
 models/modelling methods 1647–1648, 1657–1658, 1658–1659, 1845–1846, 1875–1876  
 new markets, finance and creative destruction 1587  
 new technologies 1656, 1661, 1667, 1681, 1685, 1692–1693  
 policies 11, 1655–1656, 1661, 1669–1683, 1694, 1698  
 adapting to local context 1663  
 demand-pull (market-pull) instruments 1650, 1669, 1670, 1675–1677  
 drivers and politics 1671  
 impact assessment 1672–1680  
 impact indicators 1672, 1672  
 instrument types 1670, 1670, 1671, 1680  
 intellectual property rights (IPR) 1681–1682  
 mission-oriented 1687–1688  
 policy design 1645, 1665  
 policy mixes 1661–1662, 1667, 1669, 1683  
 regulatory instruments 1677–1678, 1679  
 soft instruments 1678–1680  
 sub-national 1678, 1682–1683  
 system-oriented 1683  
 technology-push instruments 1650, 1669, 1670, 1672–1675, 1674–1675  
 trade-related instruments 1681  
 recombinant innovations 1651  
 renewable energy technology 1656  
 responsible innovation 1696  
 scenarios and pathways 305, 351, 1647–1648, 1657–1658, 1658–1659  
 social innovation 1647, 1688, 1690, 1696  
 soft technologies 1647  
 speed/sources of technological change 1650–1655  
 stages of innovation process 1648–1650, 1648, 1671  
 demonstration 1648, 1649  
 deployment and diffusion 1648, 1649  
*see also* research and development (R&D)  
 standards and labelling 1388–1389, 1662–1663, 1678, 1679  
 sustainable development and technological change 1645, 1647, 1690–1699, 1691–1694  
 sustainable innovations 1690  
 synergies and trade-offs with SDGs 1644, 1695–1697, 1697–1698, 1698  
 systemic approach to innovation 1697–1698  
 systemic failures 1661–1662, 1662–1663  
 systemic view 1644, 1645, 1660–1669, 1662, 1698  
 technology development 1645, 1683–1684  
 technology readiness levels (TRLs) 1648, 1649–1650  
 transitions 692–693, 1396–1397, 1691–1694, 1695  
 unit costs 11, 12, 28  
 ‘valley of death’ 1665, 1692–1693
- technology deployment\*** 1648, 1649, 1651  
 in developing countries 1688  
 modelling 305, 1657–1658
- technology diffusion\*** 1646, 1646, 1647, 1648, 1649, 1701  
 in developing countries 1688  
 modelling 305, 1657–1658
- Technology Executive Committee (TEC)** 1486–1487, 1685, 1686
- Technology Mechanism** 1472–1473, 1486–1487
- technology-push policy instruments** 1650, 1669, 1670, 1672–1675  
 demonstration funding schemes 1675  
 public procurement 1669, 1672–1674, 1673  
 public R&D funding 1644, 1669, 1672, 1673, 1674–1675, 1674–1675  
 R&D incentives 1672
- technology readiness level (TRL)** 1648, 1649–1650  
 batteries 1070  
 biofuels 1067  
 CDR methods 114, 115–116  
 fuel cells 1070–1071  
 natural gas vehicles 1065
- technology transfer\*** 48, 218, 257, 1644, 1649, 1689  
 adaptation and mitigation 469  
 Clean Development Mechanism 1645, 1684, 1686–1687  
 geographies of 1502  
 institutional approaches 1685–1688  
 intellectual property rights (IPR) regimes 1687–1688  
 international cooperation 1645, 1656, 1683–1689, 1701  
 Paris Agreement 1472–1473, 1487  
 UN climate regime 1486–1487  
 and sustainable development 1644
- teleworking** 529, 541, 561
- temperature categories** 1886, 1886, 1887, 1889, 1890
- temperature levels** 315–318, 315, 317, 330–332  
 and economic impacts from climate change 365–366  
 and emissions 319–324, 320–322, 323, 329  
 and net zero emissions 324, 325–328
- temperature overshoot\*** 305, 347, 349, 1874
- terrestrial biomass dumping** 1273
- territorial accounting (TA)** 872, 873
- territorial emissions** 167, 221–238, 239, 240, 1165, 1176, 1283–1285, 1284
- Thailand** 434, 875, 957
- thermal energy storage (TES)** 655
- thermal power plants** 665, 668

- thermoelectric power generation** 1752–1753
- tipping points\*** 180, 468, 1683  
 climate 1557  
 for climate action 922  
 finance and risk 1583, 1587  
 social 547, 555, 556, 1509  
 strategic targeting 1410, 1411  
 tipping point cascades 1410, 1411
- tradable green certificates (TGCs)** 1013, 1677, 1680
- tradable performance standards** 1011, 1013, 1388, 1389, 1677, 1680
- tradable white certificates (TWCs)** 1011, 1677, 1680
- trade-offs\*** 40–42, 153, 156, 1248  
 adaptation and mitigation 468, 876, 1401–1402, 1404, 1756–1759  
 AFOLU measures 751, 780, 793, 796, 809, 1749–1751, 1762  
 assessment methodology 1838  
 barriers to implementation 1729–1730  
 buildings mitigation 1018  
 CANOPIES agroforestry project 791  
 carbon pricing instruments 466  
 CDR methods 1267, 1268, 1270, 1271, 1274, 1275–1276, 1277  
 competing demands for land 1309–1311  
 cross-sectoral approaches to mitigation 1248, 1249  
 digitalisation 11  
 economic quantification 368  
 ecosystem services 1301  
 energy systems mitigation and SDGs 704–706, 705  
 farming system approaches 470  
 fossil fuel phase-out/renewables deployment 1743–1744  
 industry mitigation and SDGs 1754  
 innovation and sustainable development 1644, 1695–1697, 1698  
 integrated assessment models (IAMs) 341  
 land-based mitigation 775, 1304–1306  
 land restoration 471  
 long-term mitigation pathways and SDGs 369–370, 370, 371, 373–378  
 managing 457, 1302, 1304–1306, 1503–1504  
 mitigation and SDGs 450, 1729–1730, 1742, 1761–1764, 1762  
 policy impacts 171  
 sectoral policy interactions 1316–1317  
 with sustainable development 40–42, 878, 1738, 1740, 1743–1744  
 urban mitigation 875, 876  
 water-energy-food nexus 1753
- trade-related measures** 1500–1501
- traditional biomass\*** 622–623, 623–624, 629, 644, 970–971, 972
- transformation pathways\*** 303, 1198–1206, 1598, 1870
- transformational changes** 458, 1729  
 behaviour and lifestyle changes 463  
 enabling 460  
 industry 1203–1204  
 near term 411, 412  
 opposition to 472  
 policies for 464  
 transition dynamics 1691–1693  
 see also just transitions\*
- transformative capacity** 1766–1767
- transformative change** 572
- transformative megatrends** 538–546, 558–559
- transformative potential**  
 experimentation and policy innovation 1380  
 international cooperation 1460, 1460, 1475, 1515  
 mitigation policies 1383–1384, 1383
- transient climate response to cumulative CO<sub>2</sub> emissions (TCRE)\*** 320, 321
- transit-oriented development** 864, 897–898
- transition\*** 147, 153–154, 183–185, 560–564, 1772  
 accelerating 45, 185, 255, 256–259, 562–564, 565, 1772  
 see also accelerating transition in sustainable development context  
 from coal 1742–1744, 1743, 1746, 1748  
 cross-sectoral transitions 1749–1764  
 demand-side 506, 560–561  
 drivers and constraints 165–173  
 dynamics 184, 1667, 1691–1694, 1698  
 economic implications 1744–1745, 1746, 1747  
 enabling policies 1395–1398, 1395  
 end-use technologies 256  
 energy transition 28, 66, 256, 259, 1742–1749  
 feasibility 378–383  
 financial risk 1581, 1582–1583  
 funding 169  
 to high well-being low-carbon-demand society 546, 546, 558  
 industry 29  
 inner transitions 1737  
 long-term 1738–1739  
 low-carbon 1746–1749  
 feasibility frameworks 378–379  
 policies 461, 568  
 socio-economic context 871  
 see also low-carbon energy transition; low-carbon societal transition  
 management 1746, 1748  
 to net-zero energy systems 681–682  
 orderly/disorderly 1581  
 phases 561, 571  
 policies 461, 568, 1395–1397  
 scenarios 1583, 1584–1585, 1871–1872  
 sectoral transitions 1398, 1399–1400  
 scenarios/pathways 1872, 1892, 1892  
 shifting development pathways 458  
 short-term 1738–1739  
 speed 66, 256–259, 350–351, 507, 562–564  
 structural system changes 1395  
 sustainable 29, 558, 1729, 1730, 1734  
 system transitions 1693–1694, 1698, 1729  
 technological 255–259, 682, 1661  
 transformational system changes 1395  
 understanding mitigation response strategies 183–185  
 urban mobility 558–559  
 see also just transitions\*
- transition pathways** 411, 506, 535, 1729, 1748–1749, 1770  
 distributional effects 412  
 sustainable 705, 1734
- transnational alliances** 165
- transport** 98–99, 100, 159, 1049–1121  
 abatement costs 1085–1086  
 accelerated mitigation pathways 435, 436, 440  
 accountability 1092–1093, 1097  
 active travel/transport 908, 909, 926, 1052  
 adaptation and mitigation 1057, 1759  
 air pollution 1097  
 alternative fuels 677, 1118–1119  
 ASI opportunities 529–531, 530, 1056, 1059–1061  
 automated vehicles 541, 542–543, 1062, 1063, 1735  
 autonomous systems 1062, 1095  
 aviation see aviation  
 barriers to mitigation 543  
 behaviour change 908, 909, 1052, 1059–1063, 1089, 1111–1112, 1121, 1766  
 car dependence 1059  
 carbon intensity 1106, 1107  
 carbon leakage 1319  
 circular economy 1061  
 climate action 1117–1118  
 climate change impacts 1057, 1759  
 climate finance 1564  
 climate-related financial risk 1584  
 co-benefits 1058  
 costs 1078, 1079, 1080, 1082, 1084–1085, 1085, 1097  
 costs and potentials 38–39, 1252, 1253, 1255, 1257, 1257, 1258, 1259, 1260  
 COVID-19 pandemic 230, 230, 1087, 1090, 1092, 1121  
 critical minerals 1116, 1116–1117  
 cross-sectoral implications 1313  
 decarbonisation 1074–1098  
 demand 1053, 1101–1104, 1111–1112  
 demand management 1052, 1053, 1059–1063  
 demand reduction 1111–1112, 1118–1119, 1121  
 demand-side measures 529–531, 530  
 digitalisation 1062–1063, 1062, 1653, 1760, 1761  
 disruptive innovation 1057–1058  
 electrification 440, 676, 677, 899–901, 1053, 1108–1109  
 electric rail systems 1079  
 electromobility 440, 1052, 1112–1113, 1116–1117, 1118–1119, 1120  
 shipping 1095, 1098  
 see also electric vehicles (EVs)  
 emissions 8, 66  
 aviation 1086–1087, 1086, 1090–1092, 1091, 1092, 1506–1507  
 CO<sub>2</sub> emissions 230, 230, 1053, 1065, 1086–1087, 1086, 1089, 1091, 1092  
 direct emissions 1052

- energy sector CO<sub>2</sub> emissions 620, 620  
 food system GHG emissions 1281  
 GHG emissions 236–237, 237, 238, 529, 1281, 1507  
 global emissions trajectories 1099–1101, 1100  
 growth 218  
 land-based transport 230, 230, 1074–1077, 1075, 1079–1080, 1081, 1083, 1084, 1090  
 lifecycle emissions 1065, 1079–1080, 1081, 1083–1084, 1084, 1145–1146  
 methane (CH<sub>4</sub>) emissions sources 1833, 1834, 1835  
 non-CO<sub>2</sub> emissions 1086–1087, 1088, 1089  
 particulate matter (PM) 1077  
 production-based emissions 1076  
 projections and scenarios 1053, 1090–1092, 1091, 1092, 1097–1098, 1098, 1099–1101, 1100, 1111  
 residual fossil fuel emissions 268–269, 268  
 shipping 1093–1094, 1093, 1096, 1097, 1506, 1507–1508  
 short-lived climate forcers (SLCFs) 1086–1087, 1093–1094  
 sources 1833, 1834, 1835  
 trends and drivers 218, 236–237, 237, 238, 246, 251–252, 252, 1055–1056, 1055, 1075, 1076, 1077  
 urban GHG emissions 897–898  
 zero emissions targets 529
- enabling conditions 1111–1118, 1118–1119  
 energy efficiency 251, 252, 1106, 1107, 1507  
 FAQs 1120–1121  
 feasibility assessment 1113, 1114, 1150–1160  
 financing 1118  
 food system mitigation options 1290–1291  
 freight 252, 1053, 1056, 1082–1085, 1083, 1085, 1095, 1101–1104, 1102, 1105, 1108–1109  
 fuel cell vehicles (FCVs) *see* hydrogen fuel cell vehicles (HFCVs)  
 fuel efficiency 1074, 1076–1077, 1084, 1087, 1146–1147, 1677–1678  
 fuel switching 1108–1109  
 fuels and fuel alternatives 1052, 1053, 1064–1071, 1074, 1075, 1080  
 aviation and shipping 1113  
 emissions factors 1146  
 projections 1090, 1091  
 governance 1053, 1092–1093, 1097, 1115–1116  
 hydrogen *see* hydrogen fuel cell vehicles (HFCVs)  
 infrastructure 768, 769, 1057, 1058–1059, 1071–1073  
 innovation 1057–1058, 1677–1678  
 integrated energy sector planning 1053, 1115  
 internal combustion engine (ICE) vehicles 1064–1065, 1065, 1068  
 buses and passenger rail 1080, 1082  
 freight 1083, 1084–1085, 1085  
 ICE efficiency improvement 529  
 lifecycle assessment 1074, 1075, 1076, 1077, 1078, 1079  
 international cooperation 1506–1508, 1514  
 investment and finance 1569  
 investment gap 1576  
 investment needs 364, 1572–1573, 1573  
 land-based 1052, 1053, 1065, 1070, 1074–1086, 1112–1113  
 lifecycle assessment (LCA) 1074–1080, 1075, 1078, 1081, 1082, 1145–1146  
 lifecycle costs (LCCs) 1078, 1079, 1080, 1082, 1084–1085, 1085, 1148–1149  
 lock-in 894, 1059  
 long-term mitigation options 1260  
 mitigation options 1111–1113, 1112, 1114  
 mitigation potential 530, 1087–1090, 1094–1097, 1096  
 modal shift 558–559, 1060, 1085, 1089–1090, 1104–1106, 1105  
 models/modelling methods 1098–1099, 1100, 1101, 1104, 1110–1111, 1851, 1853–1854, 1853, 1892  
 Nationally Determined Contributions (NDCs) 421  
 net zero strategies 680, 1117–1118  
 occupancy rates 544, 1077, 1080, 1106  
 offsetting measures 1089  
 passenger transport 251–252, 1053, 1056, 1074–1082, 1089–1090  
 energy intensity 1106  
 technology 1079–1080, 1081, 1082, 1108–1109  
 trajectories 1101–1104, 1102, 1105, 1106, 1108–1109  
 policies and legislation 567–568, 1053, 1090, 1382  
 policy impacts 270–271  
 policy packages 569  
 public transport 271, 467, 558–559, 925, 926, 1060  
 buses 1079–1080, 1081, 1082, 1146, 1148–1149  
 rail 1079–1080, 1081, 1082, 1089–1090  
 shifts from private transport 558–559, 1060, 1085, 1104–1106  
 rail 1052, 1056, 1070, 1085–1086, 1105, 1148  
 emissions 1079–1080, 1081, 1090  
 freight 1082–1085, 1083  
 high-speed rail (HSR) 1089–1090  
 lifecycle costs (LCCs) 1080, 1082, 1084–1085, 1085  
 modal shift to 1089–1090  
 passenger rail 1079–1080, 1081, 1082  
 road 252, 1056, 1074–1079, 1085–1086, 1104, 1105, 1148–1149  
 automation/autonomous vehicles 541, 542–543, 1062, 1063, 1735  
 buses and public transport 1079–1080, 1081, 1082  
 freight 1082, 1083, 1084–1085, 1104  
 heavy-duty vehicles (HDVs) 1056, 1070, 1082, 1083, 1084–1086, 1085, 1120  
 improved/alternative vehicles 1061  
 lifecycle costs (LCCs) 1078, 1079, 1080, 1082, 1082, 1084–1085, 1085  
 lifecycle emissions 1074–1079, 1075, 1081  
 light-duty vehicles (LDVs) 1069–1070, 1074–1079, 1075, 1076–1077, 1078, 1085–1086, 1106, 1108–1109  
 medium-duty vehicles 1082, 1083, 1085  
 passenger 1104  
 two-wheelers 1077, 1113  
 road construction 768, 769  
 scenarios, pathways and projections 32, 343–345, 344, 535, 536, 1053, 1098–1111, 1892  
 aviation 1090–1092, 1091, 1092, 1105  
 energy and carbon efficiency trajectories 1106, 1107  
 fuel energy and technology trajectories 1108–1109, 1108  
 global emissions trajectories 1099–1101, 1100  
 Illustrative Mitigation Pathways (IMPs) 1109–1110  
 shipping 1097–1098, 1098, 1105  
 transport activity trajectories 1101–1104, 1102  
 transport modes trajectories 1104–1106, 1105  
 service-based business models 1607  
 service delivery efficiency 534  
 service demand 509, 514, 567  
 shared mobility 263–264, 271, 541–543, 558–559, 1061, 1103  
 shipping *see* shipping  
 smart mobility 1062–1063, 1062  
 socio-cultural factors 529, 531  
 spatial patterns of development 466–467  
 synergies and trade-offs with SDGs 41–42, 1054, 1055, 1762, 1763, 1764  
 systemic changes 1052, 1058–1064, 1063  
 technology 440, 1062–1063, 1062  
 alternative fuels 1064–1068, 1064, 1066, 1067, 1082, 1087–1089  
 aviation 1087–1090  
 batteries energy storage systems 654–655, 1069–1070  
 creative foresight 1117  
 for decarbonisation 1064–1073, 1064, 1108–1109, 1108  
 fuel cells 1070–1071  
 ICE technologies 1064–1065, 1065  
 land-based freight 1084  
 refuelling and charging 1071–1073  
 shipping 1095  
 trade-offs 1089  
 trackless trams 1113  
 transformation trajectories 1097–1098, 1098  
 transformative change 1052, 1057–1058  
 travel demand reduction (TDR) 1118–1119  
 urban 897–898, 899–901, 908, 909, 1052, 1058–1059, 1058, 1059, 1060, 1079–1080, 1081, 1082, 1755–1756  
 urban mitigation 875  
 urban systems 894–896, 1755–1756

- vehicle emissions standards 1388–1389  
 vehicle miles or kilometres travelled (VMT/VKT) 897–898, 909  
 vehicle size trends 1076–1077  
 trust 521, 522, 524, 525, 555, 556, 564, 570  
 Turkey 262, 434, 437
- U**
- Uganda** 1113, 1578, 1746, 1766  
**Ukraine** 870  
**uncertainty\*** 157, 181  
 AFOLU emissions accounting 752  
 AFOLU mitigation 751, 753, 780, 802  
 bioenergy and BECCS 800, 802  
 CDR methods 1265, 1274  
 coastal wetlands conversion rates 787  
 emission metrics 1830  
 emissions 222–226, 240  
   AFOLU emissions 756–758, 757, 830  
   GHG emissions 6n, 7  
   historical emissions 6, 222  
 financing needs 1569–1570  
 low-carbon innovation 696  
 mitigation potentials 1253  
 modelled temperature outcomes 316, 318  
 NDC estimates 423–424  
 remaining carbon budget 322  
 scenarios 1876  
 shifting development pathways and accelerated mitigation 471–472  
 sub-national and non-state action 429–430  
 sustainable development pathways 1770  
 technology investments 1651  
**unit costs** 11, 12, 28, 89, 98, 1052  
**United Kingdom (UK)**  
 accelerated mitigation pathways 439, 455  
 buildings 439, 989, 990, 1003, 1005  
 CDR policies and R&D 1277–1278  
 climate governance and institutions 1366, 1366, 1367  
 climate laws 1361, 1363  
 consumption-based emissions 243  
 dietary shifts 547  
 Emissions Trading System (ETS) 1384  
 energy regulatory policy 1389  
 energy sector 1766  
 energy system model 1848  
 energy transition policies 700  
 food system 804  
 food waste reduction initiative 1750–1751  
 household emissions 260  
 industry policy 1215  
 net zero targets 432, 1277–1278  
 Offshore Wind Accelerator Project 1216  
 policies 1277–1278  
 policy impacts 270  
 public trust 555  
 REDD+ 1503  
 regulatory analysis 1391  
 social movements 1508  
 transport 1060  
 urban green and blue infrastructure 876, 905  
**United Nations Addis Ababa Conference on Finance for Development** 159  
**United Nations Convention to Combat Desertification (UNCCD)** 1503  
**United Nations Framework Convention on Climate Change (UNFCCC)\*** 157, 172, 1460–1461, 1461, 1464  
 capacity building 1487–1488  
 climate finance 1482–1483, 1484  
 countries and areas classification schemes 1823  
 effectiveness 1515  
 Financial Mechanism 1486–1487  
 Local Communities and Indigenous Peoples Platform 1508  
 mitigation and adaptation 1497–1498  
 technology development and transfer 1486–1487  
 Technology Mechanism 1685–1686, 1689  
 see also Kyoto Protocol; Paris Agreement  
**United States of America (USA)**  
 accelerated mitigation pathways 435, 436, 437, 439, 440  
 AFOLU emissions 254, 816  
 AFOLU mitigation potential 781, 782  
 agriculture 455, 1753  
 air pollution reduction health benefits 377  
 bioenergy policies 818  
 buildings mitigation potential 989, 990  
 Buy Clean California Act 1218  
 California Zero Emission Vehicle (ZEV) mandate 1678  
 Californian CBA tariffs 1214  
 carbon offset credits 813–814, 815  
 carbon pricing policies 1385  
 coal-fired power plants, retirement of 1743–1744  
 coal use and phase-out 624, 625, 626, 699  
 conservation programs 816  
 education and environmental knowledge 264  
 electricity consumption 669  
 end-use technologies transitions 256  
 energy-related CO<sub>2</sub> emission pathways 434  
 energy resilience 669  
 energy sector scenarios 436, 437, 439, 1743–1744  
 energy storage 628  
 energy system 682  
 energy use 518  
 EV infrastructure 271  
 fire management 784  
 fire regimes 770  
 forest 767, 784, 817  
 geologic CO<sub>2</sub> storage potential 641, 641  
 Global Methane Initiative (GMI) 1511  
 grassland 784  
 household carbon footprint 1747  
 household emissions 260, 262, 263  
 industry policy 1214  
 international cooperation 1501  
 international trade and consumption 520  
 irrigation and crop yields 1753  
 marginal/abandoned/degraded land 800  
 mitigation potential of subnational actors 913–914  
 National Energy Modelling System (NEMS) 1848  
 net zero energy buildings 440  
 net zero targets 1465  
 New York City, urban carbon storage 905–907  
 non-CO<sub>2</sub> emissions 1390  
 opposition to climate action 557  
 Paris Agreement 1459, 1462, 1463, 1465, 1476, 1478  
 payment for ecosystem services (PES) 815  
 perception of climate risk 547  
 performance standards 1677–1678  
 policy impacts 270  
 pollution policies and regulation 271  
 public trust 555  
 REDD+ 1503  
 Regional Greenhouse Gas Initiative (RGGI) 270  
 regulatory analysis 1391  
 renewable energy support measures 1500  
 stranded assets 355  
 technology and innovation 1682, 1683  
 technology and innovation funding 1674, 1674–1675, 1675  
 transport 542, 1060  
 urban green infrastructure 905, 905–907  
 urban land expansion 888  
 urban land use trends 884  
 urban population 870  
 voluntary agreements 1392  
 water-energy-food nexus 1753  
 wind energy 636  
**urban form** 32, 896–899, 909, 919, 919, 920  
 accelerated mitigation pathways 440  
 compact and walkable 897, 897, 898–899, 920, 921, 922  
 dispersed and auto-centric 897, 897, 920, 921 and transport 897–898, 1058–1059, 1058, 1059  
 transport demand and GHG emissions 466–467 and transport emissions 1058–1059, 1058, 1059  
**urban growth** 882, 883–884, 883  
 direct driver of emissions 255, 768  
 mitigation opportunities 922–925  
 typologies 898–899, 919–921, 919, 920  
 urban sprawl 883–884  
**urban heat island (UHI)\*** 876–877, 888, 890, 905, 906  
**urban metabolism** 872  
**urban symbiosis** 1180  
**urban systems\* and other settlements** 94–98, 861–927  
 adaptation and mitigation 864, 876–877, 877–880, 903, 903–904, 907–908, 1403, 1758–1759, 1771  
 agriculture 875, 910  
 air pollution 925–926  
 barriers and enablers for implementation 879–880, 916–917, 918, 921–922  
 carbon cycle 871, 901–902  
 carbon footprint 255, 871–873, 893, 908, 924  
 cascading effects 864, 894, 895–896, 919, 920, 923  
 mitigation potential of subnational actors 913–914  
 National Energy Modelling System (NEMS) 1848  
 net zero energy buildings 440  
 net zero targets 1465  
 New York City, urban carbon storage 905–907  
 non-CO<sub>2</sub> emissions 1390  
 opposition to climate action 557  
 Paris Agreement 1459, 1462, 1463, 1465, 1476, 1478  
 payment for ecosystem services (PES) 815  
 perception of climate risk 547  
 performance standards 1677–1678  
 policy impacts 270  
 pollution policies and regulation 271  
 public trust 555  
 REDD+ 1503  
 Regional Greenhouse Gas Initiative (RGGI) 270  
 regulatory analysis 1391  
 renewable energy support measures 1500  
 stranded assets 355  
 technology and innovation 1682, 1683  
 technology and innovation funding 1674, 1674–1675, 1675  
 transport 542, 1060  
 urban green infrastructure 905, 905–907  
 urban land expansion 888  
 urban land use trends 884  
 urban population 870  
 voluntary agreements 1392  
 water-energy-food nexus 1753  
 wind energy 636

- circular economy and recycling 901, 902, 909–910
- climate action 866–867, 879
- and climate change 864, 866–867, 877–880, 905
- climate networks 914, 1378–1379, 1512–1513, 1756
- climate-resilient development 878–879
- climate-smart villages (CSV) 795
- co-benefits 378, 864, 873–877, 874, 878, 897, 903–908, 903–904, 905–907, 1755–1756
- competitiveness 875
- construction materials 901–902, 901
- COVID-19 pandemic 925–926
- cross-sector effects 864
- cross-sectoral coordination 898, 917, 924
- cross-sectoral implications 1313
- deep decarbonisation and systemic transformation 864, 894
- defining 867–868, 895–896
- developing countries 869, 870–871
- digitalisation 1760
- economic development 875–876, 917
- economic growth 255
- electrification and energy switching 899–902, 920
- emissions accounting frameworks 871–873, 927
- emissions data 926, 927
- emissions forecasts 890–894, 890, 891, 926
- emissions reduction 864
- emissions trends and drivers 8, 255, 768, 863, 867, 881, 884–886, 887, 925–926
- energy demand 898, 899–901
- energy-driven urban design 923
- energy efficiency 899, 908–909
- energy systems 873, 875, 899–901, 921
- energy use 897, 898, 899, 905, 908–909
- expansion 882, 883–884, 883, 887–890, 888, 889
- extended metropolitan regions 870
- FAQs 927
- feasibility assessment 867, 917, 918
- food systems 910
- GHG abatement potential 911
- governance, institutions, and finance 865, 878, 911–917
- growth typologies 919–921, 919
- heating and cooling 898–899, 907
- household emissions 260, 262, 263
- housing 897–898
- Illustrative Mitigation Pathways (IMPs) 893, 894
- informal sector 925
- economy 870, 910
- settlements 864–865, 884
- information and communication technology 924–925
- infrastructure 869, 890, 894–896, 926
- blue infrastructure 864, 875, 876, 877
- cycling and 908, 926
- green infrastructure 864, 875, 876, 877, 902–908, 903–904, 905–907
- investment 915
- integrated spatial planning 864, 865, 896–899, 909, 911, 920, 921, 1304
- international cooperation 1514
- investment and finance 871, 915–916, 1597
- jobs 897–898
- land use mix 897–898
- land use trends 880–884, 881, 882, 883, 887–890, 887, 888, 889
- local decision making and community involvement 900
- lock-in 268, 697, 863, 894–896, 895–896, 899, 911, 1059
- low-carbon urban development 875, 878, 880, 924
- material demand 923, 923
- mitigation options and strategies 864, 867, 873–877, 874, 884, 894–911, 920, 927
- active transport 908, 909
- avoiding carbon lock-in 894–896, 899, 911
- avoiding, minimising and recycling waste 909–910
- cascading effects 864, 894, 895–896, 920, 923
- cross-sectoral integration 910–911
- electrification and energy switching 899–902, 920
- green and blue infrastructure 902–908, 903–904, 905–907, 920
- material efficiency 911
- net-zero emissions materials and supply chains 901–902
- resource efficiency 911
- socio-behavioural aspects 908–910, 920
- spatial planning, urban form and infrastructure 864, 865, 896–899, 897, 909, 911, 920, 921
- urban-rural linkages 910
- mitigation pathways for different urban growth typologies 919–925, 920
- mitigation potential 884, 890, 893, 897, 899, 905, 905–907, 907–908, 910, 913–914, 920, 921
- net-zero emissions targets 30, 914–915, 923
- net zero GHG emissions 864, 872
- policies 864, 878, 879–880, 1756
- population 768, 869, 870
- population decline 870
- population density 881, 883, 898, 899, 900, 925
- population growth 863, 868–870, 869, 901–902
- resilience 877–879, 880
- rural development 795
- scenarios and pathways 30, 887–894, 888, 889, 890, 891, 892, 893
- SDG linkages 903, 903–904
- sequencing mitigation strategies 864, 919
- settlement types 869–870, 870
- smart cities 1653
- socio-economic context 871
- stormwater reduction and management 907–908
- street connectivity 897–898
- subnational actors 913–914
- suburbanisation 466–467
- sustainability experiments 1694
- sustainable development 795, 867, 873–875, 874, 898–899, 900
- synergies and trade-offs with SDGs 41–42, 903, 903–904, 1730, 1762, 1763, 1764, 1770, 1771
- towns 869–870, 870
- transformational change 865
- transport 1060, 1062, 1755–1756
- active transport 908, 926
- ‘Avoid’ policies 565–566
- cycling and urban infrastructure 908, 926
- modal shift from private 558–559
- public transport 915, 1079–1080, 1081, 1082
- smart technology and 1062–1063, 1062
- and urban form 897–898, 1058–1059, 1058, 1059
- urban planning and transport 1058–1059, 1059
- vulnerability 878–879
- waste and waste management 909–910
- water systems 910
- wood products building materials 804–805
- see also cities\**
- urbanisation\*** 166, 863, 864
- biophysical effects 766
- and climate change 877–880
- demand for materials 1175–1176
- developing countries 869, 870–871
- development pathways and emissions 452–453, 466–467
- emerging economies 870
- and emissions 768, 887
- and income 868, 868, 887
- megatrend 877–880
- rapid 255
- resource-efficient and walkable 893
- scenarios of future urban land expansion 887–890, 888, 889, 891, 892
- Uruguay** 256
- USD100 billion a year commitment** 1560, 1565, 1604
- USEPA emissions data** 764
- V**
- value chains** 659
- values** *see* ideas, values and beliefs
- variable renewable energy (VRE)\***
- batteries and energy storage 627–628
- electricity transmission 660
- energy storage 652–653
- flexibility technologies 651–652
- integration 650
- net-zero energy systems 674
- and SDGs 706
- vehicle emissions standards** 1388–1389
- Vietnam** 626, 793, 875
- voluntary actions, agreements and networks** 1392

city and sub-national networks 914, 1369, 1378–1379, 1381, 1512–1513, 1736, 1756, 1758, 1770

forestry, land use and REDD+ 813–815, 818, 1503–1504, 1507

international partnerships and initiatives 1509–1512

methane emissions reduction 430, 1511

offset credits 813–815, 1386, 1507

sustainability standards and labelling 1293–1294, 1679–1680

technology and innovation 1679–1680

**Voluntary Local Reviews (VLRs)** 1733

**Voluntary National Reviews (VNRs)** 1733

**vulnerability\*** 525, 1400, 1729

buildings 956

developing countries 1757

energy sector 1752

fossil fuel-dependent countries 1746

and just transitions 1747

risk management for V20 countries 1595

and sustainable development 42

urban systems and other settlements 878–879

water resources 1754

## W

**waste and waste management** 1192, 1763

anaerobic digestion 1301

animal waste management 795–796, 806

biochar production 1301–1302

co-benefits 876, 1210

costs and potentials 38–39, 1257, 1258

e-waste 539, 540

emissions sources 1833

food loss and waste 254, 803–804, 1285, 1290, 1750–1751

food system GHG emissions 1281, 1281, 1282

industry 1169–1170, 1179, 1180, 1186, 1189, 1192, 1210

SDG co-benefits 1210

urban symbiosis 1180

urban systems and other settlements 876

**waste heat to power (WHP)** 1181

**waste-to-energy** 649–650, 910

**water**

availability/quality 825–826, 1301, 1741

demand 374–375, 666

energy-water-land nexus 1859

mitigation and sustainable development 374–375

resources 1751–1753

**water-energy-food nexus** 1295–1296, 1317–1318

accelerated mitigation pathways 442

accelerating sustainable transitions 1751–1754, 1758, 1759, 1760–1761

Food-Energy-Water (FEW) nexus 1402–1403, 1406

technology and innovation 1691

**water footprint** 647–648

**water management** 793, 1317–1318

**water management systems** 1753, 1754, 1758

**water use**

CDR and CCS 668, 705–706

hydropower 666, 1303

nuclear power 640

power plants with CCS 643

**water use efficiency** 793

**well-being\*** 176, 254–255, 375–377, 505, 508, 509–510

AFOLU linkages 827, 829

buildings 956

co-benefits of urban mitigation 894, 898, 905

and demand-side mitigation 521–525, 572

eudaimonic 513

and GHG emissions 512–514

hedonic 513

impacts of solar radiation modification (SRM) 1491–1492

metrics 512–514, 515, 516, 570

policies for 521–524

positive feedbacks 522

services for 514–516, 515, 517, 519

social well-being benefits of buildings mitigation 1003–1004

women 525–527

**West and East Africa** 795

**white certificates** 1011, 1677, 1680

**wildfires** 670

**wind energy\*** 11, 12, 634–637, 635, 636, 1752

capacity and generation 615, 627, 627

capacity factors 635–636

climate change impacts 665, 667

costs 168, 634, 635, 636–637, 636

costs and potential 634–635

critical strategic minerals 637–638

electricity prices 615

environmental/ecological impacts 637

impact on climate 670–671

industry 1183, 1216

land occupation, impacts and risks 1302

levelised costs of electricity (LCOE) 636, 636, 662

low-carbon energy transition 689

net-zero energy systems 674

offshore 257, 258, 634, 635–637

onshore 257, 258, 634, 635, 636

public support 637

synergies and trade-offs 1697, 1761

technical potential 634–635

technology improvement 257, 259

technology transfer and cooperation 1502

trends 627, 627

**women** 525–527

**wood products** 804–805, 995–996, 1299

**World Business Council on Sustainable Development (WBCSD)** 1511

**World in 2050 Initiative (TWI2050)** 1742

**World Trade Organization (WTO)** 1500–1501

## Y

**youth activism** 506, 525, 557, 1375, 1508–1509, 1765

## Z

**zero deforestation pledges** 272–273

**Zimbabwe** 626, 1113

