# Annex

The EDMC Energy Databank provides even more data to its members.

**Table A1 | Regional groupings**

| | | |
|---|---|---|
| Asia | People's Republic of China | |
| | Hong Kong (China) | |
| | India | |
| | Japan | |
| | Korea | |
| | Chinese Taipei | |
| | ASEAN | Brunei Darussalam |
| | | Cambodia |
| | | Indonesia |
| | | Lao People's Democratic Republic |
| | | Malaysia |
| | | Myanmar |
| | | Philippines |
| | | Singapore |
| | | Thailand |
| | | Viet Nam |
| | Other Asia | Bangladesh, Democratic People's Republic of Korea, Mongolia, Nepal, Pakistan, Sri Lanka, and Other non-Asia in IEA statistics |
| North America | Canada | |
| | United States | |
| Latin America | Brazil | |
| | Chile | |
| | Mexico | |
| | Other Latin America | Argentina, Plurinational State of Bolivia, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Bolivarian Republic of Venezuela, and Other non–OECD Americas in IEA statistics |
| Europe | Advanced Europe | France |
| | | Germany |
| | | Italy |

| | | | |
|---|---|---|---|
| | | United Kingdom | |
| | | Others | Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and Republic of Türkiye |
| | Other Europe/Eurasia | Russian Federation | |
| | | Other Former Soviet Union | Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan |
| | | Other Emerging and Developing Europe | Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Gibraltar, Kosovo, Malta, Montenegro, Republic of North Macedonia, Romania, and Serbia |
| Africa | South Africa (Republic of) | | |
| | North Africa | Algeria, Egypt, Libya, Morocco, and Tunisia | |
| | Other Africa | Angola, Benin, Botswana, Cameroon, Republic of the Congo, Democratic Republic of Congo, Côte d'Ivoire, Eritrea, Kingdom of Eswatini, Ethiopia, Gabon, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Sudan, Sudan, Togo, United Republic of Tanzania, Uganda, Zambia, Zimbabwe, and Other Africa in IEA statistics | |
| Middle East | Islamic Republic of Iran | | |
| | Iraq | | |
| | Kuwait | | |
| | Oman | | |
| | Qatar | | |
| | Saudi Arabia | | |
| | United Arab Emirates | | |

| | | |
|---|---|---|
| | Other Middle East | Bahrain, Israel, Jordan, Lebanon, Syrian Arab Republic, and Yemen |
| Oceania | Australia | |
| | New Zealand | |
| International bunkers | | |
| European Union | Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, and Sweden | |
| Advanced Economies | Advanced Europe, Hong Kong, Japan, Korea, North America, Oceania, Singapore, and Chinese Taipei | |
| Emerging and Developing Economies | Africa, Brunei Darussalam, Cambodia, People's Republic of China, India, Indonesia, Lao People's Democratic Republic, Latin America, Malaysia, Middle East, Myanmar, Other Europe/Eurasia, Other Asia, Philippines, Thailand, and Viet Nam | |
| Group of Seven | Canada, France, Germany, Italy, Japan, United Kingdom, and United States | |
| Organization of the Petroleum Exporting Countries (OPEC) | Algeria, Republic of the Congo, Equatorial Guinea, Gabon, Islamic Republic of Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, United Arab Emirates, and Bolivarian Republic of Venezuela | |

Notes: (1) Other Former Soviet Union includes Estonia, Latvia and Lithuania before 1990, and (2) Advanced Economies, and Emerging and Developing Economies include regions.

## Table A2 | International energy prices

| Real prices | | | Reference | | | Advanced Technologies | | |
|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
| Oil | $2024/bbl | 79 | 80 | 85 | 85 | 75 | 70 | 65 |
| Natural gas | | | | | | | | |
| Japan | $2024/MBtu | 12.1 | 8.8 | 9.2 | 9.1 | 8.3 | 8.1 | 7.6 |
| Europe (Netherlands) | $2024/MBtu | 11.0 | 8.9 | 9.8 | 9.9 | 8.7 | 9.0 | 8.6 |
| United States | $2024/MBtu | 2.4 | 3.0 | 4.2 | 4.7 | 3.0 | 4.1 | 4.0 |
| Steam coal | $2024/t | 157 | 105 | 110 | 110 | 100 | 90 | 80 |

| Nominal prices | | | Reference | | | Advanced Technologies | | |
|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
| Oil | $/bbl | 79 | 91 | 131 | 179 | 89 | 112 | 144 |
| Natural gas | | | | | | | | |
| Japan | $/MBtu | 12.1 | 10.0 | 14.2 | 19.1 | 9.9 | 12.9 | 16.8 |
| Europe (Netherlands) | $/MBtu | 11.0 | 10.1 | 15.0 | 21.0 | 10.3 | 14.4 | 18.9 |
| United States | $/MBtu | 2.4 | 3.4 | 6.5 | 9.9 | 3.6 | 6.6 | 8.8 |
| Steam coal | $/t | 157 | 120 | 169 | 232 | 119 | 145 | 177 |

(Intentionally blank)

## Table A3 | Population

| | (Million) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 5 292 | 6 153 | 6 991 | 8 054 | 8 526 | 8 838 | 9 126 | 9 385 | 9 606 |
| Asia | 2 954 | 3 461 | 3 891 | 4 350 | 4 500 | 4 589 | 4 656 | 4 700 | 4 718 |
| China | 1 135 | 1 263 | 1 338 | 1 411 | 1 387 | 1 362 | 1 332 | 1 295 | 1 250 |
| India | 865 | 1 058 | 1 243 | 1 438 | 1 525 | 1 579 | 1 623 | 1 656 | 1 680 |
| Japan | 123 | 127 | 128 | 125 | 120 | 116 | 112 | 109 | 105 |
| Korea | 43 | 47 | 50 | 52 | 51 | 50 | 49 | 47 | 45 |
| Chinese Taipei | 20 | 22 | 23 | 23 | 23 | 22 | 21 | 20 | 19 |
| ASEAN | 439 | 526 | 603 | 689 | 721 | 740 | 756 | 767 | 773 |
| Indonesia | 184 | 216 | 246 | 281 | 296 | 305 | 312 | 317 | 321 |
| Malaysia | 18 | 23 | 29 | 35 | 38 | 40 | 42 | 43 | 44 |
| Myanmar | 40 | 45 | 49 | 54 | 56 | 57 | 58 | 59 | 59 |
| Philippines | 63 | 80 | 96 | 115 | 121 | 126 | 130 | 132 | 134 |
| Singapore | 3.0 | 4.0 | 5.1 | 5.9 | 6.2 | 6.3 | 6.3 | 6.3 | 6.2 |
| Thailand | 55 | 63 | 69 | 72 | 71 | 71 | 70 | 68 | 66 |
| Viet Nam | 66 | 77 | 87 | 100 | 104 | 107 | 108 | 110 | 110 |
| North America | 277 | 313 | 343 | 377 | 391 | 400 | 408 | 415 | 420 |
| United States | 250 | 282 | 309 | 337 | 349 | 356 | 363 | 369 | 373 |
| Latin America | 438 | 517 | 585 | 655 | 684 | 701 | 714 | 722 | 727 |
| Brazil | 149 | 174 | 194 | 211 | 216 | 218 | 219 | 219 | 217 |
| Advanced Europe | 507 | 529 | 558 | 587 | 587 | 586 | 583 | 580 | 574 |
| Other Europe/Eurasia | 338 | 336 | 333 | 339 | 343 | 343 | 344 | 345 | 346 |
| Russia | 148 | 147 | 143 | 144 | 140 | 138 | 137 | 136 | 135 |
| Africa | 625 | 805 | 1 038 | 1 430 | 1 667 | 1 843 | 2 022 | 2 201 | 2 378 |
| Middle East | 131 | 168 | 217 | 284 | 320 | 342 | 364 | 384 | 404 |
| Oceania | 20 | 23 | 26 | 32 | 34 | 35 | 36 | 37 | 39 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 1 000 | 1 072 | 1 140 | 1 209 | 1 219 | 1 223 | 1 223 | 1 221 | 1 215 |
| Group of Seven | 652 | 699 | 741 | 781 | 791 | 795 | 798 | 800 | 800 |
| Emerging and Developing Economies | 4 291 | 5 081 | 5 851 | 6 845 | 7 307 | 7 616 | 7 903 | 8 164 | 8 391 |
| Emerging and Developing Asia | 2 759 | 3 255 | 3 678 | 4 137 | 4 293 | 4 387 | 4 461 | 4 511 | 4 536 |
| Non-Asia | 2 337 | 2 692 | 3 101 | 3 704 | 4 026 | 4 250 | 4 470 | 4 684 | 4 888 |
| European Union | 421 | 429 | 442 | 449 | 446 | 442 | 438 | 433 | 427 |

Source: United Nations "World Population Prospects 2024", World Bank "World Development Indicators"
Note: Same value for Reference Scenario and Advanced Technologies Scenario

| CAGR (%) | | | | |
|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.3 | 0.8 | 0.7 | 0.5 | 0.7 |
| 1.2 | 0.5 | 0.3 | 0.1 | 0.3 |
| 0.7 | -0.2 | -0.4 | -0.6 | -0.4 |
| 1.6 | 0.8 | 0.6 | 0.3 | 0.6 |
| 0.0 | -0.6 | -0.6 | -0.6 | -0.6 |
| 0.6 | -0.2 | -0.4 | -0.8 | -0.5 |
| 0.4 | -0.5 | -0.6 | -0.9 | -0.7 |
| 1.4 | 0.7 | 0.5 | 0.2 | 0.4 |
| 1.3 | 0.7 | 0.5 | 0.3 | 0.5 |
| 2.1 | 1.1 | 0.9 | 0.7 | 0.9 |
| 0.9 | 0.6 | 0.3 | 0.1 | 0.3 |
| 1.8 | 0.8 | 0.7 | 0.4 | 0.6 |
| 2.0 | 0.6 | 0.3 | -0.2 | 0.2 |
| 0.8 | -0.1 | -0.2 | -0.5 | -0.3 |
| 1.3 | 0.5 | 0.4 | 0.1 | 0.3 |
| 0.9 | 0.5 | 0.4 | 0.3 | 0.4 |
| 0.9 | 0.5 | 0.4 | 0.3 | 0.4 |
| 1.2 | 0.6 | 0.4 | 0.2 | 0.4 |
| 1.1 | 0.3 | 0.1 | -0.1 | 0.1 |
| 0.4 | 0.0 | -0.1 | -0.2 | -0.1 |
| 0.0 | 0.2 | 0.0 | 0.1 | 0.1 |
| -0.1 | -0.4 | -0.3 | -0.2 | -0.2 |
| 2.5 | 2.2 | 1.9 | 1.6 | 1.9 |
| 2.4 | 1.7 | 1.3 | 1.0 | 1.3 |
| 1.4 | 0.9 | 0.7 | 0.6 | 0.7 |
| n.a. | n.a. | n.a. | n.a. | n.a. |
| 0.6 | 0.1 | 0.0 | -0.1 | 0.0 |
| 0.5 | 0.2 | 0.1 | 0.0 | 0.1 |
| 1.4 | 0.9 | 0.8 | 0.6 | 0.8 |
| 1.2 | 0.5 | 0.4 | 0.2 | 0.3 |
| 1.4 | 1.2 | 1.1 | 0.9 | 1.0 |
| 0.2 | -0.1 | -0.2 | -0.3 | -0.2 |

## Table A4 | GDP

| | ($2015 billion) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 36 016 | 48 379 | 65 081 | 93 506 | 112 250 | 127 708 | 145 013 | 164 008 | 184 245 |
| Asia | 6 719 | 10 478 | 18 086 | 32 734 | 42 276 | 50 161 | 59 295 | 69 593 | 80 766 |
| China | 1 041 | 2 825 | 7 712 | 17 612 | 23 232 | 27 323 | 31 895 | 36 873 | 42 032 |
| India | 475 | 817 | 1 567 | 3 333 | 5 148 | 6 930 | 9 163 | 11 880 | 15 058 |
| Japan | 3 510 | 3 987 | 4 219 | 4 601 | 4 764 | 4 942 | 5 131 | 5 317 | 5 500 |
| Korea | 402 | 799 | 1 261 | 1 764 | 1 997 | 2 175 | 2 343 | 2 495 | 2 623 |
| Chinese Taipei | 161 | 307 | 463 | 688 | 826 | 913 | 999 | 1 083 | 1 159 |
| ASEAN | 739 | 1 180 | 1 975 | 3 377 | 4 537 | 5 645 | 6 955 | 8 443 | 10 075 |
| Indonesia | 270 | 395 | 658 | 1 179 | 1 649 | 2 085 | 2 606 | 3 221 | 3 929 |
| Malaysia | 75 | 148 | 233 | 401 | 533 | 646 | 775 | 920 | 1 076 |
| Myanmar | 7.1 | 14 | 44 | 67 | 74 | 90 | 113 | 140 | 172 |
| Philippines | 107 | 143 | 229 | 430 | 646 | 853 | 1 087 | 1 324 | 1 535 |
| Singapore | 71 | 141 | 248 | 392 | 468 | 522 | 571 | 615 | 656 |
| Thailand | 144 | 221 | 347 | 459 | 531 | 625 | 738 | 862 | 995 |
| Viet Nam | 45 | 94 | 177 | 379 | 545 | 711 | 924 | 1 186 | 1 496 |
| North America | 10 663 | 14 881 | 17 739 | 23 868 | 27 532 | 30 218 | 33 051 | 35 972 | 38 929 |
| United States | 9 785 | 13 718 | 16 339 | 22 063 | 25 520 | 28 022 | 30 663 | 33 387 | 36 146 |
| Latin America | 2 636 | 3 592 | 4 885 | 5 757 | 6 834 | 7 874 | 9 029 | 10 261 | 11 544 |
| Brazil | 917 | 1 186 | 1 703 | 1 961 | 2 315 | 2 688 | 3 111 | 3 567 | 4 044 |
| Advanced Europe | 11 667 | 14 676 | 16 969 | 20 871 | 23 040 | 24 837 | 26 651 | 28 479 | 30 246 |
| Other Europe/Eurasia | 1 797 | 1 233 | 2 050 | 2 706 | 3 211 | 3 558 | 3 936 | 4 353 | 4 800 |
| Russia | 1 161 | 780 | 1 251 | 1 545 | 1 724 | 1 860 | 2 015 | 2 187 | 2 370 |
| Africa | 967 | 1 233 | 2 040 | 2 865 | 3 742 | 4 682 | 5 843 | 7 227 | 8 845 |
| Middle East | 911 | 1 378 | 2 092 | 3 000 | 3 661 | 4 200 | 4 791 | 5 446 | 6 167 |
| Oceania | 656 | 907 | 1 220 | 1 704 | 1 953 | 2 177 | 2 417 | 2 676 | 2 950 |
| International Bunkers | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Advanced Economies | 27 250 | 35 877 | 42 387 | 54 216 | 60 965 | 66 212 | 71 633 | 77 139 | 82 582 |
| Group of Seven | 21 501 | 27 927 | 31 987 | 40 084 | 44 720 | 48 450 | 52 410 | 56 468 | 60 526 |
| Emerging and Developing Economies | 8 766 | 12 502 | 22 694 | 39 290 | 51 285 | 61 496 | 73 380 | 86 869 | 101 663 |
| Emerging and Developing Asia | 2 455 | 5 066 | 11 628 | 24 961 | 33 837 | 41 182 | 49 782 | 59 581 | 70 308 |
| Non-Asia | 29 297 | 37 900 | 46 995 | 60 772 | 69 974 | 77 547 | 85 718 | 94 415 | 103 479 |
| European Union | 9 094 | 11 284 | 12 931 | 15 477 | 17 038 | 18 344 | 19 670 | 21 003 | 22 287 |

Source: World Bank "World Development Indicators", etc. (historical)
The Institute of Energy Economics, Japan (assumption)
Note: Same value for Reference Scenario and Advanced Technologies Scenario

| CAGR (%) | | | | |
|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.9 | 2.6 | 2.6 | 2.4 | 2.5 |
| 4.9 | 3.7 | 3.4 | 3.1 | 3.4 |
| 8.9 | 4.0 | 3.2 | 2.8 | 3.3 |
| 6.1 | 6.4 | 5.9 | 5.1 | 5.7 |
| 0.8 | 0.5 | 0.7 | 0.7 | 0.7 |
| 4.6 | 1.8 | 1.6 | 1.1 | 1.5 |
| 4.5 | 2.7 | 1.9 | 1.5 | 2.0 |
| 4.7 | 4.3 | 4.4 | 3.8 | 4.1 |
| 4.6 | 4.9 | 4.7 | 4.2 | 4.6 |
| 5.2 | 4.1 | 3.8 | 3.3 | 3.7 |
| 7.0 | 1.5 | 4.3 | 4.3 | 3.6 |
| 4.3 | 6.0 | 5.3 | 3.5 | 4.8 |
| 5.3 | 2.6 | 2.0 | 1.4 | 1.9 |
| 3.6 | 2.1 | 3.3 | 3.0 | 2.9 |
| 6.7 | 5.3 | 5.4 | 4.9 | 5.2 |
| 2.5 | 2.1 | 1.8 | 1.7 | 1.8 |
| 2.5 | 2.1 | 1.9 | 1.7 | 1.8 |
| 2.4 | 2.5 | 2.8 | 2.5 | 2.6 |
| 2.3 | 2.4 | 3.0 | 2.7 | 2.7 |
| 1.8 | 1.4 | 1.5 | 1.3 | 1.4 |
| 1.2 | 2.5 | 2.1 | 2.0 | 2.1 |
| 0.9 | 1.6 | 1.6 | 1.6 | 1.6 |
| 3.3 | 3.9 | 4.6 | 4.2 | 4.3 |
| 3.7 | 2.9 | 2.7 | 2.6 | 2.7 |
| 2.9 | 2.0 | 2.2 | 2.0 | 2.1 |
| n.a. | n.a. | n.a. | n.a. | n.a. |
| 2.1 | 1.7 | 1.6 | 1.4 | 1.6 |
| 1.9 | 1.6 | 1.6 | 1.5 | 1.5 |
| 4.7 | 3.9 | 3.6 | 3.3 | 3.6 |
| 7.3 | 4.4 | 3.9 | 3.5 | 3.9 |
| 2.2 | 2.0 | 2.1 | 1.9 | 2.0 |
| 1.6 | 1.4 | 1.4 | 1.3 | 1.4 |

## Table A5 | GDP per capita

| | ($2015 thousand/person) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 6.8 | 7.9 | 9.3 | 12 | 13 | 14 | 16 | 17 | 19 |
| Asia | 2.3 | 3.0 | 4.6 | 7.5 | 9.4 | 11 | 13 | 15 | 17 |
| China | 0.9 | 2.2 | 5.8 | 12 | 17 | 20 | 24 | 28 | 34 |
| India | 0.5 | 0.8 | 1.3 | 2.3 | 3.4 | 4.4 | 5.6 | 7.2 | 9.0 |
| Japan | 28 | 31 | 33 | 37 | 40 | 43 | 46 | 49 | 52 |
| Korea | 9.4 | 17 | 25 | 34 | 39 | 43 | 48 | 53 | 58 |
| Chinese Taipei | 7.9 | 14 | 20 | 29 | 37 | 41 | 47 | 53 | 60 |
| ASEAN | 1.7 | 2.2 | 3.3 | 4.9 | 6.3 | 7.6 | 9.2 | 11 | 13 |
| Indonesia | 1.5 | 1.8 | 2.7 | 4.2 | 5.6 | 6.8 | 8.4 | 10 | 12 |
| Malaysia | 4.2 | 6.5 | 8.1 | 11 | 14 | 16 | 19 | 21 | 24 |
| Myanmar | 0.2 | 0.3 | 0.9 | 1.2 | 1.3 | 1.6 | 1.9 | 2.4 | 2.9 |
| Philippines | 1.7 | 1.8 | 2.4 | 3.7 | 5.3 | 6.8 | 8.4 | 10.0 | 11 |
| Singapore | 23 | 35 | 49 | 66 | 76 | 83 | 90 | 98 | 106 |
| Thailand | 2.6 | 3.5 | 5.1 | 6.4 | 7.5 | 8.9 | 11 | 13 | 15 |
| Viet Nam | 0.7 | 1.2 | 2.0 | 3.8 | 5.2 | 6.7 | 8.5 | 11 | 14 |
| North America | 38 | 48 | 52 | 63 | 70 | 76 | 81 | 87 | 93 |
| United States | 39 | 49 | 53 | 66 | 73 | 79 | 84 | 91 | 97 |
| Latin America | 6.0 | 6.9 | 8.4 | 8.8 | 10.0 | 11 | 13 | 14 | 16 |
| Brazil | 6.1 | 6.8 | 8.8 | 9.3 | 11 | 12 | 14 | 16 | 19 |
| Advanced Europe | 23 | 28 | 30 | 36 | 39 | 42 | 46 | 49 | 53 |
| Other Europe/Eurasia | 5.3 | 3.7 | 6.1 | 8.0 | 9.4 | 10 | 11 | 13 | 14 |
| Russia | 7.8 | 5.3 | 8.8 | 11 | 12 | 13 | 15 | 16 | 18 |
| Africa | 1.5 | 1.5 | 2.0 | 2.0 | 2.2 | 2.5 | 2.9 | 3.3 | 3.7 |
| Middle East | 6.9 | 8.2 | 9.6 | 11 | 11 | 12 | 13 | 14 | 15 |
| Oceania | 32 | 40 | 46 | 53 | 58 | 62 | 67 | 71 | 76 |
| International Bunkers | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Advanced Economies | 27 | 33 | 37 | 45 | 50 | 54 | 59 | 63 | 68 |
| Group of Seven | 33 | 40 | 43 | 51 | 57 | 61 | 66 | 71 | 76 |
| Emerging and Developing Economies | 2.0 | 2.5 | 3.9 | 5.7 | 7.0 | 8.1 | 9.3 | 11 | 12 |
| Emerging and Developing Asia | 0.9 | 1.6 | 3.2 | 6.0 | 7.9 | 9.4 | 11 | 13 | 16 |
| Non-Asia | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| European Union | 22 | 26 | 29 | 34 | 38 | 41 | 45 | 48 | 52 |

Source: World Bank "World Development Indicators", International Energy Agency "World Energy Balances", etc. (historical)
The Institute of Energy Economics, Japan (assumption)
Note: Same value for Reference Scenario and Advanced Technologies Scenario

| CAGR (%) | | | | |
|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.6 | 1.8 | 1.9 | 1.9 | 1.9 |
| 3.7 | 3.2 | 3.1 | 3.0 | 3.1 |
| 8.2 | 4.3 | 3.6 | 3.5 | 3.7 |
| 4.5 | 5.5 | 5.3 | 4.7 | 5.1 |
| 0.8 | 1.1 | 1.4 | 1.4 | 1.3 |
| 4.0 | 1.9 | 2.1 | 2.0 | 2.0 |
| 4.1 | 3.1 | 2.5 | 2.4 | 2.6 |
| 3.3 | 3.6 | 3.9 | 3.5 | 3.7 |
| 3.2 | 4.1 | 4.1 | 3.9 | 4.0 |
| 3.1 | 3.0 | 2.9 | 2.7 | 2.8 |
| 6.0 | 0.9 | 4.0 | 4.2 | 3.3 |
| 2.4 | 5.1 | 4.7 | 3.1 | 4.2 |
| 3.2 | 2.0 | 1.7 | 1.6 | 1.7 |
| 2.7 | 2.2 | 3.6 | 3.5 | 3.2 |
| 5.3 | 4.8 | 5.0 | 4.8 | 4.9 |
| 1.5 | 1.5 | 1.4 | 1.4 | 1.4 |
| 1.6 | 1.6 | 1.4 | 1.4 | 1.5 |
| 1.2 | 1.8 | 2.4 | 2.3 | 2.2 |
| 1.3 | 2.1 | 2.8 | 2.7 | 2.6 |
| 1.3 | 1.4 | 1.5 | 1.4 | 1.5 |
| 1.2 | 2.3 | 2.0 | 1.9 | 2.1 |
| 1.0 | 1.9 | 1.8 | 1.8 | 1.8 |
| 0.8 | 1.6 | 2.6 | 2.6 | 2.3 |
| 1.3 | 1.1 | 1.4 | 1.5 | 1.4 |
| 1.5 | 1.1 | 1.5 | 1.4 | 1.3 |
| n.a. | n.a. | n.a. | n.a. | n.a. |
| 1.5 | 1.6 | 1.6 | 1.5 | 1.6 |
| 1.4 | 1.4 | 1.5 | 1.4 | 1.4 |
| 3.2 | 2.9 | 2.8 | 2.7 | 2.8 |
| 6.0 | 3.9 | 3.5 | 3.3 | 3.6 |
| 0.8 | 0.8 | 1.0 | 1.0 | 0.9 |
| 1.4 | 1.5 | 1.6 | 1.5 | 1.6 |

## Table A6 | Primary energy consumption

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 8 701 | 9 938 | 12 735 | 15 135 | 15 702 | 16 164 | 16 538 | 16 922 | 17 266 |
| Asia | 2 073 | 2 839 | 4 758 | 6 869 | 7 301 | 7 595 | 7 865 | 8 137 | 8 340 |
| China | 878 | 1 134 | 2 541 | 4 022 | 4 032 | 3 930 | 3 842 | 3 722 | 3 528 |
| India | 280 | 418 | 661 | 1 098 | 1 361 | 1 574 | 1 781 | 2 010 | 2 234 |
| Japan | 437 | 516 | 500 | 378 | 358 | 339 | 320 | 305 | 293 |
| Korea | 90 | 186 | 244 | 276 | 263 | 261 | 252 | 242 | 232 |
| Chinese Taipei | 51 | 90 | 118 | 111 | 117 | 116 | 114 | 111 | 108 |
| ASEAN | 217 | 355 | 506 | 757 | 919 | 1 090 | 1 229 | 1 369 | 1 513 |
| Indonesia | 85 | 127 | 166 | 276 | 360 | 470 | 542 | 615 | 695 |
| Malaysia | 21 | 48 | 73 | 106 | 118 | 128 | 138 | 147 | 155 |
| Myanmar | 11 | 14 | 14 | 22 | 23 | 25 | 28 | 32 | 36 |
| Philippines | 27 | 39 | 42 | 67 | 85 | 100 | 115 | 127 | 137 |
| Singapore | 12 | 19 | 25 | 31 | 34 | 35 | 35 | 36 | 36 |
| Thailand | 42 | 73 | 118 | 133 | 139 | 146 | 155 | 163 | 170 |
| Viet Nam | 18 | 29 | 59 | 102 | 134 | 158 | 184 | 214 | 245 |
| North America | 2 126 | 2 525 | 2 476 | 2 437 | 2 329 | 2 292 | 2 240 | 2 191 | 2 158 |
| United States | 1 914 | 2 273 | 2 216 | 2 143 | 2 046 | 2 012 | 1 965 | 1 925 | 1 900 |
| Latin America | 467 | 611 | 791 | 867 | 925 | 976 | 1 023 | 1 068 | 1 112 |
| Brazil | 141 | 188 | 268 | 313 | 331 | 355 | 376 | 396 | 413 |
| Advanced Europe | 1 644 | 1 759 | 1 834 | 1 548 | 1 456 | 1 409 | 1 353 | 1 287 | 1 229 |
| Other Europe/Eurasia | 1 514 | 988 | 1 113 | 1 160 | 1 161 | 1 167 | 1 167 | 1 175 | 1 183 |
| Russia | 879 | 619 | 693 | 791 | 778 | 776 | 773 | 771 | 769 |
| Africa | 354 | 437 | 610 | 813 | 898 | 985 | 1 047 | 1 115 | 1 196 |
| Middle East | 223 | 380 | 647 | 899 | 978 | 1 036 | 1 088 | 1 148 | 1 206 |
| Oceania | 99 | 125 | 145 | 150 | 154 | 152 | 151 | 149 | 148 |
| International Bunkers | 202 | 274 | 361 | 391 | 500 | 551 | 603 | 652 | 695 |
| Advanced Economies | 4 467 | 5 233 | 5 355 | 4 943 | 4 722 | 4 613 | 4 474 | 4 330 | 4 210 |
| Group of Seven | 3 490 | 4 024 | 3 945 | 3 555 | 3 365 | 3 270 | 3 161 | 3 050 | 2 974 |
| Emerging and Developing Economies | 4 032 | 4 430 | 7 020 | 9 800 | 10 481 | 10 999 | 11 461 | 11 941 | 12 361 |
| Emerging and Developing Asia | 1 475 | 2 015 | 3 859 | 6 062 | 6 519 | 6 835 | 7 135 | 7 435 | 7 665 |
| Non-Asia | 6 427 | 6 825 | 7 617 | 7 875 | 7 901 | 8 018 | 8 070 | 8 134 | 8 231 |
| European Union | 1 441 | 1 471 | 1 528 | 1 248 | 1 182 | 1 139 | 1 091 | 1 036 | 987 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.7 | 0.5 | 0.5 | 0.4 | 0.5 | 15 305 | 15 099 | 14 691 | 14 435 | 14 282 | 0.2 | -0.4 | -0.3 | -0.2 |
| 3.7 | 0.9 | 0.7 | 0.6 | 0.7 | 7 112 | 7 053 | 6 882 | 6 745 | 6 631 | 0.5 | -0.3 | -0.4 | -0.1 |
| 4.7 | 0.0 | -0.5 | -0.8 | -0.5 | 3 935 | 3 625 | 3 290 | 3 001 | 2 710 | -0.3 | -1.8 | -1.9 | -1.5 |
| 4.2 | 3.1 | 2.7 | 2.3 | 2.7 | 1 324 | 1 459 | 1 558 | 1 636 | 1 725 | 2.7 | 1.6 | 1.0 | 1.7 |
| -0.4 | -0.8 | -1.1 | -0.9 | -0.9 | 355 | 326 | 296 | 278 | 263 | -0.9 | -1.8 | -1.2 | -1.3 |
| 3.5 | -0.7 | -0.4 | -0.8 | -0.6 | 262 | 253 | 241 | 227 | 209 | -0.7 | -0.8 | -1.4 | -1.0 |
| 2.4 | 0.8 | -0.3 | -0.6 | -0.1 | 115 | 109 | 102 | 95 | 90 | 0.5 | -1.2 | -1.2 | -0.8 |
| 3.9 | 2.8 | 2.9 | 2.1 | 2.6 | 875 | 1 013 | 1 101 | 1 183 | 1 271 | 2.1 | 2.3 | 1.4 | 1.9 |
| 3.6 | 3.9 | 4.2 | 2.5 | 3.5 | 345 | 444 | 503 | 557 | 613 | 3.2 | 3.8 | 2.0 | 3.0 |
| 5.0 | 1.6 | 1.6 | 1.2 | 1.4 | 111 | 117 | 120 | 122 | 124 | 0.8 | 0.8 | 0.3 | 0.6 |
| 2.2 | 0.5 | 1.9 | 2.6 | 1.8 | 21 | 21 | 22 | 25 | 27 | -0.7 | 0.6 | 1.9 | 0.7 |
| 2.8 | 3.6 | 3.0 | 1.8 | 2.7 | 82 | 97 | 105 | 112 | 117 | 2.9 | 2.6 | 1.0 | 2.1 |
| 3.1 | 1.2 | 0.4 | 0.2 | 0.5 | 34 | 34 | 34 | 33 | 32 | 1.0 | 0.0 | -0.4 | 0.1 |
| 3.5 | 0.6 | 1.1 | 1.0 | 0.9 | 135 | 137 | 139 | 140 | 142 | 0.2 | 0.3 | 0.3 | 0.3 |
| 5.4 | 4.0 | 3.2 | 2.9 | 3.3 | 123 | 137 | 150 | 166 | 185 | 2.7 | 2.0 | 2.1 | 2.2 |
| 0.4 | -0.6 | -0.4 | -0.4 | -0.4 | 2 271 | 2 157 | 2 021 | 1 926 | 1 853 | -1.0 | -1.2 | -0.9 | -1.0 |
| 0.3 | -0.7 | -0.4 | -0.3 | -0.4 | 1 991 | 1 889 | 1 766 | 1 685 | 1 624 | -1.0 | -1.2 | -0.8 | -1.0 |
| 1.9 | 0.9 | 1.0 | 0.8 | 0.9 | 901 | 916 | 919 | 923 | 935 | 0.5 | 0.2 | 0.2 | 0.3 |
| 2.5 | 0.8 | 1.3 | 0.9 | 1.0 | 322 | 329 | 331 | 332 | 335 | 0.4 | 0.3 | 0.1 | 0.3 |
| -0.2 | -0.9 | -0.7 | -1.0 | -0.9 | 1 416 | 1 328 | 1 225 | 1 165 | 1 149 | -1.3 | -1.4 | -0.6 | -1.1 |
| -0.8 | 0.0 | 0.1 | 0.1 | 0.1 | 1 154 | 1 127 | 1 085 | 1 051 | 1 022 | -0.1 | -0.6 | -0.6 | -0.5 |
| -0.3 | -0.2 | -0.1 | -0.1 | -0.1 | 772 | 744 | 711 | 680 | 652 | -0.3 | -0.8 | -0.9 | -0.7 |
| 2.6 | 1.4 | 1.6 | 1.3 | 1.4 | 853 | 882 | 898 | 921 | 950 | 0.7 | 0.5 | 0.6 | 0.6 |
| 4.3 | 1.2 | 1.1 | 1.0 | 1.1 | 950 | 972 | 983 | 1 011 | 1 040 | 0.8 | 0.3 | 0.6 | 0.5 |
| 1.3 | 0.3 | -0.2 | -0.2 | -0.1 | 153 | 144 | 135 | 133 | 131 | 0.2 | -1.2 | -0.3 | -0.5 |
| 2.0 | 3.5 | 1.9 | 1.4 | 2.2 | 496 | 521 | 543 | 560 | 572 | 3.4 | 0.9 | 0.5 | 1.4 |
| 0.3 | -0.7 | -0.5 | -0.6 | -0.6 | 4 614 | 4 359 | 4 061 | 3 863 | 3 734 | -1.0 | -1.3 | -0.8 | -1.0 |
| 0.1 | -0.8 | -0.6 | -0.6 | -0.7 | 3 279 | 3 075 | 2 854 | 2 701 | 2 612 | -1.2 | -1.4 | -0.9 | -1.1 |
| 2.7 | 1.0 | 0.9 | 0.8 | 0.9 | 10 195 | 10 219 | 10 088 | 10 011 | 9 977 | 0.6 | -0.1 | -0.1 | 0.1 |
| 4.4 | 1.0 | 0.9 | 0.7 | 0.9 | 6 337 | 6 323 | 6 202 | 6 106 | 6 030 | 0.6 | -0.2 | -0.3 | 0.0 |
| 0.6 | 0.0 | 0.2 | 0.2 | 0.2 | 7 697 | 7 525 | 7 267 | 7 130 | 7 079 | -0.3 | -0.6 | -0.3 | -0.4 |
| -0.4 | -0.8 | -0.8 | -1.0 | -0.9 | 1 155 | 1 083 | 998 | 949 | 930 | -1.1 | -1.4 | -0.7 | -1.1 |

## Table A7 | Primary energy consumption, coal

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 2 219 | 2 313 | 3 645 | 4 202 | 3 668 | 3 452 | 3 337 | 3 270 | 3 144 |
| Asia | 785 | 1 033 | 2 400 | 3 422 | 3 081 | 2 915 | 2 829 | 2 771 | 2 650 |
| China | 531 | 665 | 1 790 | 2 449 | 2 030 | 1 776 | 1 606 | 1 441 | 1 224 |
| India | 93 | 146 | 274 | 510 | 574 | 652 | 726 | 817 | 904 |
| Japan | 77 | 97 | 115 | 99 | 73 | 63 | 53 | 48 | 45 |
| Korea | 22 | 39 | 68 | 66 | 62 | 56 | 54 | 50 | 45 |
| Chinese Taipei | 11 | 30 | 42 | 38 | 37 | 35 | 32 | 29 | 26 |
| ASEAN | 12 | 31 | 79 | 218 | 262 | 282 | 301 | 317 | 325 |
| Indonesia | 3.5 | 12 | 25 | 98 | 119 | 124 | 132 | 137 | 136 |
| Malaysia | 1.4 | 2.3 | 15 | 24 | 26 | 26 | 24 | 22 | 19 |
| Myanmar | 0.1 | 0.3 | 0.4 | 0.9 | 1.1 | 1.3 | 1.5 | 1.7 | 2.0 |
| Philippines | 1.3 | 4.6 | 7.0 | 23 | 29 | 35 | 37 | 38 | 38 |
| Singapore | 0.0 | - | 0.0 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| Thailand | 3.8 | 7.7 | 16 | 15 | 15 | 15 | 15 | 14 | 14 |
| Viet Nam | 2.2 | 4.4 | 15 | 51 | 63 | 71 | 80 | 92 | 103 |
| North America | 484 | 565 | 525 | 210 | 115 | 88 | 74 | 63 | 52 |
| United States | 460 | 533 | 501 | 202 | 111 | 84 | 70 | 60 | 49 |
| Latin America | 21 | 28 | 40 | 37 | 32 | 32 | 32 | 33 | 35 |
| Brazil | 9.7 | 13 | 14 | 14 | 13 | 13 | 14 | 15 | 15 |
| Advanced Europe | 450 | 331 | 301 | 168 | 118 | 102 | 85 | 76 | 67 |
| Other Europe/Eurasia | 365 | 209 | 211 | 218 | 191 | 183 | 180 | 181 | 186 |
| Russia | 191 | 120 | 106 | 143 | 125 | 121 | 116 | 114 | 116 |
| Africa | 74 | 90 | 109 | 103 | 99 | 104 | 111 | 122 | 131 |
| Middle East | 3.0 | 8.1 | 9.2 | 7.8 | 6.8 | 6.0 | 5.0 | 4.8 | 4.9 |
| Oceania | 36 | 49 | 52 | 36 | 26 | 23 | 21 | 19 | 18 |
| International Bunkers | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Advanced Economies | 1 087 | 1 115 | 1 109 | 622 | 433 | 368 | 320 | 286 | 254 |
| Group of Seven | 787 | 811 | 776 | 367 | 221 | 178 | 148 | 132 | 118 |
| Emerging and Developing Economies | 1 133 | 1 198 | 2 536 | 3 581 | 3 235 | 3 084 | 3 018 | 2 984 | 2 890 |
| Emerging and Developing Asia | 669 | 863 | 2 168 | 3 214 | 2 907 | 2 759 | 2 689 | 2 643 | 2 533 |
| Non-Asia | 1 434 | 1 280 | 1 246 | 780 | 587 | 537 | 508 | 499 | 495 |
| European Union | 393 | 285 | 252 | 129 | 90 | 77 | 66 | 60 | 55 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.0 | -1.9 | -0.9 | -0.6 | -1.1 | 3 431 | 2 872 | 2 421 | 2 057 | 1 698 | -2.9 | -3.4 | -3.5 | -3.3 |
| 4.6 | -1.5 | -0.8 | -0.7 | -0.9 | 2 909 | 2 450 | 2 045 | 1 700 | 1 358 | -2.3 | -3.5 | -4.0 | -3.4 |
| 4.7 | -2.6 | -2.3 | -2.7 | -2.5 | 1 949 | 1 524 | 1 165 | 884 | 581 | -3.2 | -5.0 | -6.7 | -5.2 |
| 5.3 | 1.7 | 2.4 | 2.2 | 2.1 | 535 | 548 | 536 | 492 | 469 | 0.7 | 0.0 | -1.3 | -0.3 |
| 0.8 | -4.3 | -3.2 | -1.5 | -2.9 | 62 | 49 | 38 | 33 | 32 | -6.6 | -4.8 | -1.8 | -4.2 |
| 3.4 | -1.0 | -1.4 | -1.9 | -1.5 | 51 | 40 | 29 | 22 | 17 | -3.8 | -5.4 | -5.0 | -4.9 |
| 3.7 | -0.5 | -1.3 | -1.9 | -1.4 | 32 | 28 | 23 | 19 | 15 | -2.5 | -3.3 | -4.0 | -3.3 |
| 9.1 | 2.6 | 1.4 | 0.8 | 1.5 | 239 | 216 | 205 | 195 | 178 | 1.3 | -1.5 | -1.4 | -0.8 |
| 10.6 | 2.7 | 1.1 | 0.3 | 1.2 | 111 | 100 | 97 | 90 | 76 | 1.7 | -1.3 | -2.4 | -0.9 |
| 9.0 | 1.3 | -0.5 | -2.3 | -0.7 | 24 | 22 | 18 | 13 | 8.2 | 0.3 | -3.0 | -7.5 | -3.8 |
| 8.4 | 1.7 | 3.2 | 3.1 | 2.8 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | -3.3 | 0.3 | 0.9 | -0.4 |
| 9.1 | 3.9 | 2.4 | 0.1 | 1.9 | 26 | 26 | 26 | 26 | 25 | 2.3 | -0.2 | -0.2 | 0.4 |
| 8.7 | 0.5 | -1.5 | -2.4 | -1.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | -0.6 | -2.8 | -3.8 | -2.6 |
| 4.3 | -0.1 | -0.1 | -0.5 | -0.3 | 14 | 13 | 11 | 10.0 | 8.9 | -0.8 | -2.4 | -2.2 | -1.9 |
| 9.9 | 3.3 | 2.4 | 2.6 | 2.7 | 54 | 46 | 43 | 45 | 49 | 0.9 | -2.1 | 1.3 | -0.1 |
| -2.5 | -8.3 | -4.3 | -3.4 | -5.0 | 82 | 36 | 25 | 25 | 24 | -12.6 | -11.1 | -0.8 | -7.8 |
| -2.5 | -8.2 | -4.4 | -3.5 | -5.1 | 79 | 33 | 23 | 22 | 21 | -12.5 | -11.7 | -0.7 | -8.0 |
| 1.7 | -2.0 | 0.0 | 1.0 | -0.2 | 29 | 26 | 24 | 25 | 27 | -3.4 | -1.8 | 1.2 | -1.1 |
| 1.1 | -1.2 | 0.9 | 1.1 | 0.4 | 12 | 11 | 11 | 11 | 11 | -2.4 | -0.5 | 0.3 | -0.7 |
| -2.9 | -4.9 | -3.2 | -2.4 | -3.3 | 106 | 82 | 63 | 55 | 53 | -6.4 | -5.1 | -1.6 | -4.2 |
| -1.5 | -1.9 | -0.6 | 0.3 | -0.6 | 181 | 161 | 150 | 139 | 131 | -2.6 | -1.9 | -1.3 | -1.9 |
| -0.9 | -1.9 | -0.8 | 0.0 | -0.8 | 120 | 110 | 100 | 91 | 85 | -2.5 | -1.8 | -1.6 | -1.9 |
| 1.0 | -0.6 | 1.2 | 1.7 | 0.9 | 92 | 85 | 79 | 75 | 68 | -1.7 | -1.4 | -1.5 | -1.5 |
| 3.0 | -2.0 | -3.0 | -0.1 | -1.7 | 4.9 | 3.6 | 3.2 | 3.4 | 3.5 | -6.4 | -4.1 | 0.8 | -2.9 |
| 0.0 | -4.3 | -2.4 | -1.3 | -2.5 | 27 | 29 | 31 | 35 | 34 | -3.9 | 1.4 | 1.0 | -0.2 |
| n.a. | n.a. | -0.7 | 1.9 | n.a. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | n.a. | 2.8 | 5.3 | n.a. |
| -1.7 | -5.0 | -3.0 | -2.3 | -3.3 | 362 | 265 | 209 | 189 | 175 | -7.4 | -5.3 | -1.7 | -4.6 |
| -2.3 | -7.0 | -3.9 | -2.2 | -4.1 | 173 | 107 | 84 | 77 | 74 | -10.2 | -7.0 | -1.2 | -5.7 |
| 3.5 | -1.4 | -0.7 | -0.4 | -0.8 | 3 069 | 2 608 | 2 211 | 1 869 | 1 523 | -2.2 | -3.2 | -3.7 | -3.1 |
| 4.9 | -1.4 | -0.8 | -0.6 | -0.9 | 2 762 | 2 332 | 1 955 | 1 626 | 1 293 | -2.1 | -3.4 | -4.0 | -3.3 |
| -1.8 | -4.0 | -1.4 | -0.3 | -1.7 | 522 | 423 | 376 | 357 | 341 | -5.6 | -3.2 | -1.0 | -3.0 |
| -3.3 | -5.1 | -3.1 | -1.7 | -3.1 | 80 | 61 | 49 | 44 | 42 | -6.7 | -4.8 | -1.3 | -4.0 |

## Table A8 | Primary energy consumption, oil

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 3 237 | 3 682 | 4 153 | 4 577 | 4 682 | 4 720 | 4 762 | 4 780 | 4 764 |
| Asia | 618 | 918 | 1 171 | 1 576 | 1 702 | 1 750 | 1 810 | 1 863 | 1 903 |
| China | 119 | 221 | 428 | 736 | 785 | 756 | 730 | 697 | 659 |
| India | 61 | 112 | 162 | 271 | 331 | 392 | 460 | 530 | 599 |
| Japan | 249 | 253 | 201 | 141 | 128 | 118 | 107 | 97 | 86 |
| Korea | 50 | 99 | 95 | 101 | 96 | 92 | 88 | 83 | 78 |
| Chinese Taipei | 28 | 42 | 48 | 37 | 43 | 42 | 40 | 39 | 36 |
| ASEAN | 88 | 154 | 191 | 236 | 260 | 282 | 307 | 329 | 347 |
| Indonesia | 33 | 58 | 67 | 73 | 79 | 86 | 93 | 99 | 103 |
| Malaysia | 11 | 19 | 25 | 33 | 33 | 33 | 34 | 33 | 32 |
| Myanmar | 0.7 | 2.0 | 1.3 | 6.2 | 6.5 | 7.8 | 9.7 | 12 | 14 |
| Philippines | 9.9 | 16 | 14 | 20 | 27 | 33 | 39 | 45 | 50 |
| Singapore | 11 | 17 | 18 | 20 | 22 | 23 | 23 | 23 | 23 |
| Thailand | 18 | 32 | 45 | 54 | 54 | 55 | 57 | 58 | 59 |
| Viet Nam | 2.7 | 7.8 | 18 | 25 | 31 | 35 | 40 | 45 | 51 |
| North America | 833 | 958 | 901 | 858 | 764 | 719 | 668 | 613 | 558 |
| United States | 757 | 871 | 807 | 762 | 682 | 641 | 596 | 546 | 497 |
| Latin America | 241 | 314 | 367 | 356 | 360 | 370 | 379 | 382 | 380 |
| Brazil | 59 | 88 | 106 | 115 | 112 | 116 | 121 | 126 | 130 |
| Advanced Europe | 617 | 654 | 605 | 519 | 461 | 423 | 387 | 350 | 314 |
| Other Europe/Eurasia | 459 | 199 | 216 | 237 | 237 | 232 | 227 | 221 | 215 |
| Russia | 264 | 126 | 139 | 151 | 150 | 147 | 143 | 139 | 136 |
| Africa | 85 | 100 | 161 | 215 | 235 | 256 | 283 | 311 | 338 |
| Middle East | 146 | 224 | 323 | 372 | 377 | 391 | 399 | 405 | 406 |
| Oceania | 35 | 40 | 48 | 53 | 61 | 59 | 56 | 53 | 49 |
| International Bunkers | 202 | 274 | 361 | 390 | 484 | 520 | 554 | 581 | 602 |
| Advanced Economies | 1 827 | 2 070 | 1 919 | 1 733 | 1 577 | 1 477 | 1 371 | 1 258 | 1 145 |
| Group of Seven | 1 447 | 1 578 | 1 413 | 1 247 | 1 104 | 1 025 | 942 | 856 | 771 |
| Emerging and Developing Economies | 1 208 | 1 338 | 1 873 | 2 454 | 2 621 | 2 723 | 2 837 | 2 940 | 3 017 |
| Emerging and Developing Asia | 277 | 500 | 805 | 1 274 | 1 412 | 1 474 | 1 550 | 1 620 | 1 679 |
| Non-Asia | 2 417 | 2 490 | 2 621 | 2 611 | 2 495 | 2 449 | 2 398 | 2 336 | 2 259 |
| European Union | 531 | 550 | 506 | 426 | 379 | 348 | 318 | 287 | 257 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.1 | 0.3 | 0.2 | 0.0 | 0.1 | 4 425 | 4 025 | 3 593 | 3 135 | 2 715 | -0.5 | -2.1 | -2.8 | -1.9 |
| 2.9 | 1.1 | 0.6 | 0.5 | 0.7 | 1 615 | 1 521 | 1 427 | 1 324 | 1 223 | 0.3 | -1.2 | -1.5 | -0.9 |
| 5.7 | 0.9 | -0.7 | -1.0 | -0.4 | 751 | 664 | 584 | 509 | 445 | 0.3 | -2.5 | -2.7 | -1.8 |
| 4.6 | 2.9 | 3.4 | 2.7 | 3.0 | 310 | 335 | 357 | 369 | 371 | 1.9 | 1.4 | 0.4 | 1.2 |
| -1.7 | -1.4 | -1.8 | -2.2 | -1.8 | 120 | 101 | 82 | 65 | 53 | -2.3 | -3.8 | -4.3 | -3.6 |
| 2.2 | -0.7 | -0.9 | -1.2 | -0.9 | 93 | 84 | 74 | 64 | 56 | -1.1 | -2.3 | -2.7 | -2.1 |
| 0.8 | 1.9 | -0.5 | -1.1 | -0.1 | 41 | 38 | 35 | 31 | 27 | 1.5 | -1.8 | -2.3 | -1.1 |
| 3.0 | 1.4 | 1.7 | 1.2 | 1.4 | 243 | 237 | 233 | 222 | 207 | 0.4 | -0.4 | -1.2 | -0.5 |
| 2.4 | 1.1 | 1.7 | 1.1 | 1.3 | 71 | 68 | 66 | 61 | 55 | -0.3 | -0.8 | -1.8 | -1.0 |
| 3.3 | 0.1 | 0.0 | -0.4 | -0.1 | 32 | 29 | 25 | 21 | 18 | -0.6 | -2.2 | -3.5 | -2.3 |
| 6.7 | 0.8 | 4.0 | 3.8 | 3.1 | 6.1 | 6.9 | 7.8 | 8.8 | 9.7 | -0.1 | 2.5 | 2.2 | 1.7 |
| 2.1 | 4.4 | 4.0 | 2.4 | 3.5 | 25 | 29 | 31 | 31 | 28 | 3.8 | 2.1 | -1.2 | 1.3 |
| 1.7 | 1.2 | 0.3 | 0.0 | 0.4 | 19 | 15 | 14 | 14 | 13 | -1.1 | -2.7 | -0.6 | -1.5 |
| 3.3 | 0.1 | 0.5 | 0.4 | 0.3 | 52 | 49 | 46 | 43 | 40 | -0.4 | -1.2 | -1.5 | -1.1 |
| 7.0 | 3.0 | 2.6 | 2.4 | 2.6 | 29 | 31 | 32 | 33 | 32 | 2.2 | 1.0 | 0.0 | 0.9 |
| 0.1 | -1.6 | -1.3 | -1.8 | -1.6 | 725 | 613 | 485 | 353 | 250 | -2.4 | -4.0 | -6.4 | -4.5 |
| 0.0 | -1.6 | -1.4 | -1.8 | -1.6 | 650 | 551 | 436 | 316 | 221 | -2.2 | -3.9 | -6.6 | -4.5 |
| 1.2 | 0.2 | 0.5 | 0.0 | 0.2 | 340 | 320 | 289 | 252 | 216 | -0.6 | -1.6 | -2.9 | -1.8 |
| 2.0 | -0.4 | 0.8 | 0.7 | 0.4 | 103 | 100 | 96 | 90 | 85 | -1.5 | -0.8 | -1.2 | -1.1 |
| -0.5 | -1.7 | -1.7 | -2.1 | -1.8 | 417 | 326 | 246 | 174 | 121 | -3.1 | -5.1 | -6.9 | -5.3 |
| -2.0 | 0.0 | -0.4 | -0.6 | -0.4 | 228 | 205 | 178 | 150 | 126 | -0.6 | -2.4 | -3.4 | -2.3 |
| -1.7 | 0.0 | -0.5 | -0.5 | -0.4 | 145 | 130 | 113 | 96 | 82 | -0.6 | -2.4 | -3.2 | -2.2 |
| 2.9 | 1.3 | 1.9 | 1.8 | 1.7 | 223 | 225 | 230 | 227 | 220 | 0.5 | 0.3 | -0.4 | 0.1 |
| 2.9 | 0.2 | 0.6 | 0.2 | 0.3 | 351 | 328 | 298 | 272 | 254 | -0.8 | -1.6 | -1.6 | -1.4 |
| 1.3 | 1.8 | -0.8 | -1.3 | -0.3 | 57 | 48 | 37 | 27 | 18 | 1.0 | -4.2 | -6.9 | -3.9 |
| 2.0 | 3.2 | 1.4 | 0.8 | 1.6 | 467 | 438 | 402 | 357 | 288 | 2.6 | -1.5 | -3.3 | -1.1 |
| -0.2 | -1.3 | -1.4 | -1.8 | -1.5 | 1 475 | 1 226 | 974 | 728 | 540 | -2.3 | -4.1 | -5.7 | -4.2 |
| -0.4 | -1.7 | -1.6 | -2.0 | -1.8 | 1 029 | 846 | 658 | 478 | 341 | -2.7 | -4.4 | -6.4 | -4.7 |
| 2.2 | 0.9 | 0.8 | 0.6 | 0.8 | 2 482 | 2 360 | 2 217 | 2 051 | 1 888 | 0.2 | -1.1 | -1.6 | -1.0 |
| 4.7 | 1.5 | 0.9 | 0.8 | 1.0 | 1 340 | 1 281 | 1 222 | 1 150 | 1 072 | 0.7 | -0.9 | -1.3 | -0.6 |
| 0.2 | -0.6 | -0.4 | -0.6 | -0.5 | 2 342 | 2 065 | 1 764 | 1 454 | 1 205 | -1.5 | -2.8 | -3.7 | -2.8 |
| -0.7 | -1.6 | -1.7 | -2.1 | -1.9 | 343 | 269 | 204 | 145 | 103 | -3.1 | -5.1 | -6.6 | -5.1 |

## Table A9 | Primary energy consumption, natural gas

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 1 662 | 2 069 | 2 737 | 3 443 | 3 616 | 3 804 | 3 989 | 4 221 | 4 483 |
| Asia | 116 | 234 | 454 | 739 | 884 | 983 | 1 089 | 1 206 | 1 325 |
| China | 13 | 21 | 89 | 319 | 370 | 382 | 386 | 378 | 354 |
| India | 11 | 23 | 54 | 58 | 84 | 108 | 132 | 156 | 179 |
| Japan | 44 | 66 | 86 | 80 | 72 | 70 | 64 | 60 | 57 |
| Korea | 2.7 | 18 | 38 | 51 | 52 | 51 | 54 | 55 | 54 |
| Chinese Taipei | 1.6 | 6.2 | 15 | 26 | 29 | 30 | 30 | 30 | 30 |
| ASEAN | 30 | 74 | 125 | 147 | 207 | 257 | 321 | 399 | 494 |
| Indonesia | 16 | 27 | 39 | 43 | 77 | 106 | 147 | 199 | 264 |
| Malaysia | 6.8 | 25 | 31 | 44 | 52 | 61 | 69 | 79 | 89 |
| Myanmar | 0.8 | 1.2 | 1.3 | 3.2 | 4.4 | 5.7 | 7.0 | 8.7 | 11 |
| Philippines | - | 0.0 | 3.1 | 2.6 | 4.6 | 7.0 | 11 | 16 | 21 |
| Singapore | - | 1.1 | 6.5 | 9.9 | 10 | 10 | 10 | 10 | 11 |
| Thailand | 5.0 | 17 | 33 | 35 | 41 | 44 | 45 | 47 | 49 |
| Viet Nam | 0.0 | 1.1 | 8.1 | 6.5 | 15 | 21 | 28 | 36 | 45 |
| North America | 493 | 622 | 635 | 885 | 896 | 895 | 883 | 870 | 867 |
| United States | 438 | 548 | 556 | 765 | 775 | 772 | 755 | 744 | 742 |
| Latin America | 71 | 118 | 178 | 207 | 215 | 232 | 254 | 283 | 314 |
| Brazil | 3.4 | 8.4 | 24 | 26 | 23 | 27 | 30 | 34 | 39 |
| Advanced Europe | 267 | 396 | 473 | 362 | 316 | 298 | 273 | 245 | 213 |
| Other Europe/Eurasia | 596 | 481 | 566 | 565 | 530 | 521 | 512 | 514 | 527 |
| Russia | 367 | 319 | 384 | 413 | 378 | 372 | 356 | 352 | 357 |
| Africa | 30 | 47 | 89 | 143 | 167 | 214 | 262 | 319 | 381 |
| Middle East | 72 | 145 | 311 | 501 | 563 | 604 | 644 | 694 | 748 |
| Oceania | 19 | 24 | 32 | 39 | 38 | 39 | 39 | 40 | 41 |
| International Bunkers | - | - | - | 0.8 | 8.4 | 19 | 33 | 50 | 68 |
| Advanced Economies | 827 | 1 136 | 1 287 | 1 457 | 1 417 | 1 398 | 1 358 | 1 316 | 1 277 |
| Group of Seven | 704 | 941 | 992 | 1 162 | 1 132 | 1 115 | 1 081 | 1 049 | 1 025 |
| Emerging and Developing Economies | 835 | 933 | 1 450 | 1 985 | 2 190 | 2 387 | 2 597 | 2 855 | 3 138 |
| Emerging and Developing Asia | 67 | 141 | 306 | 568 | 716 | 816 | 925 | 1 045 | 1 168 |
| Non-Asia | 1 547 | 1 834 | 2 283 | 2 703 | 2 724 | 2 802 | 2 867 | 2 966 | 3 090 |
| European Union | 250 | 309 | 363 | 272 | 238 | 224 | 206 | 186 | 163 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.2 | 0.7 | 1.0 | 1.2 | 1.0 | 3 566 | 3 617 | 3 552 | 3 497 | 3 423 | 0.5 | 0.0 | -0.4 | 0.0 |
| 5.8 | 2.6 | 2.1 | 2.0 | 2.2 | 851 | 865 | 849 | 830 | 818 | 2.0 | 0.0 | -0.4 | 0.4 |
| 10.2 | 2.2 | 0.4 | -0.9 | 0.4 | 371 | 339 | 279 | 206 | 124 | 2.2 | -2.8 | -7.8 | -3.4 |
| 5.3 | 5.5 | 4.5 | 3.1 | 4.3 | 88 | 105 | 115 | 116 | 118 | 6.2 | 2.6 | 0.3 | 2.7 |
| 1.8 | -1.5 | -1.1 | -1.3 | -1.3 | 62 | 53 | 42 | 34 | 22 | -3.6 | -3.8 | -6.3 | -4.7 |
| 9.4 | 0.2 | 0.4 | 0.1 | 0.2 | 46 | 44 | 38 | 33 | 32 | -1.5 | -2.0 | -1.6 | -1.7 |
| 8.9 | 1.5 | 0.3 | 0.0 | 0.5 | 27 | 25 | 23 | 21 | 18 | 0.2 | -1.4 | -2.7 | -1.5 |
| 4.9 | 5.0 | 4.5 | 4.4 | 4.6 | 191 | 220 | 261 | 309 | 370 | 3.8 | 3.2 | 3.6 | 3.5 |
| 3.1 | 8.5 | 6.7 | 6.1 | 6.9 | 70 | 88 | 118 | 155 | 201 | 7.1 | 5.5 | 5.5 | 5.9 |
| 5.8 | 2.5 | 2.8 | 2.6 | 2.6 | 48 | 56 | 62 | 68 | 75 | 1.3 | 2.6 | 1.8 | 2.0 |
| 4.5 | 4.6 | 4.7 | 4.5 | 4.6 | 4.4 | 5.6 | 6.7 | 8.1 | 9.7 | 4.5 | 4.4 | 3.8 | 4.2 |
| n.a. | 8.7 | 9.2 | 6.7 | 8.1 | 4.0 | 5.3 | 8.1 | 13 | 17 | 6.4 | 7.4 | 7.6 | 7.2 |
| n.a. | 0.6 | 0.1 | 0.2 | 0.3 | 10 | 10 | 9.7 | 9.0 | 8.3 | 0.3 | -0.4 | -1.6 | -0.7 |
| 6.1 | 2.3 | 1.0 | 0.7 | 1.2 | 39 | 39 | 38 | 38 | 38 | 1.4 | -0.1 | 0.0 | 0.3 |
| 26.6 | 12.7 | 6.5 | 4.8 | 7.4 | 13 | 13 | 14 | 15 | 18 | 10.1 | 1.0 | 2.3 | 3.8 |
| 1.8 | 0.2 | -0.1 | -0.2 | -0.1 | 896 | 886 | 818 | 745 | 649 | 0.2 | -0.9 | -2.3 | -1.1 |
| 1.7 | 0.2 | -0.3 | -0.2 | -0.1 | 772 | 763 | 698 | 632 | 548 | 0.1 | -1.0 | -2.4 | -1.2 |
| 3.3 | 0.5 | 1.7 | 2.2 | 1.6 | 214 | 227 | 242 | 255 | 267 | 0.5 | 1.3 | 1.0 | 0.9 |
| 6.4 | -1.7 | 2.5 | 2.6 | 1.4 | 22 | 22 | 21 | 20 | 18 | -2.3 | -0.5 | -1.7 | -1.4 |
| 0.9 | -1.9 | -1.4 | -2.4 | -1.9 | 296 | 249 | 181 | 128 | 92 | -2.8 | -4.8 | -6.5 | -4.9 |
| -0.2 | -0.9 | -0.3 | 0.3 | -0.3 | 529 | 505 | 487 | 465 | 447 | -0.9 | -0.8 | -0.8 | -0.9 |
| 0.4 | -1.3 | -0.6 | 0.0 | -0.5 | 375 | 360 | 340 | 321 | 305 | -1.4 | -1.0 | -1.1 | -1.1 |
| 4.9 | 2.2 | 4.6 | 3.8 | 3.7 | 166 | 209 | 241 | 270 | 295 | 2.1 | 3.8 | 2.0 | 2.7 |
| 6.1 | 1.7 | 1.3 | 1.5 | 1.5 | 560 | 607 | 646 | 692 | 720 | 1.6 | 1.4 | 1.1 | 1.4 |
| 2.3 | -0.5 | 0.3 | 0.4 | 0.1 | 39 | 38 | 36 | 35 | 34 | 0.0 | -1.0 | -0.4 | -0.5 |
| n.a. | 39.7 | 14.8 | 7.4 | 17.8 | 14 | 31 | 53 | 77 | 100 | 49.5 | 14.6 | 6.6 | 19.5 |
| 1.7 | -0.4 | -0.4 | -0.6 | -0.5 | 1 381 | 1 311 | 1 152 | 1 009 | 859 | -0.8 | -1.8 | -2.9 | -1.9 |
| 1.5 | -0.4 | -0.5 | -0.5 | -0.5 | 1 112 | 1 066 | 949 | 839 | 711 | -0.6 | -1.6 | -2.8 | -1.8 |
| 2.7 | 1.4 | 1.7 | 1.9 | 1.7 | 2 172 | 2 276 | 2 348 | 2 411 | 2 464 | 1.3 | 0.8 | 0.5 | 0.8 |
| 6.7 | 3.4 | 2.6 | 2.4 | 2.7 | 702 | 728 | 732 | 729 | 735 | 3.1 | 0.4 | 0.0 | 1.0 |
| 1.7 | 0.1 | 0.5 | 0.8 | 0.5 | 2 701 | 2 722 | 2 651 | 2 590 | 2 505 | 0.0 | -0.2 | -0.6 | -0.3 |
| 0.3 | -1.9 | -1.4 | -2.3 | -1.9 | 224 | 188 | 136 | 98 | 70 | -2.8 | -4.8 | -6.4 | -4.9 |

## Table A10 | Primary energy consumption, nuclear

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 526 | 675 | 719 | 715 | 830 | 902 | 946 | 955 | 971 |
| Asia | 77 | 132 | 152 | 206 | 282 | 313 | 344 | 371 | 403 |
| China | - | 4.4 | 19 | 113 | 149 | 171 | 193 | 214 | 236 |
| India | 1.6 | 4.4 | 6.8 | 12 | 36 | 41 | 46 | 53 | 61 |
| Japan | 53 | 84 | 75 | 22 | 47 | 42 | 42 | 42 | 42 |
| Korea | 14 | 28 | 39 | 47 | 37 | 42 | 35 | 29 | 28 |
| Chinese Taipei | 8.6 | 10 | 11 | 4.6 | - | - | - | - | - |
| ASEAN | - | - | - | - | - | 2.2 | 7.9 | 14 | 18 |
| Indonesia | - | - | - | - | - | - | - | - | - |
| Malaysia | - | - | - | - | - | - | 1.8 | 3.7 | 3.7 |
| Myanmar | - | - | - | - | - | - | - | - | - |
| Philippines | - | - | - | - | - | - | - | - | - |
| Singapore | - | - | - | - | - | - | - | - | - |
| Thailand | - | - | - | - | - | - | 1.8 | 3.7 | 6.2 |
| Viet Nam | - | - | - | - | - | 2.2 | 4.2 | 6.4 | 8.6 |
| North America | 179 | 227 | 242 | 234 | 236 | 234 | 223 | 215 | 211 |
| United States | 159 | 208 | 219 | 211 | 214 | 214 | 209 | 204 | 204 |
| Latin America | 3.2 | 5.3 | 7.2 | 9.5 | 9.9 | 17 | 18 | 15 | 15 |
| Brazil | 0.6 | 1.6 | 3.8 | 3.8 | 4.0 | 6.9 | 6.9 | 5.6 | 5.6 |
| Advanced Europe | 210 | 247 | 239 | 171 | 181 | 190 | 198 | 184 | 177 |
| Other Europe/Eurasia | 55 | 61 | 76 | 81 | 103 | 126 | 140 | 148 | 142 |
| Russia | 31 | 34 | 45 | 57 | 65 | 75 | 94 | 97 | 88 |
| Africa | 2.2 | 3.4 | 3.2 | 2.2 | 5.6 | 7.8 | 10.0 | 8.8 | 8.8 |
| Middle East | - | - | - | 10 | 13 | 13 | 13 | 13 | 13 |
| Oceania | - | - | - | - | - | - | - | - | - |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 463 | 596 | 606 | 479 | 500 | 508 | 498 | 470 | 458 |
| Group of Seven | 370 | 485 | 482 | 356 | 397 | 395 | 380 | 351 | 346 |
| Emerging and Developing Economies | 62 | 79 | 113 | 236 | 330 | 393 | 448 | 484 | 513 |
| Emerging and Developing Asia | 1.7 | 9.3 | 27 | 133 | 199 | 229 | 266 | 299 | 334 |
| Non-Asia | 449 | 544 | 567 | 508 | 548 | 588 | 602 | 584 | 567 |
| European Union | 190 | 224 | 223 | 162 | 175 | 183 | 182 | 161 | 155 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 0.9 | 2.2 | 1.3 | 0.3 | 1.1 | 880 | 1 077 | 1 243 | 1 393 | 1 545 | 3.0 | 3.5 | 2.2 | 2.9 |
| 3.0 | 4.6 | 2.0 | 1.6 | 2.5 | 319 | 431 | 534 | 622 | 696 | 6.4 | 5.3 | 2.7 | 4.6 |
| n.a. | 4.0 | 2.6 | 2.0 | 2.7 | 149 | 187 | 225 | 263 | 300 | 4.0 | 4.2 | 2.9 | 3.7 |
| 6.4 | 16.4 | 2.5 | 2.7 | 6.0 | 37 | 62 | 92 | 130 | 158 | 16.7 | 9.6 | 5.5 | 9.9 |
| -2.6 | 11.4 | -0.9 | 0.0 | 2.5 | 62 | 63 | 65 | 65 | 65 | 16.0 | 0.5 | 0.0 | 4.1 |
| 3.8 | -3.4 | -0.6 | -2.3 | -2.0 | 53 | 58 | 67 | 65 | 55 | 1.6 | 2.4 | -2.0 | 0.6 |
| -1.8 | -100 | n.a. | n.a. | -100 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.0 | 0.0 | 0.0 | 0.3 |
| n.a. | n.a. | n.a. | 8.9 | n.a. | - | 37 | 54 | 67 | 83 | n.a. | n.a. | 4.5 | n.a. |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | 15 | 15 | 15 | 15 | n.a. | n.a. | 0.0 | n.a. |
| n.a. | n.a. | n.a. | 7.1 | n.a. | - | - | 3.8 | 6.3 | 8.9 | n.a. | n.a. | 8.9 | n.a. |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | 4.4 | 6.6 | 6.6 | 8.8 | n.a. | n.a. | 2.9 | n.a. |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| n.a. | n.a. | n.a. | 13.0 | n.a. | - | 1.8 | 3.9 | 6.4 | 9.0 | n.a. | n.a. | 8.8 | n.a. |
| n.a. | n.a. | n.a. | 7.4 | n.a. | - | 16 | 25 | 33 | 42 | n.a. | n.a. | 5.4 | n.a. |
| 0.8 | 0.1 | -0.5 | -0.5 | -0.4 | 236 | 238 | 245 | 259 | 273 | 0.1 | 0.4 | 1.1 | 0.6 |
| 0.8 | 0.3 | -0.2 | -0.3 | -0.1 | 214 | 214 | 222 | 236 | 250 | 0.3 | 0.3 | 1.2 | 0.6 |
| 3.3 | 0.6 | 6.2 | -2.0 | 1.7 | 9.9 | 18 | 26 | 34 | 41 | 0.6 | 10.2 | 4.5 | 5.5 |
| 5.8 | 0.9 | 5.5 | -2.1 | 1.4 | 4.0 | 7.9 | 12 | 16 | 19 | 0.9 | 11.3 | 5.1 | 6.2 |
| -0.6 | 0.8 | 0.9 | -1.1 | 0.1 | 189 | 218 | 241 | 248 | 277 | 1.4 | 2.5 | 1.4 | 1.8 |
| 1.2 | 3.3 | 3.1 | 0.2 | 2.1 | 107 | 142 | 153 | 174 | 189 | 4.0 | 3.6 | 2.1 | 3.2 |
| 1.8 | 1.9 | 3.8 | -0.7 | 1.6 | 65 | 75 | 86 | 96 | 100 | 1.9 | 2.9 | 1.5 | 2.1 |
| 0.0 | 14.0 | 6.0 | -1.3 | 5.2 | 5.6 | 14 | 22 | 32 | 45 | 14.0 | 14.7 | 7.4 | 11.7 |
| n.a. | 4.0 | 0.0 | 0.0 | 1.0 | 13 | 17 | 21 | 23 | 25 | 4.0 | 4.7 | 1.8 | 3.4 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 0.1 | 0.6 | 0.0 | -0.8 | -0.2 | 545 | 582 | 623 | 643 | 675 | 1.9 | 1.4 | 0.8 | 1.3 |
| -0.1 | 1.6 | -0.4 | -0.9 | -0.1 | 413 | 423 | 442 | 442 | 473 | 2.1 | 0.7 | 0.7 | 1.1 |
| 4.1 | 4.9 | 3.1 | 1.4 | 2.9 | 336 | 496 | 619 | 750 | 870 | 5.2 | 6.3 | 3.5 | 5.0 |
| 14.2 | 6.0 | 3.0 | 2.3 | 3.5 | 199 | 305 | 397 | 487 | 571 | 6.0 | 7.1 | 3.7 | 5.6 |
| 0.4 | 1.1 | 0.9 | -0.6 | 0.4 | 561 | 647 | 709 | 771 | 849 | 1.4 | 2.4 | 1.8 | 1.9 |
| -0.5 | 1.1 | 0.4 | -1.6 | -0.2 | 185 | 215 | 226 | 223 | 241 | 1.9 | 2.0 | 0.7 | 1.5 |

## Table A11 | Primary energy consumption, hydro

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 184 | 225 | 297 | 366 | 413 | 433 | 453 | 473 | 494 |
| Asia | 32 | 41 | 92 | 151 | 174 | 184 | 194 | 203 | 212 |
| China | 11 | 19 | 61 | 106 | 117 | 121 | 124 | 127 | 130 |
| India | 6.2 | 6.4 | 11 | 12 | 19 | 22 | 25 | 29 | 33 |
| Japan | 7.6 | 7.2 | 7.2 | 6.5 | 7.2 | 7.3 | 7.4 | 7.5 | 7.5 |
| Korea | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Chinese Taipei | 0.5 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| ASEAN | 2.3 | 4.4 | 6.8 | 18 | 21 | 23 | 25 | 27 | 28 |
| Indonesia | 0.5 | 0.9 | 1.5 | 2.1 | 2.9 | 3.2 | 3.6 | 4.0 | 4.3 |
| Malaysia | 0.3 | 0.6 | 0.6 | 2.7 | 3.2 | 3.7 | 4.1 | 4.5 | 4.8 |
| Myanmar | 0.1 | 0.2 | 0.5 | 0.8 | 1.2 | 1.4 | 1.5 | 1.7 | 1.8 |
| Philippines | 0.5 | 0.7 | 0.7 | 0.9 | 1.3 | 1.5 | 1.8 | 2.1 | 2.5 |
| Singapore | - | - | - | - | - | - | - | - | - |
| Thailand | 0.4 | 0.5 | 0.5 | 0.6 | 1.0 | 1.1 | 1.1 | 1.2 | 1.2 |
| Viet Nam | 0.5 | 1.3 | 2.4 | 6.9 | 7.7 | 8.1 | 8.4 | 8.6 | 8.8 |
| North America | 49 | 53 | 53 | 52 | 61 | 62 | 63 | 63 | 64 |
| United States | 23 | 22 | 23 | 21 | 26 | 27 | 27 | 27 | 28 |
| Latin America | 34 | 51 | 64 | 66 | 73 | 76 | 79 | 82 | 85 |
| Brazil | 18 | 26 | 35 | 37 | 37 | 39 | 42 | 44 | 47 |
| Advanced Europe | 39 | 47 | 48 | 48 | 51 | 51 | 52 | 52 | 53 |
| Other Europe/Eurasia | 22 | 23 | 26 | 29 | 31 | 32 | 33 | 34 | 34 |
| Russia | 14 | 14 | 14 | 17 | 19 | 20 | 21 | 22 | 22 |
| Africa | 4.8 | 6.4 | 9.4 | 14 | 18 | 22 | 26 | 32 | 39 |
| Middle East | 1.0 | 0.7 | 1.5 | 1.7 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 |
| Oceania | 3.2 | 3.5 | 3.3 | 3.6 | 3.8 | 3.8 | 3.9 | 4.0 | 4.2 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 100 | 111 | 112 | 111 | 123 | 125 | 127 | 128 | 130 |
| Group of Seven | 66 | 72 | 72 | 69 | 80 | 81 | 82 | 83 | 84 |
| Emerging and Developing Economies | 85 | 114 | 185 | 255 | 290 | 308 | 326 | 345 | 365 |
| Emerging and Developing Asia | 23 | 33 | 84 | 144 | 166 | 176 | 185 | 195 | 204 |
| Non-Asia | 153 | 184 | 205 | 215 | 240 | 249 | 259 | 270 | 282 |
| European Union | 24 | 30 | 32 | 28 | 30 | 30 | 31 | 31 | 31 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.1 | 1.8 | 0.9 | 0.9 | 1.1 | 422 | 448 | 477 | 509 | 544 | 2.1 | 1.2 | 1.3 | 1.5 |
| 4.8 | 2.0 | 1.1 | 0.9 | 1.3 | 181 | 198 | 216 | 236 | 258 | 2.7 | 1.8 | 1.8 | 2.0 |
| 7.1 | 1.5 | 0.6 | 0.4 | 0.8 | 119 | 124 | 129 | 135 | 140 | 1.6 | 0.9 | 0.8 | 1.0 |
| 2.1 | 6.3 | 3.0 | 2.5 | 3.7 | 23 | 30 | 37 | 47 | 58 | 9.2 | 5.0 | 4.4 | 5.9 |
| -0.5 | 1.6 | 0.3 | 0.1 | 0.6 | 7.3 | 7.4 | 7.6 | 7.7 | 7.7 | 1.7 | 0.4 | 0.2 | 0.7 |
| -1.6 | -0.6 | 0.0 | 0.0 | -0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | -0.6 | 0.0 | 0.0 | -0.2 |
| -1.3 | 2.5 | 0.0 | 0.0 | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 2.5 | 0.0 | 0.0 | 0.6 |
| 6.3 | 2.3 | 1.8 | 1.3 | 1.7 | 23 | 26 | 29 | 32 | 35 | 3.7 | 2.4 | 1.7 | 2.5 |
| 4.5 | 4.4 | 2.3 | 1.9 | 2.7 | 3.0 | 3.5 | 4.0 | 4.4 | 4.9 | 5.3 | 2.7 | 2.2 | 3.2 |
| 6.5 | 2.4 | 2.4 | 1.6 | 2.1 | 3.6 | 4.2 | 4.8 | 5.3 | 5.8 | 4.0 | 2.9 | 1.9 | 2.8 |
| 6.4 | 6.4 | 2.2 | 1.8 | 3.1 | 1.4 | 1.6 | 1.9 | 2.1 | 2.3 | 8.3 | 3.0 | 2.3 | 4.1 |
| 1.6 | 6.0 | 2.9 | 3.4 | 3.9 | 1.4 | 1.6 | 1.9 | 2.2 | 2.7 | 6.4 | 3.2 | 3.7 | 4.2 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 0.9 | 7.3 | 1.7 | 0.9 | 2.8 | 1.0 | 1.2 | 1.3 | 1.4 | 1.4 | 8.6 | 2.1 | 1.0 | 3.3 |
| 8.6 | 1.5 | 0.8 | 0.5 | 0.9 | 8.8 | 9.8 | 11 | 11 | 12 | 3.5 | 1.9 | 1.3 | 2.1 |
| 0.2 | 2.3 | 0.3 | 0.2 | 0.8 | 62 | 62 | 63 | 64 | 64 | 2.4 | 0.3 | 0.2 | 0.8 |
| -0.3 | 3.2 | 0.2 | 0.2 | 1.0 | 26 | 27 | 27 | 27 | 28 | 3.2 | 0.2 | 0.2 | 1.0 |
| 2.1 | 1.4 | 0.8 | 0.7 | 0.9 | 73 | 77 | 80 | 84 | 88 | 1.5 | 0.9 | 0.9 | 1.0 |
| 2.2 | 0.2 | 1.2 | 1.2 | 0.9 | 37 | 40 | 43 | 47 | 50 | 0.3 | 1.4 | 1.5 | 1.2 |
| 0.7 | 0.7 | 0.2 | 0.2 | 0.4 | 51 | 51 | 52 | 52 | 53 | 0.7 | 0.2 | 0.2 | 0.4 |
| 0.8 | 0.9 | 0.7 | 0.4 | 0.6 | 31 | 32 | 33 | 34 | 34 | 0.9 | 0.7 | 0.4 | 0.6 |
| 0.6 | 1.8 | 0.8 | 0.5 | 0.9 | 19 | 20 | 21 | 22 | 22 | 1.8 | 0.8 | 0.5 | 0.9 |
| 3.3 | 3.5 | 3.9 | 4.0 | 3.8 | 18 | 22 | 26 | 32 | 39 | 3.5 | 3.9 | 4.0 | 3.8 |
| 1.5 | 5.4 | 0.8 | 0.6 | 1.9 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 5.4 | 0.8 | 0.6 | 1.9 |
| 0.4 | 0.4 | 0.4 | 0.7 | 0.5 | 3.8 | 3.9 | 4.0 | 4.2 | 4.4 | 0.6 | 0.6 | 0.9 | 0.7 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 0.3 | 1.5 | 0.3 | 0.2 | 0.6 | 124 | 126 | 127 | 129 | 130 | 1.6 | 0.3 | 0.2 | 0.6 |
| 0.2 | 2.1 | 0.2 | 0.2 | 0.7 | 81 | 82 | 83 | 84 | 84 | 2.2 | 0.3 | 0.2 | 0.7 |
| 3.4 | 1.9 | 1.2 | 1.1 | 1.3 | 298 | 323 | 350 | 380 | 413 | 2.3 | 1.6 | 1.7 | 1.8 |
| 5.7 | 2.1 | 1.1 | 0.9 | 1.3 | 173 | 190 | 208 | 228 | 249 | 2.7 | 1.8 | 1.8 | 2.1 |
| 1.0 | 1.6 | 0.8 | 0.9 | 1.0 | 240 | 250 | 261 | 273 | 286 | 1.6 | 0.8 | 0.9 | 1.1 |
| 0.5 | 0.8 | 0.3 | 0.2 | 0.4 | 30 | 30 | 31 | 31 | 31 | 0.8 | 0.3 | 0.2 | 0.4 |

## Table A12 | Primary energy consumption, solar, wind, etc.

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 2.5 | 8.2 | 48 | 385 | 867 | 1 127 | 1 328 | 1 526 | 1 729 |
| Asia | 1.3 | 2.1 | 16 | 195 | 533 | 715 | 830 | 932 | 1 036 |
| China | 0.0 | 1.0 | 12 | 154 | 408 | 541 | 609 | 666 | 725 |
| India | 0.0 | 0.2 | 2.0 | 20 | 77 | 111 | 144 | 175 | 206 |
| Japan | 1.2 | 0.9 | 1.1 | 9.3 | 14 | 18 | 22 | 25 | 27 |
| Korea | 0.0 | 0.0 | 0.2 | 3.3 | 7.4 | 9.1 | 11 | 13 | 15 |
| Chinese Taipei | 0.0 | 0.1 | 0.2 | 1.7 | 5.9 | 7.1 | 8.3 | 9.7 | 11 |
| ASEAN | - | 0.0 | 0.0 | 5.3 | 14 | 21 | 25 | 31 | 37 |
| Indonesia | - | - | 0.0 | 0.4 | 2.2 | 4.3 | 5.6 | 7.5 | 9.5 |
| Malaysia | - | - | - | 0.3 | 0.5 | 0.9 | 1.3 | 1.8 | 2.4 |
| Myanmar | - | - | - | 0.0 | 0.1 | 0.1 | 0.3 | 0.4 | 0.6 |
| Philippines | - | - | 0.0 | 0.3 | 1.7 | 2.3 | 2.6 | 3.1 | 3.6 |
| Singapore | - | - | 0.0 | 0.1 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| Thailand | - | - | 0.0 | 0.8 | 2.0 | 3.0 | 3.9 | 4.9 | 5.9 |
| Viet Nam | - | - | 0.0 | 3.3 | 7.2 | 9.1 | 11 | 12 | 14 |
| North America | 0.3 | 2.1 | 11 | 63 | 121 | 159 | 196 | 234 | 274 |
| United States | 0.3 | 2.1 | 11 | 59 | 113 | 149 | 185 | 222 | 260 |
| Latin America | 0.0 | 0.2 | 0.9 | 24 | 45 | 56 | 69 | 81 | 93 |
| Brazil | 0.0 | 0.1 | 0.5 | 14 | 26 | 32 | 39 | 44 | 49 |
| Advanced Europe | 0.4 | 2.9 | 18 | 82 | 114 | 126 | 145 | 174 | 205 |
| Other Europe/Eurasia | - | 0.0 | 0.2 | 3.9 | 8.3 | 10 | 12 | 14 | 16 |
| Russia | - | 0.0 | 0.0 | 0.6 | 1.0 | 1.3 | 1.6 | 2.0 | 2.3 |
| Africa | 0.0 | 0.0 | 0.3 | 5.0 | 19 | 27 | 35 | 43 | 51 |
| Middle East | 0.4 | 0.7 | 1.3 | 4.5 | 14 | 18 | 23 | 27 | 30 |
| Oceania | 0.1 | 0.1 | 0.9 | 7.2 | 13 | 16 | 19 | 21 | 24 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 2.1 | 6.1 | 31 | 167 | 275 | 335 | 401 | 477 | 556 |
| Group of Seven | 1.6 | 4.1 | 20 | 111 | 187 | 235 | 286 | 338 | 396 |
| Emerging and Developing Economies | 0.5 | 2.1 | 17 | 218 | 592 | 792 | 927 | 1 049 | 1 173 |
| Emerging and Developing Asia | 0.0 | 1.2 | 14 | 180 | 505 | 680 | 788 | 884 | 982 |
| Non-Asia | 1.3 | 6.0 | 33 | 191 | 335 | 412 | 499 | 595 | 693 |
| European Union | 0.3 | 2.5 | 16 | 68 | 93 | 102 | 121 | 146 | 171 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 16.4 | 12.3 | 4.4 | 2.7 | 5.7 | 950 | 1 352 | 1 702 | 2 125 | 2 584 | 13.8 | 6.0 | 4.3 | 7.3 |
| 16.4 | 15.4 | 4.5 | 2.2 | 6.4 | 573 | 829 | 1 007 | 1 188 | 1 394 | 16.7 | 5.8 | 3.3 | 7.6 |
| 29.2 | 14.9 | 4.1 | 1.8 | 5.9 | 419 | 594 | 697 | 786 | 895 | 15.3 | 5.2 | 2.5 | 6.7 |
| 25.7 | 21.4 | 6.4 | 3.7 | 9.1 | 97 | 151 | 197 | 255 | 314 | 25.4 | 7.4 | 4.8 | 10.8 |
| 6.4 | 5.8 | 4.8 | 2.1 | 4.0 | 15 | 22 | 28 | 33 | 37 | 7.2 | 6.4 | 2.9 | 5.3 |
| 19.2 | 12.1 | 3.9 | 3.2 | 5.7 | 9.0 | 12 | 15 | 19 | 23 | 15.4 | 5.3 | 4.1 | 7.4 |
| 14.6 | 19.2 | 3.4 | 2.9 | 7.1 | 6.8 | 8.7 | 11 | 13 | 16 | 21.5 | 4.8 | 3.8 | 8.5 |
| n.a. | 15.1 | 6.0 | 3.9 | 7.5 | 19 | 32 | 45 | 65 | 88 | 20.1 | 8.9 | 6.9 | 10.9 |
| n.a. | 28.7 | 9.5 | 5.5 | 12.6 | 3.9 | 8.6 | 13 | 20 | 29 | 39.3 | 12.9 | 8.2 | 17.3 |
| n.a. | 6.8 | 10.8 | 6.1 | 8.0 | 0.6 | 1.8 | 3.1 | 5.6 | 9.0 | 11.2 | 17.6 | 11.1 | 13.5 |
| n.a. | 23.3 | 16.1 | 7.9 | 14.7 | 0.1 | 0.4 | 0.9 | 2.0 | 3.2 | 32.2 | 25.6 | 13.0 | 22.4 |
| n.a. | 26.7 | 4.2 | 3.3 | 9.3 | 2.8 | 4.2 | 5.3 | 6.9 | 8.6 | 35.4 | 6.7 | 4.9 | 12.8 |
| n.a. | 15.1 | 3.3 | 1.4 | 5.5 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 | 17.6 | 4.5 | 1.5 | 6.6 |
| n.a. | 14.7 | 6.9 | 4.1 | 7.8 | 2.6 | 4.2 | 6.1 | 8.2 | 11 | 18.8 | 9.0 | 5.7 | 10.2 |
| n.a. | 11.7 | 4.0 | 2.4 | 5.4 | 8.7 | 12 | 15 | 20 | 26 | 14.7 | 5.8 | 5.2 | 7.8 |
| 17.3 | 9.7 | 4.9 | 3.4 | 5.6 | 127 | 184 | 244 | 332 | 428 | 10.5 | 6.7 | 5.8 | 7.3 |
| 17.1 | 9.7 | 5.0 | 3.5 | 5.6 | 119 | 172 | 228 | 308 | 395 | 10.5 | 6.7 | 5.6 | 7.3 |
| 22.1 | 9.2 | 4.3 | 3.0 | 5.1 | 49 | 70 | 96 | 136 | 187 | 10.5 | 6.9 | 6.9 | 7.8 |
| 22.7 | 9.6 | 4.1 | 2.5 | 4.9 | 28 | 36 | 43 | 50 | 60 | 10.9 | 4.2 | 3.5 | 5.6 |
| 17.9 | 4.8 | 2.4 | 3.5 | 3.4 | 131 | 168 | 216 | 285 | 340 | 6.9 | 5.1 | 4.7 | 5.4 |
| n.a. | 11.3 | 4.0 | 2.5 | 5.3 | 9.4 | 13 | 18 | 24 | 32 | 13.3 | 6.5 | 6.0 | 8.0 |
| n.a. | 6.8 | 4.9 | 3.3 | 4.8 | 1.1 | 1.4 | 1.8 | 2.1 | 2.3 | 7.9 | 5.0 | 2.8 | 4.9 |
| 32.2 | 21.4 | 6.2 | 3.8 | 9.0 | 27 | 41 | 57 | 75 | 94 | 27.2 | 7.9 | 5.0 | 11.5 |
| 7.5 | 17.4 | 5.0 | 3.0 | 7.3 | 20 | 30 | 42 | 57 | 74 | 23.3 | 8.0 | 5.6 | 10.9 |
| 13.1 | 8.7 | 3.7 | 2.5 | 4.5 | 14 | 17 | 22 | 29 | 36 | 9.4 | 5.0 | 5.0 | 6.1 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 14.3 | 7.4 | 3.8 | 3.3 | 4.6 | 303 | 412 | 536 | 710 | 880 | 8.9 | 5.9 | 5.1 | 6.3 |
| 13.6 | 7.8 | 4.3 | 3.3 | 4.8 | 206 | 290 | 379 | 511 | 646 | 9.2 | 6.3 | 5.5 | 6.7 |
| 20.3 | 15.3 | 4.6 | 2.4 | 6.4 | 647 | 940 | 1 166 | 1 415 | 1 704 | 16.8 | 6.1 | 3.9 | 7.9 |
| 28.7 | 15.8 | 4.5 | 2.2 | 6.5 | 542 | 786 | 952 | 1 123 | 1 318 | 17.0 | 5.8 | 3.3 | 7.6 |
| 16.4 | 8.4 | 4.1 | 3.3 | 4.9 | 377 | 523 | 695 | 937 | 1 190 | 10.2 | 6.3 | 5.5 | 7.0 |
| 17.7 | 4.6 | 2.7 | 3.6 | 3.5 | 107 | 137 | 179 | 235 | 282 | 6.8 | 5.2 | 4.7 | 5.4 |

## Table A13 | Primary energy consumption, biomass and waste

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 836 | 912 | 1 075 | 1 338 | 1 468 | 1 483 | 1 458 | 1 420 | 1 391 |
| Asia | 435 | 456 | 444 | 518 | 558 | 580 | 597 | 609 | 620 |
| China | 205 | 203 | 140 | 127 | 146 | 155 | 166 | 171 | 176 |
| India | 108 | 126 | 151 | 215 | 240 | 246 | 246 | 248 | 249 |
| Japan | 4.2 | 5.0 | 11 | 17 | 14 | 14 | 17 | 17 | 17 |
| Korea | 0.7 | 1.4 | 3.5 | 6.8 | 8.4 | 8.7 | 9.0 | 9.1 | 9.2 |
| Chinese Taipei | 0.0 | 0.9 | 1.8 | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 | 1.9 |
| ASEAN | 78 | 73 | 80 | 94 | 100 | 106 | 111 | 116 | 120 |
| Indonesia | 30 | 21 | 17 | 31 | 39 | 42 | 45 | 47 | 49 |
| Malaysia | 1.2 | 1.3 | 0.9 | 1.7 | 2.8 | 3.5 | 3.5 | 3.4 | 3.2 |
| Myanmar | 9.1 | 10.0 | 11 | 11 | 9.7 | 8.7 | 8.0 | 7.5 | 7.0 |
| Philippines | 10 | 7.6 | 8.7 | 11 | 10.0 | 9.7 | 9.5 | 9.2 | 9.0 |
| Singapore | 0.1 | 0.2 | 0.6 | 0.7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Thailand | 15 | 15 | 23 | 25 | 23 | 26 | 28 | 31 | 33 |
| Viet Nam | 12 | 14 | 15 | 9.3 | 9.8 | 11 | 12 | 13 | 14 |
| North America | 73 | 86 | 101 | 126 | 125 | 122 | 121 | 119 | 117 |
| United States | 62 | 73 | 89 | 112 | 111 | 109 | 108 | 106 | 105 |
| Latin America | 91 | 89 | 128 | 160 | 178 | 180 | 180 | 180 | 179 |
| Brazil | 48 | 47 | 82 | 102 | 115 | 120 | 123 | 125 | 127 |
| Advanced Europe | 56 | 72 | 137 | 173 | 193 | 190 | 184 | 176 | 170 |
| Other Europe/Eurasia | 17 | 15 | 19 | 28 | 57 | 58 | 59 | 61 | 63 |
| Russia | 12 | 6.9 | 6.9 | 11 | 36 | 38 | 40 | 43 | 46 |
| Africa | 158 | 187 | 237 | 324 | 342 | 333 | 293 | 247 | 210 |
| Middle East | 0.5 | 0.5 | 1.0 | 1.4 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 |
| Oceania | 4.8 | 6.1 | 6.1 | 5.9 | 6.0 | 6.0 | 6.1 | 6.0 | 6.0 |
| International Bunkers | - | - | - | 1.1 | 7.3 | 12 | 16 | 21 | 25 |
| Advanced Economies | 139 | 172 | 262 | 331 | 349 | 344 | 339 | 330 | 321 |
| Group of Seven | 95 | 114 | 175 | 221 | 226 | 221 | 219 | 212 | 206 |
| Emerging and Developing Economies | 697 | 740 | 813 | 1 006 | 1 111 | 1 127 | 1 103 | 1 069 | 1 045 |
| Emerging and Developing Asia | 430 | 448 | 427 | 491 | 533 | 554 | 569 | 581 | 591 |
| Non-Asia | 400 | 456 | 631 | 819 | 903 | 892 | 845 | 790 | 746 |
| European Union | 47 | 65 | 129 | 155 | 174 | 171 | 164 | 157 | 151 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.4 | 1.3 | -0.1 | -0.5 | 0.1 | 1 477 | 1 446 | 1 406 | 1 391 | 1 415 | 1.4 | -0.5 | 0.1 | 0.2 |
| 0.5 | 1.1 | 0.7 | 0.4 | 0.7 | 573 | 581 | 581 | 585 | 599 | 1.4 | 0.1 | 0.3 | 0.5 |
| -1.4 | 2.0 | 1.3 | 0.6 | 1.2 | 154 | 168 | 184 | 199 | 215 | 2.8 | 1.8 | 1.6 | 2.0 |
| 2.1 | 1.6 | 0.2 | 0.1 | 0.5 | 234 | 226 | 211 | 202 | 199 | 1.3 | -1.0 | -0.6 | -0.3 |
| 4.4 | -3.4 | 2.0 | 0.0 | -0.1 | 21 | 22 | 22 | 22 | 21 | 3.0 | 0.6 | -0.4 | 0.8 |
| 7.0 | 3.2 | 0.7 | 0.3 | 1.2 | 9.0 | 9.6 | 11 | 12 | 13 | 4.2 | 1.6 | 2.2 | 2.5 |
| 11.3 | 0.1 | 0.4 | 0.3 | 0.3 | 1.8 | 2.1 | 2.6 | 3.1 | 3.7 | 0.8 | 3.3 | 3.8 | 2.8 |
| 0.6 | 0.9 | 1.1 | 0.8 | 0.9 | 104 | 111 | 112 | 113 | 113 | 1.5 | 0.7 | 0.1 | 0.7 |
| 0.1 | 3.6 | 1.4 | 0.9 | 1.8 | 45 | 50 | 51 | 51 | 50 | 5.6 | 1.3 | -0.1 | 1.9 |
| 1.0 | 7.2 | 2.2 | -0.7 | 2.4 | 2.9 | 3.3 | 3.6 | 3.8 | 3.9 | 7.9 | 2.2 | 0.8 | 3.1 |
| 0.6 | -1.8 | -2.0 | -1.3 | -1.7 | 8.4 | 6.0 | 4.8 | 4.1 | 3.4 | -3.9 | -5.4 | -3.4 | -4.3 |
| 0.3 | -1.9 | -0.5 | -0.5 | -0.9 | 10 | 9.9 | 9.5 | 9.1 | 8.8 | -1.9 | -0.5 | -0.8 | -1.0 |
| 7.2 | 5.0 | 0.1 | 0.3 | 1.4 | 1.1 | 1.2 | 1.3 | 1.5 | 1.7 | 7.0 | 1.6 | 2.8 | 3.4 |
| 1.6 | -1.0 | 2.0 | 1.4 | 1.0 | 23 | 27 | 29 | 30 | 32 | -1.0 | 2.2 | 1.1 | 0.9 |
| -0.9 | 0.7 | 2.0 | 1.6 | 1.5 | 9.5 | 9.3 | 9.2 | 9.3 | 9.7 | 0.3 | -0.3 | 0.5 | 0.1 |
| 1.6 | -0.1 | -0.3 | -0.4 | -0.3 | 133 | 134 | 139 | 144 | 148 | 0.8 | 0.4 | 0.6 | 0.6 |
| 1.8 | -0.2 | -0.3 | -0.3 | -0.3 | 119 | 121 | 126 | 132 | 137 | 0.8 | 0.6 | 0.8 | 0.7 |
| 1.7 | 1.5 | 0.1 | -0.1 | 0.4 | 174 | 166 | 156 | 147 | 140 | 1.1 | -1.1 | -1.1 | -0.5 |
| 2.3 | 1.6 | 0.7 | 0.3 | 0.8 | 114 | 110 | 106 | 101 | 96 | 1.5 | -0.7 | -0.9 | -0.2 |
| 3.5 | 1.6 | -0.5 | -0.8 | -0.1 | 201 | 191 | 179 | 167 | 157 | 2.2 | -1.2 | -1.3 | -0.4 |
| 1.6 | 10.7 | 0.3 | 0.6 | 3.0 | 64 | 64 | 64 | 65 | 66 | 12.3 | 0.0 | 0.4 | 3.2 |
| -0.4 | 19.2 | 1.1 | 1.4 | 5.6 | 44 | 46 | 47 | 50 | 53 | 22.8 | 0.7 | 1.1 | 6.1 |
| 2.2 | 0.8 | -1.5 | -3.3 | -1.6 | 310 | 265 | 219 | 185 | 158 | -0.6 | -3.4 | -3.2 | -2.6 |
| 3.4 | 1.9 | 0.6 | 0.9 | 1.0 | 1.7 | 1.8 | 2.0 | 2.4 | 2.9 | 2.7 | 1.8 | 3.7 | 2.7 |
| 0.6 | 0.2 | 0.2 | -0.1 | 0.1 | 6.0 | 5.8 | 5.6 | 5.4 | 5.3 | 0.3 | -0.7 | -0.6 | -0.4 |
| n.a. | 30.4 | 8.2 | 4.7 | 12.2 | 15 | 38 | 60 | 90 | 139 | 44.9 | 14.7 | 8.8 | 19.5 |
| 2.7 | 0.8 | -0.3 | -0.5 | -0.1 | 374 | 366 | 360 | 354 | 350 | 1.8 | -0.4 | -0.3 | 0.2 |
| 2.6 | 0.3 | -0.3 | -0.6 | -0.3 | 249 | 244 | 243 | 242 | 242 | 1.7 | -0.2 | -0.1 | 0.3 |
| 1.1 | 1.4 | -0.1 | -0.5 | 0.1 | 1 088 | 1 042 | 986 | 947 | 926 | 1.1 | -1.0 | -0.6 | -0.3 |
| 0.4 | 1.2 | 0.7 | 0.4 | 0.7 | 540 | 546 | 544 | 547 | 558 | 1.3 | 0.1 | 0.3 | 0.5 |
| 2.2 | 1.4 | -0.7 | -1.2 | -0.3 | 889 | 827 | 764 | 715 | 678 | 1.2 | -1.5 | -1.2 | -0.7 |
| 3.7 | 1.7 | -0.6 | -0.9 | -0.1 | 181 | 172 | 160 | 148 | 139 | 2.3 | -1.3 | -1.4 | -0.4 |

## Table A14 | Final energy consumption

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 6 183 | 6 927 | 8 720 | 10 249 | 10 930 | 11 246 | 11 469 | 11 674 | 11 857 |
| Asia | 1 515 | 1 952 | 3 128 | 4 280 | 4 774 | 4 996 | 5 179 | 5 350 | 5 488 |
| China | 662 | 785 | 1 649 | 2 410 | 2 609 | 2 613 | 2 577 | 2 519 | 2 430 |
| India | 215 | 291 | 440 | 724 | 924 | 1 069 | 1 210 | 1 362 | 1 511 |
| Japan | 291 | 336 | 314 | 250 | 235 | 223 | 211 | 200 | 189 |
| Korea | 65 | 127 | 161 | 174 | 174 | 172 | 167 | 162 | 156 |
| Chinese Taipei | 32 | 54 | 74 | 69 | 81 | 81 | 80 | 78 | 76 |
| ASEAN | 149 | 245 | 343 | 477 | 559 | 624 | 692 | 759 | 822 |
| Indonesia | 57 | 91 | 106 | 161 | 196 | 223 | 250 | 277 | 303 |
| Malaysia | 13 | 29 | 42 | 61 | 70 | 76 | 81 | 87 | 91 |
| Myanmar | 9.5 | 12 | 13 | 20 | 20 | 21 | 23 | 25 | 28 |
| Philippines | 19 | 23 | 25 | 37 | 48 | 58 | 67 | 76 | 83 |
| Singapore | 5.0 | 8.3 | 15 | 18 | 20 | 20 | 21 | 21 | 21 |
| Thailand | 29 | 51 | 85 | 99 | 101 | 106 | 112 | 116 | 120 |
| Viet Nam | 16 | 25 | 48 | 69 | 87 | 101 | 116 | 132 | 149 |
| North America | 1 452 | 1 728 | 1 699 | 1 757 | 1 723 | 1 700 | 1 662 | 1 623 | 1 590 |
| United States | 1 294 | 1 546 | 1 513 | 1 561 | 1 533 | 1 514 | 1 482 | 1 449 | 1 421 |
| Latin America | 343 | 442 | 571 | 630 | 673 | 704 | 733 | 760 | 784 |
| Brazil | 112 | 154 | 212 | 253 | 271 | 288 | 305 | 320 | 333 |
| Advanced Europe | 1 142 | 1 235 | 1 289 | 1 154 | 1 093 | 1 044 | 994 | 946 | 903 |
| Other Europe/Eurasia | 1 057 | 647 | 709 | 769 | 769 | 763 | 753 | 745 | 739 |
| Russia | 625 | 418 | 447 | 520 | 509 | 500 | 490 | 481 | 473 |
| Africa | 247 | 307 | 421 | 564 | 629 | 676 | 698 | 716 | 747 |
| Middle East | 158 | 260 | 451 | 610 | 672 | 713 | 748 | 782 | 813 |
| Oceania | 66 | 82 | 90 | 95 | 98 | 99 | 99 | 99 | 99 |
| International Bunkers | 202 | 274 | 361 | 391 | 500 | 551 | 603 | 652 | 695 |
| Advanced Economies | 3 059 | 3 579 | 3 649 | 3 523 | 3 429 | 3 345 | 3 240 | 3 135 | 3 039 |
| Group of Seven | 2 378 | 2 737 | 2 676 | 2 558 | 2 457 | 2 389 | 2 308 | 2 229 | 2 159 |
| Emerging and Developing Economies | 2 922 | 3 074 | 4 710 | 6 334 | 7 002 | 7 349 | 7 627 | 7 887 | 8 123 |
| Emerging and Developing Asia | 1 116 | 1 418 | 2 557 | 3 762 | 4 258 | 4 494 | 4 694 | 4 885 | 5 042 |
| Non-Asia | 4 467 | 4 701 | 5 231 | 5 578 | 5 657 | 5 698 | 5 687 | 5 671 | 5 674 |
| European Union | 995 | 1 027 | 1 071 | 931 | 881 | 841 | 799 | 759 | 722 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.5 | 0.9 | 0.5 | 0.3 | 0.5 | 10 575 | 10 277 | 9 852 | 9 502 | 9 282 | 0.4 | -0.7 | -0.6 | -0.4 |
| 3.2 | 1.6 | 0.8 | 0.6 | 0.9 | 4 609 | 4 554 | 4 433 | 4 322 | 4 260 | 1.1 | -0.4 | -0.4 | 0.0 |
| 4.0 | 1.1 | -0.1 | -0.6 | 0.0 | 2 510 | 2 368 | 2 191 | 2 029 | 1 897 | 0.6 | -1.4 | -1.4 | -0.9 |
| 3.7 | 3.6 | 2.7 | 2.2 | 2.8 | 894 | 973 | 1 034 | 1 089 | 1 151 | 3.1 | 1.5 | 1.1 | 1.7 |
| -0.5 | -0.9 | -1.0 | -1.1 | -1.0 | 227 | 205 | 182 | 165 | 153 | -1.4 | -2.2 | -1.7 | -1.8 |
| 3.0 | 0.0 | -0.4 | -0.7 | -0.4 | 171 | 162 | 151 | 140 | 131 | -0.3 | -1.2 | -1.4 | -1.0 |
| 2.4 | 2.2 | -0.1 | -0.5 | 0.3 | 78 | 75 | 70 | 66 | 62 | 1.8 | -1.1 | -1.2 | -0.4 |
| 3.6 | 2.3 | 2.2 | 1.7 | 2.0 | 542 | 574 | 595 | 611 | 626 | 1.8 | 0.9 | 0.5 | 1.0 |
| 3.2 | 2.8 | 2.5 | 1.9 | 2.4 | 190 | 206 | 217 | 224 | 231 | 2.4 | 1.3 | 0.7 | 1.4 |
| 4.7 | 1.9 | 1.6 | 1.1 | 1.5 | 68 | 69 | 68 | 66 | 65 | 1.4 | 0.1 | -0.4 | 0.2 |
| 2.2 | 0.1 | 1.4 | 2.1 | 1.3 | 18 | 17 | 17 | 19 | 20 | -1.4 | -0.1 | 1.3 | 0.1 |
| 2.0 | 3.9 | 3.3 | 2.2 | 3.1 | 47 | 54 | 59 | 62 | 63 | 3.6 | 2.3 | 0.6 | 2.0 |
| 4.0 | 1.2 | 0.5 | 0.1 | 0.5 | 19 | 19 | 18 | 18 | 17 | 0.7 | -0.4 | -0.5 | -0.2 |
| 3.8 | 0.4 | 1.0 | 0.7 | 0.7 | 100 | 100 | 100 | 99 | 98 | 0.2 | 0.0 | -0.2 | 0.0 |
| 4.5 | 3.5 | 2.9 | 2.5 | 2.9 | 85 | 91 | 97 | 103 | 110 | 3.0 | 1.4 | 1.2 | 1.7 |
| 0.6 | -0.3 | -0.4 | -0.4 | -0.4 | 1 676 | 1 566 | 1 431 | 1 323 | 1 250 | -0.7 | -1.6 | -1.3 | -1.3 |
| 0.6 | -0.3 | -0.3 | -0.4 | -0.3 | 1 493 | 1 398 | 1 278 | 1 183 | 1 120 | -0.6 | -1.5 | -1.3 | -1.2 |
| 1.9 | 0.9 | 0.9 | 0.7 | 0.8 | 653 | 648 | 634 | 618 | 610 | 0.5 | -0.3 | -0.4 | -0.1 |
| 2.5 | 1.0 | 1.2 | 0.9 | 1.0 | 263 | 265 | 264 | 263 | 262 | 0.6 | 0.1 | -0.1 | 0.1 |
| 0.0 | -0.8 | -0.9 | -0.9 | -0.9 | 1 054 | 948 | 846 | 769 | 714 | -1.3 | -2.2 | -1.7 | -1.8 |
| -1.0 | 0.0 | -0.2 | -0.2 | -0.1 | 747 | 704 | 653 | 605 | 567 | -0.4 | -1.3 | -1.4 | -1.1 |
| -0.6 | -0.3 | -0.4 | -0.3 | -0.4 | 493 | 459 | 422 | 389 | 363 | -0.8 | -1.5 | -1.5 | -1.3 |
| 2.5 | 1.6 | 1.0 | 0.7 | 1.0 | 590 | 583 | 572 | 570 | 574 | 0.7 | -0.3 | 0.0 | 0.1 |
| 4.2 | 1.4 | 1.1 | 0.8 | 1.1 | 655 | 662 | 656 | 654 | 657 | 1.0 | 0.0 | 0.0 | 0.3 |
| 1.1 | 0.5 | 0.1 | 0.0 | 0.2 | 95 | 90 | 84 | 81 | 79 | 0.0 | -1.3 | -0.5 | -0.7 |
| 2.0 | 3.5 | 1.9 | 1.4 | 2.2 | 496 | 521 | 543 | 560 | 572 | 3.4 | 0.9 | 0.5 | 1.4 |
| 0.4 | -0.4 | -0.6 | -0.6 | -0.5 | 3 326 | 3 070 | 2 787 | 2 565 | 2 411 | -0.8 | -1.8 | -1.4 | -1.4 |
| 0.2 | -0.6 | -0.6 | -0.7 | -0.6 | 2 380 | 2 185 | 1 974 | 1 811 | 1 701 | -1.0 | -1.9 | -1.5 | -1.5 |
| 2.4 | 1.4 | 0.9 | 0.6 | 0.9 | 6 753 | 6 685 | 6 522 | 6 376 | 6 299 | 0.9 | -0.3 | -0.3 | 0.0 |
| 3.8 | 1.8 | 1.0 | 0.7 | 1.1 | 4 108 | 4 088 | 4 007 | 3 929 | 3 892 | 1.3 | -0.3 | -0.3 | 0.1 |
| 0.7 | 0.2 | 0.1 | 0.0 | 0.1 | 5 470 | 5 202 | 4 876 | 4 619 | 4 451 | -0.3 | -1.1 | -0.9 | -0.8 |
| -0.2 | -0.8 | -1.0 | -1.0 | -0.9 | 850 | 764 | 680 | 616 | 569 | -1.3 | -2.2 | -1.8 | -1.8 |

## Table A15 | Final energy consumption, industry

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 1 797 | 1 864 | 2 620 | 3 080 | 3 393 | 3 533 | 3 604 | 3 652 | 3 659 |
| Asia | 512 | 654 | 1 396 | 1 811 | 2 055 | 2 151 | 2 195 | 2 223 | 2 212 |
| China | 238 | 301 | 923 | 1 166 | 1 226 | 1 200 | 1 139 | 1 063 | 962 |
| India | 59 | 85 | 157 | 287 | 413 | 491 | 553 | 614 | 664 |
| Japan | 107 | 103 | 91 | 73 | 66 | 63 | 60 | 57 | 54 |
| Korea | 20 | 38 | 48 | 46 | 47 | 47 | 46 | 45 | 43 |
| Chinese Taipei | 13 | 21 | 25 | 24 | 29 | 30 | 29 | 29 | 28 |
| ASEAN | 41 | 76 | 112 | 168 | 214 | 246 | 277 | 305 | 331 |
| Indonesia | 17 | 30 | 38 | 65 | 84 | 99 | 112 | 125 | 137 |
| Malaysia | 5.5 | 12 | 15 | 19 | 25 | 29 | 33 | 37 | 40 |
| Myanmar | 0.5 | 1.9 | 2.0 | 2.0 | 2.2 | 2.5 | 2.8 | 3.0 | 3.2 |
| Philippines | 4.1 | 4.6 | 5.9 | 7.0 | 11 | 14 | 16 | 18 | 19 |
| Singapore | 0.6 | 2.2 | 5.1 | 6.9 | 7.6 | 7.7 | 7.6 | 7.4 | 7.1 |
| Thailand | 8.7 | 17 | 27 | 30 | 33 | 36 | 38 | 40 | 42 |
| Viet Nam | 4.5 | 7.9 | 17 | 34 | 44 | 51 | 58 | 66 | 73 |
| North America | 331 | 386 | 312 | 324 | 328 | 329 | 326 | 320 | 314 |
| United States | 284 | 332 | 270 | 279 | 282 | 282 | 279 | 274 | 270 |
| Latin America | 114 | 143 | 180 | 181 | 201 | 218 | 234 | 247 | 259 |
| Brazil | 40 | 57 | 80 | 86 | 95 | 104 | 113 | 120 | 126 |
| Advanced Europe | 330 | 325 | 296 | 271 | 266 | 260 | 252 | 243 | 234 |
| Other Europe/Eurasia | 391 | 205 | 205 | 207 | 218 | 221 | 222 | 223 | 223 |
| Russia | 209 | 128 | 126 | 151 | 154 | 154 | 153 | 152 | 151 |
| Africa | 55 | 59 | 85 | 98 | 114 | 129 | 145 | 162 | 178 |
| Middle East | 42 | 64 | 119 | 160 | 183 | 194 | 200 | 205 | 209 |
| Oceania | 23 | 28 | 26 | 27 | 28 | 29 | 30 | 30 | 31 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 827 | 905 | 805 | 772 | 773 | 767 | 751 | 731 | 711 |
| Group of Seven | 602 | 646 | 545 | 516 | 505 | 499 | 486 | 472 | 459 |
| Emerging and Developing Economies | 971 | 959 | 1 816 | 2 308 | 2 620 | 2 765 | 2 853 | 2 921 | 2 948 |
| Emerging and Developing Asia | 369 | 489 | 1 226 | 1 662 | 1 904 | 2 003 | 2 052 | 2 085 | 2 079 |
| Non-Asia | 1 285 | 1 210 | 1 224 | 1 268 | 1 338 | 1 381 | 1 409 | 1 429 | 1 448 |
| European Union | 313 | 274 | 247 | 217 | 214 | 210 | 204 | 197 | 190 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.6 | 1.4 | 0.6 | 0.2 | 0.6 | 3 243 | 3 128 | 2 921 | 2 722 | 2 585 | 0.7 | -1.0 | -1.2 | -0.6 |
| 3.9 | 1.8 | 0.7 | 0.1 | 0.7 | 1 959 | 1 894 | 1 768 | 1 647 | 1 562 | 1.1 | -1.0 | -1.2 | -0.5 |
| 4.9 | 0.7 | -0.7 | -1.7 | -0.7 | 1 157 | 1 034 | 887 | 759 | 653 | -0.1 | -2.6 | -3.0 | -2.1 |
| 4.9 | 5.3 | 3.0 | 1.9 | 3.2 | 400 | 441 | 458 | 463 | 474 | 4.8 | 1.4 | 0.3 | 1.9 |
| -1.2 | -1.3 | -0.9 | -1.0 | -1.1 | 63 | 56 | 49 | 44 | 40 | -2.1 | -2.4 | -2.1 | -2.2 |
| 2.5 | 0.5 | -0.3 | -0.8 | -0.3 | 46 | 43 | 39 | 35 | 31 | -0.1 | -1.6 | -2.1 | -1.4 |
| 1.9 | 2.7 | 0.1 | -0.3 | 0.6 | 28 | 26 | 24 | 22 | 20 | 2.0 | -1.4 | -1.7 | -0.6 |
| 4.3 | 3.5 | 2.6 | 1.8 | 2.5 | 206 | 221 | 228 | 231 | 236 | 2.9 | 1.0 | 0.4 | 1.3 |
| 4.1 | 3.8 | 2.9 | 2.0 | 2.8 | 82 | 90 | 96 | 99 | 102 | 3.3 | 1.6 | 0.7 | 1.7 |
| 3.8 | 3.8 | 2.9 | 1.9 | 2.8 | 24 | 25 | 25 | 25 | 24 | 3.1 | 0.6 | -0.3 | 0.9 |
| 4.5 | 1.7 | 2.1 | 1.6 | 1.8 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | -1.4 | 0.4 | 0.9 | 0.1 |
| 1.6 | 7.4 | 3.4 | 1.6 | 3.8 | 11 | 13 | 14 | 14 | 14 | 7.1 | 2.0 | 0.3 | 2.7 |
| 7.6 | 1.4 | 0.1 | -0.6 | 0.1 | 7.1 | 6.8 | 6.1 | 5.4 | 4.8 | 0.6 | -1.6 | -2.4 | -1.3 |
| 3.8 | 1.3 | 1.5 | 0.9 | 1.2 | 32 | 33 | 33 | 32 | 31 | 1.0 | 0.1 | -0.4 | 0.2 |
| 6.3 | 3.8 | 2.8 | 2.2 | 2.8 | 43 | 45 | 46 | 47 | 50 | 3.3 | 0.7 | 0.9 | 1.4 |
| -0.1 | 0.2 | -0.1 | -0.4 | -0.1 | 316 | 293 | 262 | 234 | 213 | -0.4 | -1.8 | -2.1 | -1.6 |
| -0.1 | 0.2 | -0.1 | -0.3 | -0.1 | 271 | 251 | 224 | 199 | 181 | -0.4 | -1.9 | -2.1 | -1.6 |
| 1.4 | 1.5 | 1.5 | 1.0 | 1.3 | 194 | 197 | 194 | 190 | 189 | 1.0 | 0.0 | -0.3 | 0.1 |
| 2.3 | 1.5 | 1.7 | 1.1 | 1.4 | 92 | 94 | 93 | 91 | 90 | 1.0 | 0.1 | -0.3 | 0.2 |
| -0.6 | -0.3 | -0.6 | -0.7 | -0.5 | 257 | 238 | 214 | 194 | 179 | -0.8 | -1.8 | -1.8 | -1.5 |
| -1.9 | 0.8 | 0.2 | 0.0 | 0.3 | 209 | 197 | 182 | 168 | 158 | 0.2 | -1.4 | -1.4 | -1.0 |
| -1.0 | 0.3 | 0.0 | -0.2 | 0.0 | 147 | 137 | 123 | 111 | 103 | -0.3 | -1.8 | -1.8 | -1.4 |
| 1.8 | 2.1 | 2.5 | 2.1 | 2.2 | 108 | 114 | 118 | 121 | 126 | 1.3 | 0.9 | 0.7 | 0.9 |
| 4.1 | 1.9 | 0.9 | 0.4 | 1.0 | 174 | 169 | 159 | 147 | 138 | 1.2 | -0.9 | -1.4 | -0.5 |
| 0.5 | 0.8 | 0.6 | 0.2 | 0.5 | 27 | 26 | 24 | 22 | 21 | 0.1 | -1.2 | -1.5 | -1.0 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| -0.2 | 0.0 | -0.3 | -0.5 | -0.3 | 743 | 689 | 619 | 556 | 508 | -0.5 | -1.8 | -1.9 | -1.5 |
| -0.5 | -0.3 | -0.4 | -0.6 | -0.4 | 485 | 445 | 396 | 353 | 320 | -0.9 | -2.0 | -2.1 | -1.8 |
| 2.7 | 1.8 | 0.9 | 0.3 | 0.9 | 2 500 | 2 439 | 2 302 | 2 166 | 2 076 | 1.1 | -0.8 | -1.0 | -0.4 |
| 4.7 | 2.0 | 0.7 | 0.1 | 0.8 | 1 816 | 1 762 | 1 649 | 1 541 | 1 466 | 1.3 | -1.0 | -1.2 | -0.5 |
| 0.0 | 0.8 | 0.5 | 0.3 | 0.5 | 1 284 | 1 234 | 1 153 | 1 075 | 1 022 | 0.2 | -1.1 | -1.2 | -0.8 |
| -1.1 | -0.2 | -0.5 | -0.7 | -0.5 | 206 | 191 | 172 | 155 | 142 | -0.7 | -1.8 | -1.9 | -1.6 |

## Table A16 | Final energy consumption, transport

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 1 578 | 1 965 | 2 431 | 2 936 | 3 080 | 3 131 | 3 198 | 3 264 | 3 324 |
| Asia | 189 | 323 | 493 | 795 | 898 | 936 | 986 | 1 039 | 1 091 |
| China | 30 | 83 | 195 | 376 | 424 | 413 | 403 | 391 | 378 |
| India | 21 | 32 | 65 | 125 | 163 | 200 | 244 | 292 | 343 |
| Japan | 72 | 89 | 79 | 64 | 59 | 54 | 50 | 45 | 40 |
| Korea | 15 | 26 | 30 | 36 | 34 | 31 | 29 | 26 | 23 |
| Chinese Taipei | 7.3 | 12 | 13 | 13 | 12 | 12 | 11 | 9.6 | 8.4 |
| ASEAN | 33 | 62 | 88 | 148 | 168 | 184 | 201 | 219 | 235 |
| Indonesia | 11 | 21 | 30 | 58 | 67 | 73 | 78 | 84 | 90 |
| Malaysia | 4.9 | 11 | 15 | 23 | 23 | 23 | 23 | 22 | 21 |
| Myanmar | 0.4 | 1.2 | 0.8 | 4.7 | 5.2 | 6.5 | 8.2 | 10 | 12 |
| Philippines | 4.5 | 8.3 | 8.0 | 13 | 18 | 22 | 27 | 32 | 35 |
| Singapore | 1.4 | 1.8 | 2.4 | 2.2 | 2.2 | 2.1 | 2.0 | 1.9 | 1.7 |
| Thailand | 9.2 | 15 | 19 | 29 | 28 | 28 | 28 | 28 | 28 |
| Viet Nam | 1.4 | 3.5 | 10 | 15 | 20 | 23 | 26 | 30 | 34 |
| North America | 531 | 640 | 655 | 679 | 622 | 584 | 548 | 509 | 473 |
| United States | 488 | 588 | 596 | 619 | 569 | 535 | 502 | 467 | 434 |
| Latin America | 104 | 141 | 199 | 237 | 246 | 253 | 260 | 266 | 270 |
| Brazil | 33 | 47 | 70 | 94 | 96 | 100 | 104 | 108 | 112 |
| Advanced Europe | 269 | 318 | 335 | 347 | 312 | 285 | 260 | 236 | 215 |
| Other Europe/Eurasia | 170 | 110 | 145 | 161 | 156 | 152 | 149 | 146 | 143 |
| Russia | 116 | 74 | 96 | 107 | 103 | 100 | 99 | 98 | 96 |
| Africa | 38 | 54 | 87 | 131 | 142 | 158 | 176 | 194 | 212 |
| Middle East | 51 | 75 | 122 | 156 | 165 | 173 | 180 | 186 | 191 |
| Oceania | 24 | 30 | 35 | 38 | 39 | 38 | 37 | 36 | 34 |
| International Bunkers | 202 | 274 | 361 | 391 | 500 | 551 | 603 | 652 | 695 |
| Advanced Economies | 921 | 1 121 | 1 150 | 1 182 | 1 082 | 1 008 | 937 | 865 | 796 |
| Group of Seven | 768 | 915 | 909 | 913 | 828 | 770 | 715 | 659 | 606 |
| Emerging and Developing Economies | 456 | 570 | 919 | 1 362 | 1 498 | 1 571 | 1 658 | 1 748 | 1 832 |
| Emerging and Developing Asia | 92 | 189 | 366 | 677 | 788 | 836 | 894 | 955 | 1 017 |
| Non-Asia | 1 187 | 1 369 | 1 577 | 1 749 | 1 683 | 1 643 | 1 609 | 1 573 | 1 537 |
| European Union | 220 | 262 | 279 | 280 | 252 | 230 | 209 | 190 | 171 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.9 | 0.7 | 0.4 | 0.4 | 0.5 | 2 964 | 2 798 | 2 634 | 2 501 | 2 429 | 0.1 | -1.2 | -0.8 | -0.7 |
| 4.4 | 1.7 | 0.9 | 1.0 | 1.2 | 856 | 825 | 796 | 774 | 766 | 1.1 | -0.7 | -0.4 | -0.1 |
| 7.9 | 1.7 | -0.5 | -0.6 | 0.0 | 403 | 361 | 322 | 292 | 275 | 1.0 | -2.2 | -1.6 | -1.1 |
| 5.6 | 3.8 | 4.1 | 3.5 | 3.8 | 155 | 175 | 196 | 217 | 235 | 3.1 | 2.4 | 1.8 | 2.4 |
| -0.4 | -1.1 | -1.7 | -2.2 | -1.7 | 56 | 47 | 38 | 31 | 27 | -1.9 | -3.9 | -3.4 | -3.2 |
| 2.8 | -1.1 | -1.7 | -2.1 | -1.7 | 33 | 27 | 22 | 18 | 15 | -1.5 | -3.8 | -3.7 | -3.2 |
| 1.8 | -0.9 | -1.4 | -2.4 | -1.6 | 12 | 9.8 | 7.8 | 6.2 | 5.2 | -1.6 | -4.0 | -3.9 | -3.3 |
| 4.7 | 1.8 | 1.8 | 1.6 | 1.7 | 162 | 167 | 168 | 166 | 163 | 1.3 | 0.4 | -0.3 | 0.4 |
| 5.2 | 2.1 | 1.6 | 1.4 | 1.6 | 64 | 66 | 65 | 63 | 61 | 1.6 | 0.1 | -0.6 | 0.2 |
| 4.8 | 0.0 | -0.1 | -0.6 | -0.3 | 22 | 20 | 18 | 16 | 14 | -0.4 | -1.9 | -2.7 | -1.8 |
| 7.4 | 1.4 | 4.8 | 4.1 | 3.6 | 5.0 | 5.9 | 7.1 | 8.3 | 9.5 | 0.8 | 3.5 | 3.0 | 2.6 |
| 3.2 | 4.6 | 4.4 | 2.7 | 3.8 | 17 | 21 | 24 | 25 | 24 | 4.3 | 3.2 | 0.3 | 2.4 |
| 1.5 | -0.3 | -0.7 | -1.4 | -0.9 | 1.9 | 1.5 | 1.3 | 1.2 | 1.1 | -2.0 | -4.0 | -1.0 | -2.4 |
| 3.5 | -0.6 | 0.1 | 0.1 | -0.1 | 27 | 25 | 24 | 21 | 20 | -0.9 | -1.4 | -1.9 | -1.5 |
| 7.5 | 3.8 | 2.8 | 2.6 | 3.0 | 19 | 20 | 22 | 22 | 23 | 3.2 | 1.3 | 0.6 | 1.5 |
| 0.7 | -1.2 | -1.3 | -1.5 | -1.3 | 598 | 519 | 440 | 374 | 335 | -1.8 | -3.0 | -2.7 | -2.6 |
| 0.7 | -1.2 | -1.2 | -1.4 | -1.3 | 549 | 479 | 407 | 346 | 310 | -1.7 | -2.9 | -2.7 | -2.5 |
| 2.5 | 0.5 | 0.5 | 0.4 | 0.5 | 237 | 228 | 216 | 205 | 197 | 0.0 | -0.9 | -0.9 | -0.7 |
| 3.2 | 0.3 | 0.7 | 0.8 | 0.7 | 92 | 90 | 89 | 89 | 89 | -0.2 | -0.4 | 0.0 | -0.2 |
| 0.8 | -1.5 | -1.8 | -1.9 | -1.8 | 290 | 234 | 189 | 158 | 142 | -2.5 | -4.2 | -2.8 | -3.3 |
| -0.2 | -0.5 | -0.5 | -0.4 | -0.5 | 150 | 135 | 120 | 106 | 94 | -1.1 | -2.2 | -2.4 | -2.0 |
| -0.3 | -0.5 | -0.4 | -0.3 | -0.4 | 97 | 88 | 78 | 70 | 63 | -1.3 | -2.2 | -2.2 | -1.9 |
| 3.8 | 1.2 | 2.1 | 1.9 | 1.8 | 138 | 146 | 152 | 157 | 163 | 0.8 | 1.0 | 0.7 | 0.8 |
| 3.5 | 0.8 | 0.9 | 0.6 | 0.8 | 160 | 156 | 149 | 142 | 137 | 0.3 | -0.7 | -0.8 | -0.5 |
| 1.4 | 0.3 | -0.5 | -0.7 | -0.4 | 37 | 33 | 30 | 26 | 24 | -0.2 | -2.3 | -2.0 | -1.6 |
| 2.0 | 3.5 | 1.9 | 1.4 | 2.2 | 496 | 521 | 543 | 560 | 572 | 3.4 | 0.9 | 0.5 | 1.4 |
| 0.8 | -1.2 | -1.4 | -1.6 | -1.5 | 1 030 | 873 | 728 | 615 | 550 | -1.9 | -3.4 | -2.8 | -2.8 |
| 0.5 | -1.4 | -1.5 | -1.6 | -1.5 | 787 | 666 | 555 | 469 | 420 | -2.1 | -3.4 | -2.7 | -2.8 |
| 3.4 | 1.4 | 1.0 | 1.0 | 1.1 | 1 437 | 1 403 | 1 362 | 1 326 | 1 307 | 0.8 | -0.5 | -0.4 | -0.2 |
| 6.2 | 2.2 | 1.3 | 1.3 | 1.5 | 752 | 738 | 725 | 717 | 716 | 1.5 | -0.4 | -0.1 | 0.2 |
| 1.2 | -0.6 | -0.4 | -0.5 | -0.5 | 1 611 | 1 452 | 1 295 | 1 167 | 1 091 | -1.2 | -2.2 | -1.7 | -1.7 |
| 0.7 | -1.5 | -1.8 | -2.0 | -1.8 | 234 | 189 | 152 | 126 | 112 | -2.5 | -4.2 | -3.0 | -3.3 |

## Table A17 | Final energy consumption, buildings, etc.

| | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 2 330 | 2 478 | 2 874 | 3 232 | 3 347 | 3 424 | 3 462 | 3 513 | 3 595 |
| Asia | 697 | 787 | 942 | 1 185 | 1 252 | 1 312 | 1 374 | 1 447 | 1 529 |
| China | 351 | 338 | 412 | 584 | 624 | 659 | 691 | 724 | 758 |
| India | 122 | 147 | 184 | 254 | 275 | 290 | 310 | 335 | 366 |
| Japan | 77 | 107 | 108 | 87 | 85 | 81 | 78 | 74 | 71 |
| Korea | 24 | 38 | 44 | 44 | 43 | 42 | 41 | 40 | 39 |
| Chinese Taipei | 6.9 | 11 | 12 | 13 | 13 | 13 | 13 | 13 | 12 |
| ASEAN | 64 | 86 | 102 | 113 | 124 | 136 | 149 | 164 | 179 |
| Indonesia | 22 | 30 | 27 | 33 | 38 | 44 | 50 | 57 | 65 |
| Malaysia | 2.1 | 4.3 | 8.2 | 11 | 13 | 14 | 15 | 16 | 17 |
| Myanmar | 8.5 | 9.1 | 10 | 13 | 12 | 11 | 11 | 12 | 12 |
| Philippines | 10.0 | 9.9 | 11 | 16 | 17 | 19 | 21 | 23 | 25 |
| Singapore | 1.1 | 1.7 | 2.3 | 3.0 | 3.2 | 3.4 | 3.4 | 3.5 | 3.6 |
| Thailand | 11 | 14 | 20 | 17 | 17 | 17 | 17 | 18 | 18 |
| Viet Nam | 10 | 13 | 18 | 17 | 20 | 23 | 26 | 30 | 34 |
| North America | 456 | 528 | 572 | 573 | 585 | 594 | 592 | 593 | 599 |
| United States | 403 | 473 | 511 | 507 | 519 | 530 | 530 | 532 | 539 |
| Latin America | 99 | 121 | 147 | 176 | 187 | 192 | 196 | 201 | 207 |
| Brazil | 29 | 36 | 44 | 58 | 64 | 68 | 71 | 74 | 76 |
| Advanced Europe | 442 | 477 | 545 | 452 | 430 | 414 | 398 | 385 | 374 |
| Other Europe/Eurasia | 431 | 285 | 279 | 315 | 308 | 303 | 295 | 290 | 287 |
| Russia | 260 | 179 | 157 | 189 | 179 | 172 | 165 | 159 | 154 |
| Africa | 144 | 179 | 230 | 309 | 345 | 357 | 342 | 322 | 315 |
| Middle East | 47 | 82 | 136 | 198 | 215 | 226 | 237 | 247 | 257 |
| Oceania | 15 | 19 | 23 | 25 | 26 | 26 | 27 | 28 | 28 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 1 024 | 1 185 | 1 311 | 1 201 | 1 188 | 1 178 | 1 156 | 1 140 | 1 130 |
| Group of Seven | 783 | 904 | 972 | 887 | 878 | 872 | 855 | 844 | 839 |
| Emerging and Developing Economies | 1 306 | 1 294 | 1 562 | 2 030 | 2 159 | 2 246 | 2 306 | 2 374 | 2 465 |
| Emerging and Developing Asia | 586 | 627 | 770 | 1 033 | 1 104 | 1 168 | 1 235 | 1 313 | 1 399 |
| Non-Asia | 1 633 | 1 691 | 1 932 | 2 047 | 2 095 | 2 113 | 2 088 | 2 066 | 2 067 |
| European Union | 374 | 391 | 447 | 362 | 342 | 328 | 314 | 301 | 291 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mtoe) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.0 | 0.5 | 0.3 | 0.4 | 0.4 | 3 259 | 3 195 | 3 093 | 3 035 | 2 991 | 0.1 | -0.5 | -0.3 | -0.3 |
| 1.6 | 0.8 | 0.9 | 1.1 | 0.9 | 1 225 | 1 239 | 1 247 | 1 260 | 1 276 | 0.5 | 0.2 | 0.2 | 0.3 |
| 1.6 | 1.0 | 1.0 | 0.9 | 1.0 | 616 | 632 | 637 | 639 | 638 | 0.8 | 0.3 | 0.0 | 0.3 |
| 2.3 | 1.1 | 1.2 | 1.7 | 1.4 | 265 | 269 | 276 | 289 | 305 | 0.6 | 0.4 | 1.0 | 0.7 |
| 0.4 | -0.4 | -0.9 | -0.8 | -0.7 | 84 | 78 | 71 | 67 | 64 | -0.6 | -1.6 | -1.1 | -1.2 |
| 1.9 | -0.3 | -0.4 | -0.7 | -0.5 | 42 | 41 | 38 | 36 | 33 | -0.5 | -1.0 | -1.5 | -1.0 |
| 2.0 | -0.2 | -0.2 | -0.5 | -0.3 | 13 | 12 | 12 | 11 | 10 | -0.4 | -1.0 | -1.4 | -1.0 |
| 1.7 | 1.3 | 1.9 | 1.9 | 1.7 | 121 | 127 | 134 | 142 | 149 | 0.9 | 1.1 | 1.1 | 1.0 |
| 1.3 | 2.2 | 2.8 | 2.6 | 2.6 | 38 | 42 | 47 | 52 | 56 | 2.1 | 2.2 | 1.9 | 2.0 |
| 5.1 | 2.0 | 1.7 | 1.4 | 1.7 | 12 | 13 | 14 | 14 | 14 | 1.8 | 1.0 | 0.5 | 1.0 |
| 1.2 | -0.7 | -0.5 | 0.6 | -0.2 | 11 | 8.9 | 8.2 | 8.1 | 8.1 | -2.3 | -2.6 | -0.2 | -1.6 |
| 1.4 | 1.4 | 1.9 | 1.6 | 1.7 | 17 | 18 | 19 | 20 | 20 | 1.1 | 1.1 | 0.8 | 1.0 |
| 3.0 | 1.1 | 0.7 | 0.4 | 0.7 | 3.2 | 3.2 | 3.2 | 3.1 | 3.0 | 1.0 | 0.0 | -0.5 | 0.1 |
| 1.4 | -0.3 | 0.5 | 0.5 | 0.2 | 16 | 16 | 16 | 15 | 15 | -0.7 | -0.4 | -0.6 | -0.5 |
| 1.6 | 2.4 | 2.9 | 2.6 | 2.7 | 19 | 22 | 24 | 26 | 29 | 2.1 | 2.2 | 1.8 | 2.0 |
| 0.7 | 0.3 | 0.1 | 0.1 | 0.2 | 575 | 562 | 532 | 514 | 498 | 0.1 | -0.8 | -0.7 | -0.5 |
| 0.7 | 0.3 | 0.2 | 0.2 | 0.2 | 511 | 502 | 476 | 462 | 450 | 0.1 | -0.7 | -0.6 | -0.4 |
| 1.8 | 0.9 | 0.5 | 0.5 | 0.6 | 184 | 183 | 181 | 178 | 177 | 0.6 | -0.2 | -0.2 | 0.0 |
| 2.1 | 1.4 | 1.0 | 0.7 | 1.0 | 63 | 65 | 65 | 65 | 64 | 1.2 | 0.3 | -0.1 | 0.4 |
| 0.1 | -0.7 | -0.8 | -0.6 | -0.7 | 422 | 392 | 359 | 334 | 312 | -1.0 | -1.6 | -1.4 | -1.4 |
| -0.9 | -0.3 | -0.4 | -0.3 | -0.3 | 301 | 284 | 264 | 246 | 229 | -0.6 | -1.3 | -1.4 | -1.2 |
| -1.0 | -0.8 | -0.8 | -0.6 | -0.7 | 174 | 161 | 148 | 136 | 125 | -1.1 | -1.7 | -1.6 | -1.5 |
| 2.4 | 1.6 | -0.1 | -0.8 | 0.1 | 316 | 293 | 268 | 253 | 244 | 0.3 | -1.6 | -0.9 | -0.9 |
| 4.5 | 1.2 | 1.0 | 0.8 | 1.0 | 212 | 216 | 217 | 223 | 227 | 1.0 | 0.3 | 0.4 | 0.5 |
| 1.6 | 0.5 | 0.5 | 0.5 | 0.5 | 25 | 25 | 25 | 27 | 29 | 0.3 | -0.3 | 1.6 | 0.6 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 0.5 | -0.2 | -0.3 | -0.2 | -0.2 | 1 168 | 1 117 | 1 044 | 995 | 952 | -0.4 | -1.1 | -0.9 | -0.9 |
| 0.4 | -0.1 | -0.3 | -0.2 | -0.2 | 863 | 826 | 771 | 736 | 706 | -0.4 | -1.1 | -0.9 | -0.8 |
| 1.3 | 0.9 | 0.7 | 0.7 | 0.7 | 2 091 | 2 078 | 2 049 | 2 040 | 2 040 | 0.4 | -0.2 | 0.0 | 0.0 |
| 1.7 | 1.0 | 1.1 | 1.3 | 1.1 | 1 079 | 1 101 | 1 119 | 1 141 | 1 164 | 0.6 | 0.4 | 0.4 | 0.4 |
| 0.7 | 0.3 | 0.0 | -0.1 | 0.0 | 2 034 | 1 956 | 1 847 | 1 775 | 1 715 | -0.1 | -1.0 | -0.7 | -0.7 |
| -0.1 | -0.8 | -0.9 | -0.7 | -0.8 | 336 | 311 | 284 | 264 | 246 | -1.0 | -1.7 | -1.4 | -1.4 |

## Table A18 | Final energy consumption, electricity

| | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 9 699 | 12 638 | 17 886 | 25 247 | 29 547 | 32 684 | 35 651 | 38 834 | 42 033 |
| Asia | 1 823 | 3 249 | 6 685 | 12 876 | 15 934 | 17 868 | 19 550 | 21 244 | 22 811 |
| China | 454 | 1 036 | 3 450 | 8 012 | 9 817 | 10 725 | 11 316 | 11 773 | 12 005 |
| India | 212 | 368 | 718 | 1 608 | 2 326 | 2 897 | 3 491 | 4 167 | 4 879 |
| Japan | 765 | 973 | 1 035 | 879 | 871 | 871 | 871 | 877 | 890 |
| Korea | 94 | 263 | 449 | 535 | 571 | 594 | 607 | 616 | 621 |
| Chinese Taipei | 77 | 160 | 218 | 258 | 291 | 301 | 308 | 314 | 319 |
| ASEAN | 130 | 321 | 613 | 1 248 | 1 645 | 1 973 | 2 334 | 2 731 | 3 164 |
| Indonesia | 28 | 79 | 155 | 412 | 561 | 693 | 846 | 1 021 | 1 220 |
| Malaysia | 20 | 61 | 111 | 182 | 231 | 270 | 312 | 357 | 403 |
| Myanmar | 1.7 | 3.4 | 6.5 | 21 | 32 | 40 | 48 | 58 | 70 |
| Philippines | 21 | 37 | 55 | 96 | 147 | 183 | 222 | 260 | 296 |
| Singapore | 13 | 27 | 42 | 55 | 61 | 65 | 67 | 69 | 70 |
| Thailand | 38 | 88 | 149 | 204 | 234 | 259 | 285 | 311 | 339 |
| Viet Nam | 6.2 | 22 | 87 | 246 | 338 | 413 | 496 | 587 | 688 |
| North America | 3 051 | 3 930 | 4 265 | 4 423 | 4 775 | 5 138 | 5 474 | 5 888 | 6 348 |
| United States | 2 633 | 3 499 | 3 788 | 3 894 | 4 211 | 4 542 | 4 847 | 5 231 | 5 661 |
| Latin America | 516 | 796 | 1 124 | 1 458 | 1 688 | 1 890 | 2 102 | 2 322 | 2 553 |
| Brazil | 211 | 321 | 438 | 580 | 685 | 780 | 873 | 965 | 1 053 |
| Advanced Europe | 2 248 | 2 717 | 3 106 | 2 978 | 3 041 | 3 127 | 3 232 | 3 371 | 3 523 |
| Other Europe/Eurasia | 1 449 | 1 001 | 1 193 | 1 331 | 1 483 | 1 599 | 1 714 | 1 835 | 1 966 |
| Russia | 826 | 608 | 727 | 837 | 903 | 965 | 1 024 | 1 085 | 1 148 |
| Africa | 256 | 361 | 544 | 738 | 951 | 1 198 | 1 510 | 1 877 | 2 287 |
| Middle East | 199 | 378 | 718 | 1 179 | 1 380 | 1 546 | 1 727 | 1 927 | 2 145 |
| Oceania | 158 | 207 | 252 | 263 | 295 | 318 | 343 | 370 | 400 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 6 429 | 8 313 | 9 410 | 9 437 | 9 951 | 10 458 | 10 945 | 11 548 | 12 213 |
| Group of Seven | 5 062 | 6 373 | 6 904 | 6 701 | 7 039 | 7 425 | 7 796 | 8 269 | 8 800 |
| Emerging and Developing Economies | 3 270 | 4 326 | 8 476 | 15 810 | 19 596 | 22 226 | 24 707 | 27 286 | 29 820 |
| Emerging and Developing Asia | 851 | 1 790 | 4 898 | 11 103 | 14 095 | 15 993 | 17 654 | 19 325 | 20 868 |
| Non-Asia | 7 876 | 9 390 | 11 202 | 12 371 | 13 612 | 14 816 | 16 101 | 17 590 | 19 223 |
| European Union | 1 887 | 2 198 | 2 510 | 2 329 | 2 377 | 2 444 | 2 526 | 2 635 | 2 754 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (TWh) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.9 | 2.3 | 1.9 | 1.7 | 1.9 | 30 320 | 33 852 | 36 845 | 39 956 | 42 929 | 2.7 | 2.0 | 1.5 | 2.0 |
| 6.1 | 3.1 | 2.1 | 1.6 | 2.1 | 16 299 | 18 245 | 19 705 | 21 070 | 22 485 | 3.4 | 1.9 | 1.3 | 2.1 |
| 9.1 | 2.9 | 1.4 | 0.6 | 1.5 | 9 936 | 10 668 | 10 918 | 11 020 | 11 004 | 3.1 | 0.9 | 0.1 | 1.2 |
| 6.3 | 5.4 | 4.1 | 3.4 | 4.2 | 2 509 | 3 248 | 3 975 | 4 702 | 5 541 | 6.6 | 4.7 | 3.4 | 4.7 |
| 0.4 | -0.1 | 0.0 | 0.2 | 0.0 | 880 | 884 | 882 | 900 | 910 | 0.0 | 0.0 | 0.3 | 0.1 |
| 5.4 | 0.9 | 0.6 | 0.2 | 0.6 | 571 | 594 | 605 | 607 | 600 | 0.9 | 0.6 | -0.1 | 0.4 |
| 3.7 | 1.7 | 0.6 | 0.4 | 0.8 | 290 | 297 | 298 | 296 | 291 | 1.7 | 0.3 | -0.2 | 0.5 |
| 7.1 | 4.0 | 3.6 | 3.1 | 3.5 | 1 680 | 2 006 | 2 340 | 2 693 | 3 084 | 4.3 | 3.4 | 2.8 | 3.4 |
| 8.5 | 4.5 | 4.2 | 3.7 | 4.1 | 585 | 736 | 898 | 1 071 | 1 259 | 5.2 | 4.4 | 3.4 | 4.2 |
| 6.9 | 3.4 | 3.1 | 2.6 | 3.0 | 234 | 271 | 305 | 336 | 366 | 3.7 | 2.7 | 1.8 | 2.6 |
| 7.9 | 6.1 | 4.3 | 3.8 | 4.6 | 34 | 44 | 53 | 64 | 77 | 6.9 | 4.8 | 3.7 | 4.9 |
| 4.7 | 6.3 | 4.2 | 2.9 | 4.3 | 148 | 185 | 225 | 269 | 317 | 6.5 | 4.2 | 3.5 | 4.5 |
| 4.5 | 1.5 | 0.9 | 0.5 | 0.9 | 62 | 66 | 67 | 65 | 63 | 1.6 | 0.7 | -0.5 | 0.5 |
| 5.2 | 2.0 | 2.0 | 1.8 | 1.9 | 237 | 261 | 285 | 311 | 339 | 2.1 | 1.9 | 1.7 | 1.9 |
| 11.8 | 4.7 | 3.9 | 3.3 | 3.9 | 339 | 395 | 452 | 515 | 593 | 4.7 | 2.9 | 2.8 | 3.3 |
| 1.1 | 1.1 | 1.4 | 1.5 | 1.3 | 4 868 | 5 306 | 5 680 | 6 149 | 6 480 | 1.4 | 1.6 | 1.3 | 1.4 |
| 1.2 | 1.1 | 1.4 | 1.6 | 1.4 | 4 286 | 4 677 | 5 010 | 5 454 | 5 773 | 1.4 | 1.6 | 1.4 | 1.5 |
| 3.2 | 2.1 | 2.2 | 2.0 | 2.1 | 1 727 | 1 971 | 2 227 | 2 487 | 2 745 | 2.4 | 2.6 | 2.1 | 2.4 |
| 3.1 | 2.4 | 2.5 | 1.9 | 2.2 | 708 | 810 | 900 | 984 | 1 076 | 2.9 | 2.4 | 1.8 | 2.3 |
| 0.9 | 0.3 | 0.6 | 0.9 | 0.6 | 3 180 | 3 398 | 3 575 | 3 752 | 3 864 | 0.9 | 1.2 | 0.8 | 1.0 |
| -0.3 | 1.6 | 1.5 | 1.4 | 1.5 | 1 528 | 1 677 | 1 816 | 1 949 | 2 083 | 2.0 | 1.7 | 1.4 | 1.7 |
| 0.0 | 1.1 | 1.3 | 1.1 | 1.2 | 935 | 1 013 | 1 077 | 1 131 | 1 186 | 1.6 | 1.4 | 1.0 | 1.3 |
| 3.3 | 3.7 | 4.7 | 4.2 | 4.3 | 993 | 1 285 | 1 606 | 1 943 | 2 307 | 4.3 | 4.9 | 3.7 | 4.3 |
| 5.5 | 2.3 | 2.3 | 2.2 | 2.2 | 1 423 | 1 641 | 1 880 | 2 194 | 2 502 | 2.7 | 2.8 | 2.9 | 2.8 |
| 1.6 | 1.7 | 1.5 | 1.6 | 1.6 | 301 | 329 | 356 | 412 | 463 | 2.0 | 1.7 | 2.7 | 2.1 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 1.2 | 0.8 | 1.0 | 1.1 | 1.0 | 10 198 | 10 917 | 11 503 | 12 221 | 12 708 | 1.1 | 1.2 | 1.0 | 1.1 |
| 0.9 | 0.7 | 1.0 | 1.2 | 1.0 | 7 229 | 7 764 | 8 195 | 8 749 | 9 119 | 1.1 | 1.3 | 1.1 | 1.1 |
| 4.9 | 3.1 | 2.3 | 1.9 | 2.4 | 20 123 | 22 935 | 25 341 | 27 735 | 30 221 | 3.5 | 2.3 | 1.8 | 2.4 |
| 8.1 | 3.5 | 2.3 | 1.7 | 2.4 | 14 452 | 16 360 | 17 812 | 19 162 | 20 583 | 3.8 | 2.1 | 1.5 | 2.3 |
| 1.4 | 1.4 | 1.7 | 1.8 | 1.6 | 14 021 | 15 608 | 17 140 | 18 886 | 20 444 | 1.8 | 2.0 | 1.8 | 1.9 |
| 0.6 | 0.3 | 0.6 | 0.9 | 0.6 | 2 486 | 2 654 | 2 791 | 2 934 | 3 029 | 0.9 | 1.2 | 0.8 | 1.0 |

## Table A19 | Electricity generated

| | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 11 850 | 15 425 | 21 523 | 29 978 | 34 966 | 38 716 | 42 170 | 45 921 | 49 664 |
| Asia | 2 244 | 3 970 | 7 975 | 15 098 | 18 676 | 21 005 | 22 891 | 24 838 | 26 621 |
| China | 621 | 1 356 | 4 197 | 9 492 | 11 567 | 12 651 | 13 279 | 13 796 | 14 057 |
| India | 289 | 561 | 972 | 1 987 | 2 886 | 3 599 | 4 291 | 5 075 | 5 880 |
| Japan | 862 | 1 055 | 1 164 | 993 | 983 | 983 | 983 | 991 | 1 006 |
| Korea | 109 | 288 | 472 | 607 | 648 | 673 | 688 | 700 | 706 |
| Chinese Taipei | 90 | 181 | 244 | 279 | 315 | 327 | 335 | 342 | 349 |
| ASEAN | 154 | 374 | 692 | 1 365 | 1 810 | 2 196 | 2 599 | 3 053 | 3 549 |
| Indonesia | 33 | 93 | 177 | 433 | 599 | 753 | 921 | 1 121 | 1 348 |
| Malaysia | 23 | 69 | 125 | 193 | 247 | 294 | 342 | 394 | 448 |
| Myanmar | 2.5 | 5.2 | 8.8 | 21 | 33 | 42 | 52 | 64 | 79 |
| Philippines | 26 | 45 | 68 | 118 | 180 | 226 | 269 | 314 | 355 |
| Singapore | 16 | 32 | 46 | 58 | 64 | 67 | 70 | 72 | 73 |
| Thailand | 44 | 96 | 159 | 196 | 229 | 257 | 285 | 315 | 347 |
| Viet Nam | 8.7 | 27 | 95 | 274 | 376 | 461 | 552 | 656 | 769 |
| North America | 3 686 | 4 632 | 4 958 | 5 063 | 5 460 | 5 881 | 6 285 | 6 781 | 7 331 |
| United States | 3 203 | 4 026 | 4 354 | 4 430 | 4 789 | 5 172 | 5 534 | 5 986 | 6 496 |
| Latin America | 624 | 1 008 | 1 405 | 1 796 | 2 071 | 2 318 | 2 594 | 2 872 | 3 168 |
| Brazil | 223 | 349 | 516 | 708 | 834 | 947 | 1 059 | 1 164 | 1 264 |
| Advanced Europe | 2 695 | 3 236 | 3 623 | 3 462 | 3 632 | 3 741 | 3 894 | 4 084 | 4 292 |
| Other Europe/Eurasia | 1 856 | 1 415 | 1 689 | 1 826 | 1 889 | 2 024 | 2 149 | 2 284 | 2 425 |
| Russia | 1 082 | 876 | 1 036 | 1 159 | 1 164 | 1 241 | 1 307 | 1 363 | 1 416 |
| Africa | 315 | 442 | 687 | 912 | 1 169 | 1 466 | 1 842 | 2 272 | 2 747 |
| Middle East | 244 | 472 | 888 | 1 502 | 1 713 | 1 898 | 2 103 | 2 344 | 2 600 |
| Oceania | 187 | 249 | 298 | 318 | 356 | 383 | 412 | 445 | 480 |
| International Bunkers | - | - | - | - | - | - | - | - | - |
| Advanced Economies | 7 673 | 9 704 | 10 843 | 10 818 | 11 496 | 12 092 | 12 704 | 13 450 | 14 272 |
| Group of Seven | 6 042 | 7 437 | 7 990 | 7 639 | 8 119 | 8 574 | 9 041 | 9 554 | 10 248 |
| Emerging and Developing Economies | 4 177 | 5 721 | 10 680 | 19 160 | 23 470 | 26 624 | 29 466 | 32 471 | 35 391 |
| Emerging and Developing Asia | 1 138 | 2 383 | 6 010 | 13 124 | 16 629 | 18 918 | 20 779 | 22 697 | 24 452 |
| Non-Asia | 9 606 | 11 455 | 13 548 | 14 880 | 16 290 | 17 711 | 19 279 | 21 083 | 23 043 |
| European Union | 2 256 | 2 630 | 2 955 | 2 718 | 3 387 | 3 592 | 3 741 | 3 729 | 3 747 |

Source: International Energy Agency "World Energy Balances" (historical)
The Institute of Energy Economics, Japan (projection)
Note: Excluding generation by pumped storage hydro

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (TWh) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.9 | 2.2 | 1.9 | 1.6 | 1.9 | 36 016 | 41 212 | 45 615 | 51 394 | 57 579 | 2.7 | 2.4 | 2.4 | 2.4 |
| 5.9 | 3.1 | 2.1 | 1.5 | 2.1 | 19 147 | 21 902 | 23 739 | 25 823 | 28 204 | 3.5 | 2.2 | 1.7 | 2.3 |
| 8.6 | 2.9 | 1.4 | 0.6 | 1.5 | 11 726 | 12 877 | 13 285 | 13 676 | 14 120 | 3.1 | 1.3 | 0.6 | 1.5 |
| 6.0 | 5.5 | 4.0 | 3.2 | 4.1 | 3 118 | 4 075 | 4 839 | 5 666 | 6 618 | 6.7 | 4.5 | 3.2 | 4.6 |
| 0.4 | -0.1 | 0.0 | 0.2 | 0.0 | 994 | 1 009 | 1 016 | 1 053 | 1 081 | 0.0 | 0.2 | 0.6 | 0.3 |
| 5.3 | 0.9 | 0.6 | 0.3 | 0.6 | 649 | 687 | 708 | 727 | 741 | 1.0 | 0.9 | 0.5 | 0.7 |
| 3.5 | 1.8 | 0.6 | 0.4 | 0.8 | 315 | 326 | 332 | 342 | 352 | 1.7 | 0.5 | 0.6 | 0.9 |
| 6.8 | 4.1 | 3.7 | 3.2 | 3.6 | 1 854 | 2 291 | 2 740 | 3 312 | 3 971 | 4.5 | 4.0 | 3.8 | 4.0 |
| 8.1 | 4.7 | 4.4 | 3.9 | 4.3 | 628 | 823 | 1 031 | 1 291 | 1 586 | 5.4 | 5.1 | 4.4 | 4.9 |
| 6.7 | 3.6 | 3.3 | 2.8 | 3.2 | 252 | 307 | 360 | 426 | 502 | 3.9 | 3.6 | 3.4 | 3.6 |
| 6.7 | 6.6 | 4.8 | 4.2 | 5.0 | 35 | 50 | 67 | 90 | 120 | 7.7 | 6.6 | 6.0 | 6.7 |
| 4.7 | 6.2 | 4.1 | 2.8 | 4.2 | 183 | 234 | 285 | 350 | 419 | 6.4 | 4.5 | 3.9 | 4.8 |
| 4.0 | 1.5 | 0.8 | 0.5 | 0.9 | 65 | 70 | 73 | 73 | 71 | 1.6 | 1.1 | -0.1 | 0.8 |
| 4.6 | 2.2 | 2.2 | 2.0 | 2.1 | 229 | 257 | 288 | 327 | 373 | 2.2 | 2.3 | 2.6 | 2.4 |
| 11.0 | 4.6 | 3.9 | 3.4 | 3.9 | 374 | 449 | 527 | 635 | 768 | 4.6 | 3.5 | 3.8 | 3.9 |
| 1.0 | 1.1 | 1.4 | 1.6 | 1.4 | 5 582 | 6 269 | 6 911 | 7 875 | 8 756 | 1.4 | 2.2 | 2.4 | 2.0 |
| 1.0 | 1.1 | 1.5 | 1.6 | 1.4 | 4 888 | 5 490 | 6 045 | 6 887 | 7 646 | 1.4 | 2.1 | 2.4 | 2.0 |
| 3.3 | 2.1 | 2.3 | 2.0 | 2.1 | 2 137 | 2 547 | 3 065 | 3 775 | 4 610 | 2.5 | 3.7 | 4.2 | 3.6 |
| 3.6 | 2.4 | 2.4 | 1.8 | 2.2 | 866 | 1 002 | 1 133 | 1 281 | 1 453 | 2.9 | 2.7 | 2.5 | 2.7 |
| 0.8 | 0.7 | 0.7 | 1.0 | 0.8 | 3 817 | 4 251 | 4 674 | 5 434 | 6 207 | 1.4 | 2.0 | 2.9 | 2.2 |
| -0.1 | 0.5 | 1.3 | 1.2 | 1.1 | 1 957 | 2 155 | 2 331 | 2 526 | 2 729 | 1.0 | 1.8 | 1.6 | 1.5 |
| 0.2 | 0.1 | 1.2 | 0.8 | 0.7 | 1 210 | 1 315 | 1 386 | 1 428 | 1 466 | 0.6 | 1.4 | 0.6 | 0.9 |
| 3.3 | 3.6 | 4.7 | 4.1 | 4.2 | 1 225 | 1 606 | 2 031 | 2 509 | 3 029 | 4.3 | 5.2 | 4.1 | 4.5 |
| 5.7 | 1.9 | 2.1 | 2.1 | 2.1 | 1 786 | 2 073 | 2 406 | 2 886 | 3 382 | 2.5 | 3.0 | 3.5 | 3.1 |
| 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 365 | 410 | 460 | 565 | 662 | 2.0 | 2.3 | 3.7 | 2.7 |
| n.a. | n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. | n.a. |
| 1.0 | 0.9 | 1.0 | 1.2 | 1.0 | 11 822 | 13 056 | 14 207 | 16 100 | 17 897 | 1.3 | 1.9 | 2.3 | 1.9 |
| 0.7 | 0.9 | 1.1 | 1.3 | 1.1 | 8 368 | 9 304 | 10 152 | 11 520 | 12 900 | 1.3 | 2.0 | 2.4 | 2.0 |
| 4.7 | 2.9 | 2.3 | 1.8 | 2.3 | 24 194 | 28 156 | 31 408 | 35 293 | 39 681 | 3.4 | 2.6 | 2.4 | 2.7 |
| 7.7 | 3.4 | 2.3 | 1.6 | 2.3 | 17 089 | 19 775 | 21 576 | 23 597 | 25 931 | 3.8 | 2.4 | 1.9 | 2.6 |
| 1.3 | 1.3 | 1.7 | 1.8 | 1.6 | 16 869 | 19 310 | 21 876 | 25 570 | 29 375 | 1.8 | 2.6 | 3.0 | 2.6 |
| 0.6 | 3.2 | 1.0 | 0.0 | 1.2 | 3 627 | 4 016 | 4 256 | 4 401 | 4 673 | 4.2 | 1.6 | 0.9 | 2.0 |

## Table A20 | Primary energy consumption per capita

| | Reference Scenario (Tonne of oil equivalent [toe]/person) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 1.6 | 1.6 | 1.8 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Asia | 0.7 | 0.8 | 1.2 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.8 |
| China | 0.8 | 0.9 | 1.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 |
| India | 0.3 | 0.4 | 0.5 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |
| Japan | 3.5 | 4.1 | 3.9 | 3.0 | 3.0 | 2.9 | 2.8 | 2.8 | 2.8 |
| Korea | 2.1 | 4.0 | 4.9 | 5.3 | 5.1 | 5.2 | 5.2 | 5.1 | 5.1 |
| Chinese Taipei | 2.5 | 4.0 | 5.1 | 4.7 | 5.2 | 5.3 | 5.3 | 5.4 | 5.5 |
| ASEAN | 0.5 | 0.7 | 0.8 | 1.1 | 1.3 | 1.5 | 1.6 | 1.8 | 2.0 |
| Indonesia | 0.5 | 0.6 | 0.7 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.2 |
| Malaysia | 1.2 | 2.1 | 2.5 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
| Myanmar | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 |
| Philippines | 0.4 | 0.5 | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.0 |
| Singapore | 3.8 | 4.6 | 4.9 | 5.3 | 5.5 | 5.5 | 5.6 | 5.6 | 5.8 |
| Thailand | 0.8 | 1.2 | 1.7 | 1.9 | 1.9 | 2.1 | 2.2 | 2.4 | 2.6 |
| Viet Nam | 0.3 | 0.4 | 0.7 | 1.0 | 1.3 | 1.5 | 1.7 | 1.9 | 2.2 |
| North America | 7.7 | 8.1 | 7.2 | 6.5 | 6.0 | 5.7 | 5.5 | 5.3 | 5.1 |
| United States | 7.7 | 8.1 | 7.2 | 6.4 | 5.9 | 5.6 | 5.4 | 5.2 | 5.1 |
| Latin America | 1.1 | 1.2 | 1.4 | 1.3 | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 |
| Brazil | 0.9 | 1.1 | 1.4 | 1.5 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |
| Advanced Europe | 3.2 | 3.3 | 3.3 | 2.6 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 |
| Other Europe/Eurasia | 4.5 | 2.9 | 3.3 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| Russia | 5.9 | 4.2 | 4.9 | 5.5 | 5.5 | 5.6 | 5.7 | 5.7 | 5.7 |
| Africa | 0.6 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Middle East | 1.7 | 2.3 | 3.0 | 3.2 | 3.1 | 3.0 | 3.0 | 3.0 | 3.0 |
| Oceania | 4.9 | 5.5 | 5.5 | 4.7 | 4.5 | 4.3 | 4.2 | 4.0 | 3.8 |
| International Bunkers | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Advanced Economies | 4.5 | 4.9 | 4.7 | 4.1 | 3.9 | 3.8 | 3.7 | 3.5 | 3.5 |
| Group of Seven | 5.3 | 5.8 | 5.3 | 4.6 | 4.3 | 4.1 | 4.0 | 3.8 | 3.7 |
| Emerging and Developing Economies | 0.9 | 0.9 | 1.2 | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 |
| Emerging and Developing Asia | 0.5 | 0.6 | 1.0 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.7 |
| Non-Asia | 2.7 | 2.5 | 2.5 | 2.1 | 2.0 | 1.9 | 1.8 | 1.7 | 1.7 |
| European Union | 3.4 | 3.4 | 3.5 | 2.8 | 2.7 | 2.6 | 2.5 | 2.4 | 2.3 |

Source: World Bank "World Development Indicators", International Energy Agency "World Energy Balances", etc. (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (toe/person) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 0.4 | -0.3 | -0.2 | -0.1 | -0.2 | 1.8 | 1.7 | 1.6 | 1.5 | 1.5 | -0.7 | -1.1 | -0.8 | -0.9 |
| 2.5 | 0.4 | 0.4 | 0.5 | 0.4 | 1.6 | 1.5 | 1.5 | 1.4 | 1.4 | 0.0 | -0.7 | -0.5 | -0.4 |
| 4.0 | 0.3 | -0.1 | -0.2 | 0.0 | 2.8 | 2.7 | 2.5 | 2.3 | 2.2 | -0.1 | -1.4 | -1.3 | -1.0 |
| 2.6 | 2.3 | 2.1 | 1.9 | 2.1 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 1.9 | 1.0 | 0.7 | 1.1 |
| -0.5 | -0.2 | -0.5 | -0.2 | -0.3 | 3.0 | 2.8 | 2.6 | 2.6 | 2.5 | -0.4 | -1.2 | -0.5 | -0.7 |
| 2.9 | -0.5 | 0.0 | 0.0 | -0.1 | 5.1 | 5.0 | 4.9 | 4.8 | 4.6 | -0.6 | -0.4 | -0.6 | -0.5 |
| 2.0 | 1.3 | 0.3 | 0.3 | 0.6 | 5.1 | 5.0 | 4.8 | 4.7 | 4.6 | 1.0 | -0.6 | -0.3 | -0.1 |
| 2.5 | 2.1 | 2.5 | 1.9 | 2.2 | 1.2 | 1.4 | 1.5 | 1.5 | 1.6 | 1.4 | 1.8 | 1.2 | 1.5 |
| 2.3 | 3.1 | 3.6 | 2.2 | 3.0 | 1.2 | 1.5 | 1.6 | 1.8 | 1.9 | 2.5 | 3.3 | 1.7 | 2.5 |
| 2.9 | 0.5 | 0.7 | 0.5 | 0.6 | 2.9 | 2.9 | 2.9 | 2.8 | 2.8 | -0.4 | -0.1 | -0.3 | -0.3 |
| 1.3 | 0.0 | 1.6 | 2.5 | 1.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | -1.3 | 0.3 | 1.8 | 0.4 |
| 0.9 | 2.8 | 2.3 | 1.5 | 2.1 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 2.1 | 1.9 | 0.7 | 1.5 |
| 1.0 | 0.6 | 0.1 | 0.4 | 0.3 | 5.4 | 5.4 | 5.3 | 5.2 | 5.2 | 0.4 | -0.3 | -0.2 | -0.1 |
| 2.7 | 0.7 | 1.3 | 1.4 | 1.2 | 1.9 | 1.9 | 2.0 | 2.1 | 2.1 | 0.3 | 0.5 | 0.7 | 0.5 |
| 4.1 | 3.4 | 2.8 | 2.7 | 2.9 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 2.2 | 1.6 | 2.0 | 1.9 |
| -0.5 | -1.2 | -0.8 | -0.7 | -0.8 | 5.8 | 5.4 | 5.0 | 4.6 | 4.4 | -1.5 | -1.6 | -1.2 | -1.4 |
| -0.6 | -1.2 | -0.8 | -0.6 | -0.8 | 5.7 | 5.3 | 4.9 | 4.6 | 4.3 | -1.5 | -1.6 | -1.1 | -1.4 |
| 0.7 | 0.3 | 0.6 | 0.6 | 0.5 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | -0.1 | -0.2 | 0.0 | -0.1 |
| 1.4 | 0.5 | 1.1 | 1.0 | 0.9 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.1 | 0.1 | 0.2 | 0.1 |
| -0.6 | -0.9 | -0.7 | -0.8 | -0.8 | 2.4 | 2.3 | 2.1 | 2.0 | 2.0 | -1.3 | -1.4 | -0.5 | -1.0 |
| -0.8 | -0.2 | 0.0 | 0.1 | 0.0 | 3.4 | 3.3 | 3.2 | 3.0 | 2.9 | -0.2 | -0.7 | -0.7 | -0.6 |
| -0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 5.5 | 5.4 | 5.2 | 5.0 | 4.8 | 0.0 | -0.6 | -0.7 | -0.5 |
| 0.0 | -0.8 | -0.4 | -0.3 | -0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | -1.5 | -1.4 | -1.1 | -1.3 |
| 1.9 | -0.5 | -0.2 | 0.0 | -0.2 | 3.0 | 2.8 | 2.7 | 2.6 | 2.6 | -0.9 | -0.9 | -0.5 | -0.8 |
| -0.1 | -0.5 | -0.9 | -0.8 | -0.8 | 4.5 | 4.1 | 3.7 | 3.6 | 3.4 | -0.7 | -1.9 | -0.9 | -1.2 |
| n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| -0.3 | -0.8 | -0.6 | -0.5 | -0.6 | 3.8 | 3.6 | 3.3 | 3.2 | 3.1 | -1.1 | -1.3 | -0.8 | -1.1 |
| -0.5 | -1.0 | -0.7 | -0.6 | -0.7 | 4.1 | 3.9 | 3.6 | 3.4 | 3.3 | -1.3 | -1.5 | -0.9 | -1.2 |
| 1.3 | 0.0 | 0.1 | 0.2 | 0.1 | 1.4 | 1.3 | 1.3 | 1.2 | 1.2 | -0.4 | -0.9 | -0.7 | -0.7 |
| 3.1 | 0.5 | 0.5 | 0.5 | 0.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.3 | 0.1 | -0.6 | -0.4 | -0.4 |
| -0.8 | -1.1 | -0.8 | -0.7 | -0.9 | 1.9 | 1.8 | 1.6 | 1.5 | 1.4 | -1.5 | -1.6 | -1.1 | -1.4 |
| -0.6 | -0.7 | -0.6 | -0.7 | -0.7 | 2.6 | 2.4 | 2.3 | 2.2 | 2.2 | -1.0 | -1.3 | -0.4 | -0.9 |

## Table A21 | Primary energy consumption per GDP

| | Reference Scenario (Tonne of oil equivalent [toe]/$2015 million) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 242 | 205 | 196 | 162 | 140 | 127 | 114 | 103 | 94 |
| Asia | 309 | 271 | 263 | 210 | 173 | 151 | 133 | 117 | 103 |
| China | 843 | 401 | 330 | 228 | 174 | 144 | 120 | 101 | 84 |
| India | 590 | 511 | 422 | 329 | 264 | 227 | 194 | 169 | 148 |
| Japan | 124 | 129 | 118 | 82 | 75 | 69 | 62 | 57 | 53 |
| Korea | 223 | 233 | 193 | 156 | 132 | 120 | 108 | 97 | 88 |
| Chinese Taipei | 315 | 292 | 254 | 161 | 142 | 127 | 114 | 102 | 93 |
| ASEAN | 294 | 301 | 256 | 224 | 203 | 193 | 177 | 162 | 150 |
| Indonesia | 314 | 320 | 253 | 234 | 218 | 225 | 208 | 191 | 177 |
| Malaysia | 284 | 326 | 312 | 263 | 221 | 198 | 178 | 160 | 144 |
| Myanmar | 1 514 | 960 | 329 | 333 | 312 | 277 | 247 | 227 | 210 |
| Philippines | 251 | 272 | 182 | 155 | 132 | 118 | 106 | 96 | 90 |
| Singapore | 163 | 133 | 100 | 80 | 72 | 67 | 62 | 58 | 55 |
| Thailand | 294 | 328 | 340 | 289 | 261 | 234 | 210 | 189 | 171 |
| Viet Nam | 397 | 307 | 330 | 270 | 246 | 222 | 199 | 180 | 164 |
| North America | 199 | 170 | 140 | 102 | 85 | 76 | 68 | 61 | 55 |
| United States | 196 | 166 | 136 | 97 | 80 | 72 | 64 | 58 | 53 |
| Latin America | 177 | 170 | 162 | 151 | 135 | 124 | 113 | 104 | 96 |
| Brazil | 153 | 159 | 157 | 159 | 143 | 132 | 121 | 111 | 102 |
| Advanced Europe | 141 | 120 | 108 | 74 | 63 | 57 | 51 | 45 | 41 |
| Other Europe/Eurasia | 842 | 802 | 543 | 429 | 362 | 328 | 297 | 270 | 246 |
| Russia | 757 | 794 | 554 | 512 | 451 | 417 | 384 | 353 | 324 |
| Africa | 366 | 354 | 299 | 284 | 240 | 210 | 179 | 154 | 135 |
| Middle East | 244 | 276 | 309 | 300 | 267 | 247 | 227 | 211 | 195 |
| Oceania | 151 | 138 | 119 | 88 | 79 | 70 | 62 | 56 | 50 |
| International Bunkers | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Advanced Economies | 164 | 146 | 126 | 91 | 77 | 70 | 62 | 56 | 51 |
| Group of Seven | 162 | 144 | 123 | 89 | 75 | 68 | 60 | 54 | 49 |
| Emerging and Developing Economies | 460 | 354 | 309 | 249 | 204 | 179 | 156 | 137 | 122 |
| Emerging and Developing Asia | 601 | 398 | 332 | 243 | 193 | 166 | 143 | 125 | 109 |
| Non-Asia | 219 | 180 | 162 | 130 | 113 | 103 | 94 | 86 | 80 |
| European Union | 158 | 130 | 118 | 81 | 69 | 62 | 55 | 49 | 44 |

Source: World Bank "World Development Indicators", International Energy Agency "World Energy Balances", etc. (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (toe/$2015 million) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| -1.2 | -2.1 | -2.0 | -1.9 | -2.0 | 136 | 118 | 101 | 88 | 78 | -2.4 | -2.9 | -2.6 | -2.7 |
| -1.2 | -2.7 | -2.6 | -2.5 | -2.6 | 168 | 141 | 116 | 97 | 82 | -3.1 | -3.6 | -3.4 | -3.4 |
| -3.9 | -3.8 | -3.6 | -3.5 | -3.6 | 169 | 133 | 103 | 81 | 64 | -4.2 | -4.8 | -4.6 | -4.6 |
| -1.7 | -3.1 | -3.0 | -2.7 | -2.9 | 257 | 211 | 170 | 138 | 115 | -3.5 | -4.1 | -3.9 | -3.8 |
| -1.2 | -1.3 | -1.9 | -1.6 | -1.6 | 74 | 66 | 58 | 52 | 48 | -1.4 | -2.5 | -1.9 | -2.0 |
| -1.1 | -2.4 | -2.0 | -2.0 | -2.1 | 131 | 116 | 103 | 91 | 80 | -2.5 | -2.4 | -2.5 | -2.5 |
| -2.0 | -1.8 | -2.1 | -2.0 | -2.0 | 139 | 119 | 102 | 88 | 78 | -2.1 | -3.0 | -2.7 | -2.7 |
| -0.8 | -1.4 | -1.4 | -1.6 | -1.5 | 193 | 179 | 158 | 140 | 126 | -2.1 | -2.0 | -2.2 | -2.1 |
| -0.9 | -1.0 | -0.5 | -1.6 | -1.0 | 209 | 213 | 193 | 173 | 156 | -1.6 | -0.8 | -2.1 | -1.5 |
| -0.2 | -2.5 | -2.1 | -2.1 | -2.2 | 209 | 180 | 155 | 133 | 115 | -3.3 | -2.9 | -2.9 | -3.0 |
| -4.5 | -0.9 | -2.3 | -1.6 | -1.7 | 286 | 233 | 198 | 176 | 157 | -2.1 | -3.6 | -2.3 | -2.7 |
| -1.4 | -2.3 | -2.2 | -1.6 | -2.0 | 126 | 113 | 97 | 84 | 76 | -2.9 | -2.6 | -2.4 | -2.6 |
| -2.1 | -1.4 | -1.6 | -1.2 | -1.4 | 72 | 65 | 59 | 53 | 49 | -1.5 | -2.0 | -1.8 | -1.8 |
| -0.1 | -1.4 | -2.2 | -2.0 | -1.9 | 254 | 220 | 188 | 163 | 143 | -1.8 | -3.0 | -2.7 | -2.6 |
| -1.2 | -1.3 | -2.1 | -1.9 | -1.8 | 226 | 193 | 162 | 140 | 124 | -2.5 | -3.3 | -2.7 | -2.8 |
| -2.0 | -2.7 | -2.2 | -2.0 | -2.2 | 82 | 71 | 61 | 54 | 48 | -3.0 | -3.0 | -2.5 | -2.8 |
| -2.1 | -2.7 | -2.2 | -2.0 | -2.2 | 78 | 67 | 58 | 50 | 45 | -3.1 | -3.0 | -2.5 | -2.8 |
| -0.5 | -1.5 | -1.8 | -1.6 | -1.6 | 132 | 116 | 102 | 90 | 81 | -1.9 | -2.5 | -2.3 | -2.3 |
| 0.1 | -1.6 | -1.7 | -1.7 | -1.6 | 139 | 122 | 106 | 93 | 83 | -1.9 | -2.6 | -2.5 | -2.4 |
| -1.9 | -2.3 | -2.2 | -2.2 | -2.2 | 61 | 53 | 46 | 41 | 38 | -2.7 | -2.9 | -1.9 | -2.4 |
| -2.0 | -2.4 | -2.0 | -1.8 | -2.0 | 360 | 317 | 276 | 242 | 213 | -2.5 | -2.6 | -2.6 | -2.6 |
| -1.2 | -1.8 | -1.6 | -1.7 | -1.7 | 448 | 400 | 353 | 311 | 275 | -1.9 | -2.4 | -2.5 | -2.3 |
| -0.8 | -2.4 | -2.9 | -2.8 | -2.7 | 228 | 188 | 154 | 127 | 107 | -3.1 | -3.9 | -3.5 | -3.5 |
| 0.6 | -1.6 | -1.6 | -1.5 | -1.6 | 259 | 231 | 205 | 186 | 169 | -2.0 | -2.3 | -1.9 | -2.1 |
| -1.6 | -1.6 | -2.3 | -2.1 | -2.1 | 78 | 66 | 56 | 50 | 44 | -1.7 | -3.3 | -2.3 | -2.5 |
| n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| -1.8 | -2.3 | -2.1 | -2.0 | -2.1 | 76 | 66 | 57 | 50 | 45 | -2.6 | -2.8 | -2.2 | -2.6 |
| -1.8 | -2.3 | -2.2 | -2.0 | -2.2 | 73 | 63 | 54 | 48 | 43 | -2.7 | -2.9 | -2.3 | -2.6 |
| -1.8 | -2.8 | -2.7 | -2.5 | -2.6 | 199 | 166 | 137 | 115 | 98 | -3.2 | -3.6 | -3.3 | -3.4 |
| -2.7 | -3.3 | -2.9 | -2.7 | -2.9 | 187 | 154 | 125 | 102 | 86 | -3.6 | -4.0 | -3.7 | -3.8 |
| -1.6 | -1.9 | -1.8 | -1.7 | -1.8 | 110 | 97 | 85 | 76 | 68 | -2.3 | -2.6 | -2.1 | -2.3 |
| -2.0 | -2.1 | -2.2 | -2.2 | -2.2 | 68 | 59 | 51 | 45 | 42 | -2.5 | -2.8 | -1.9 | -2.4 |

## Table A22 | Energy-related carbon dioxide emissions

| | Reference Scenario (Mt) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| World | 20 453 | 23 032 | 30 520 | 34 603 | 33 043 | 32 581 | 32 520 | 32 659 | 32 537 |
| Asia | 4 688 | 6 748 | 12 915 | 17 810 | 17 091 | 16 702 | 16 677 | 16 752 | 16 545 |
| China | 2 198 | 3 194 | 8 093 | 11 127 | 9 719 | 8 625 | 7 862 | 7 088 | 6 064 |
| India | 518 | 872 | 1 541 | 2 771 | 3 218 | 3 722 | 4 218 | 4 784 | 5 322 |
| Japan | 1 046 | 1 149 | 1 126 | 928 | 775 | 703 | 615 | 548 | 487 |
| Korea | 208 | 391 | 531 | 533 | 494 | 460 | 441 | 411 | 370 |
| Chinese Taipei | 108 | 213 | 252 | 257 | 253 | 243 | 229 | 212 | 195 |
| ASEAN | 334 | 649 | 1 006 | 1 716 | 2 098 | 2 323 | 2 578 | 2 837 | 3 080 |
| Indonesia | 125 | 239 | 346 | 672 | 858 | 949 | 1 071 | 1 194 | 1 312 |
| Malaysia | 48 | 102 | 177 | 240 | 264 | 279 | 289 | 296 | 301 |
| Myanmar | 4.0 | 9.3 | 7.6 | 28 | 32 | 39 | 49 | 60 | 73 |
| Philippines | 35 | 65 | 75 | 153 | 204 | 248 | 286 | 317 | 339 |
| Singapore | 23 | 36 | 45 | 44 | 47 | 48 | 47 | 46 | 46 |
| Thailand | 79 | 148 | 219 | 239 | 249 | 254 | 256 | 258 | 257 |
| Viet Nam | 17 | 42 | 123 | 293 | 379 | 434 | 498 | 576 | 656 |
| North America | 5 117 | 6 075 | 5 690 | 4 938 | 4 264 | 4 012 | 3 770 | 3 528 | 3 310 |
| United States | 4 729 | 5 599 | 5 193 | 4 426 | 3 815 | 3 575 | 3 338 | 3 114 | 2 914 |
| Latin America | 829 | 1 148 | 1 471 | 1 478 | 1 472 | 1 532 | 1 602 | 1 679 | 1 749 |
| Brazil | 191 | 294 | 372 | 416 | 384 | 403 | 427 | 453 | 474 |
| Advanced Europe | 3 948 | 3 916 | 3 823 | 2 924 | 2 429 | 2 207 | 1 976 | 1 757 | 1 536 |
| Other Europe/Eurasia | 3 859 | 2 324 | 2 494 | 2 510 | 2 357 | 2 298 | 2 257 | 2 251 | 2 282 |
| Russia | 2 101 | 1 379 | 1 449 | 1 622 | 1 510 | 1 473 | 1 414 | 1 393 | 1 404 |
| Africa | 542 | 672 | 1 039 | 1 270 | 1 366 | 1 547 | 1 756 | 2 007 | 2 254 |
| Middle East | 551 | 922 | 1 524 | 2 054 | 2 157 | 2 259 | 2 341 | 2 442 | 2 533 |
| Oceania | 280 | 360 | 422 | 383 | 357 | 340 | 324 | 310 | 296 |
| International Bunkers | 639 | 867 | 1 143 | 1 235 | 1 548 | 1 683 | 1 815 | 1 933 | 2 032 |
| Advanced Economies | 10 763 | 12 180 | 11 931 | 10 038 | 8 647 | 8 037 | 7 424 | 6 828 | 6 256 |
| Group of Seven | 8 377 | 9 354 | 8 791 | 7 248 | 6 137 | 5 687 | 5 241 | 4 828 | 4 450 |
| Emerging and Developing Economies | 9 050 | 9 984 | 17 446 | 23 330 | 22 847 | 22 861 | 23 281 | 23 897 | 24 250 |
| Emerging and Developing Asia | 3 269 | 4 919 | 10 919 | 16 017 | 15 494 | 15 225 | 15 324 | 15 518 | 15 432 |
| Non-Asia | 15 126 | 15 417 | 16 462 | 15 558 | 14 404 | 14 196 | 14 027 | 13 973 | 13 960 |
| European Union | 3 970 | 3 671 | 3 512 | 2 517 | 2 117 | 1 918 | 1 717 | 1 536 | 1 356 |

Source: International Energy Agency "World Energy Balances", etc. (historical)
The Institute of Energy Economics, Japan (projection)

| Reference Scenario | | | | | Advanced Technologies Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | | (Mt) | | | | | CAGR (%) | | | |
| 1990/ 2023 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2030 | 2030/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.6 | -0.7 | -0.2 | 0.0 | -0.2 | 31 201 | 26 128 | 21 684 | 17 523 | 14 135 | -1.5 | -3.6 | -4.2 | -3.3 |
| 4.1 | -0.6 | -0.2 | -0.1 | -0.3 | 16 099 | 12 915 | 10 443 | 8 445 | 6 987 | -1.4 | -4.2 | -3.9 | -3.4 |
| 5.0 | -1.9 | -2.1 | -2.6 | -2.2 | 9 303 | 6 419 | 4 296 | 2 835 | 1 839 | -2.5 | -7.4 | -8.1 | -6.4 |
| 5.2 | 2.2 | 2.7 | 2.4 | 2.4 | 3 016 | 3 132 | 3 115 | 2 894 | 2 705 | 1.2 | 0.3 | -1.4 | -0.1 |
| -0.4 | -2.5 | -2.3 | -2.3 | -2.4 | 686 | 516 | 364 | 216 | 99 | -4.2 | -6.1 | -12.2 | -7.9 |
| 2.9 | -1.1 | -1.1 | -1.7 | -1.3 | 434 | 329 | 227 | 145 | 84 | -2.9 | -6.3 | -9.4 | -6.6 |
| 2.7 | -0.2 | -1.0 | -1.6 | -1.0 | 225 | 192 | 155 | 115 | 81 | -1.9 | -3.7 | -6.3 | -4.2 |
| 5.1 | 2.9 | 2.1 | 1.8 | 2.2 | 1 920 | 1 775 | 1 694 | 1 594 | 1 474 | 1.6 | -1.2 | -1.4 | -0.6 |
| 5.2 | 3.6 | 2.2 | 2.0 | 2.5 | 790 | 734 | 715 | 674 | 615 | 2.3 | -1.0 | -1.5 | -0.3 |
| 5.0 | 1.4 | 0.9 | 0.4 | 0.8 | 246 | 231 | 203 | 175 | 148 | 0.3 | -1.9 | -3.1 | -1.8 |
| 6.0 | 2.1 | 4.3 | 4.1 | 3.6 | 30 | 35 | 41 | 47 | 54 | 1.1 | 3.1 | 2.8 | 2.5 |
| 4.5 | 4.2 | 3.4 | 1.7 | 3.0 | 187 | 186 | 186 | 182 | 168 | 2.9 | -0.1 | -1.0 | 0.3 |
| 2.0 | 1.2 | -0.1 | -0.3 | 0.2 | 39 | 24 | 16 | 8.1 | 1.8 | -1.5 | -8.8 | -19.5 | -11.2 |
| 3.4 | 0.6 | 0.3 | 0.0 | 0.3 | 236 | 214 | 194 | 172 | 152 | -0.2 | -1.9 | -2.4 | -1.7 |
| 9.1 | 3.7 | 2.8 | 2.8 | 3.0 | 330 | 287 | 271 | 264 | 261 | 1.7 | -1.9 | -0.4 | -0.4 |
| -0.1 | -2.1 | -1.2 | -1.3 | -1.5 | 4 012 | 3 170 | 2 340 | 1 432 | 692 | -2.9 | -5.2 | -11.5 | -7.0 |
| -0.2 | -2.1 | -1.3 | -1.3 | -1.5 | 3 578 | 2 800 | 2 042 | 1 208 | 533 | -3.0 | -5.5 | -12.6 | -7.5 |
| 1.8 | -0.1 | 0.9 | 0.9 | 0.6 | 1 399 | 1 316 | 1 195 | 1 047 | 894 | -0.8 | -1.6 | -2.9 | -1.8 |
| 2.4 | -1.1 | 1.1 | 1.1 | 0.5 | 353 | 338 | 313 | 282 | 251 | -2.3 | -1.2 | -2.2 | -1.9 |
| -0.9 | -2.6 | -2.0 | -2.5 | -2.4 | 2 191 | 1 691 | 1 163 | 662 | 287 | -4.0 | -6.1 | -13.1 | -8.2 |
| -1.3 | -0.9 | -0.4 | 0.1 | -0.4 | 2 296 | 2 043 | 1 820 | 1 594 | 1 400 | -1.3 | -2.3 | -2.6 | -2.1 |
| -0.8 | -1.0 | -0.7 | -0.1 | -0.5 | 1 471 | 1 305 | 1 121 | 946 | 798 | -1.4 | -2.7 | -3.3 | -2.6 |
| 2.6 | 1.0 | 2.5 | 2.5 | 2.1 | 1 297 | 1 323 | 1 334 | 1 317 | 1 277 | 0.3 | 0.3 | -0.4 | 0.0 |
| 4.1 | 0.7 | 0.8 | 0.8 | 0.8 | 2 055 | 1 958 | 1 819 | 1 646 | 1 476 | 0.0 | -1.2 | -2.1 | -1.2 |
| 1.0 | -1.0 | -1.0 | -0.9 | -1.0 | 347 | 268 | 196 | 108 | 25 | -1.4 | -5.5 | -18.5 | -9.6 |
| 2.0 | 3.3 | 1.6 | 1.1 | 1.9 | 1 505 | 1 445 | 1 372 | 1 272 | 1 097 | 2.9 | -0.9 | -2.2 | -0.4 |
| -0.2 | -2.1 | -1.5 | -1.7 | -1.7 | 7 957 | 6 208 | 4 475 | 2 697 | 1 281 | -3.3 | -5.6 | -11.8 | -7.3 |
| -0.4 | -2.3 | -1.6 | -1.6 | -1.8 | 5 663 | 4 398 | 3 169 | 1 865 | 823 | -3.5 | -5.6 | -12.6 | -7.7 |
| 2.9 | -0.3 | 0.2 | 0.4 | 0.1 | 21 739 | 18 475 | 15 836 | 13 553 | 11 757 | -1.0 | -3.1 | -2.9 | -2.5 |
| 4.9 | -0.5 | -0.1 | 0.1 | -0.1 | 14 691 | 11 836 | 9 668 | 7 950 | 6 711 | -1.2 | -4.1 | -3.6 | -3.2 |
| 0.1 | -1.1 | -0.3 | 0.0 | -0.4 | 13 597 | 11 768 | 9 868 | 7 805 | 6 051 | -1.9 | -3.2 | -4.8 | -3.4 |
| -1.4 | -2.4 | -2.1 | -2.3 | -2.3 | 1 900 | 1 449 | 1 002 | 594 | 289 | -3.9 | -6.2 | -11.7 | -7.7 |

## Table A23 | World

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 8 701 | 9 938 | 12 735 | 15 135 | 15 702 | 16 164 | 16 538 | 16 922 | 17 266 |
| Coal | 2 219 | 2 313 | 3 645 | 4 202 | 3 668 | 3 452 | 3 337 | 3 270 | 3 144 |
| Oil | 3 237 | 3 682 | 4 153 | 4 577 | 4 682 | 4 720 | 4 762 | 4 780 | 4 764 |
| Natural gas | 1 662 | 2 069 | 2 737 | 3 443 | 3 616 | 3 804 | 3 989 | 4 221 | 4 483 |
| Nuclear | 526 | 675 | 719 | 715 | 830 | 902 | 946 | 955 | 971 |
| Hydro | 184 | 225 | 297 | 366 | 413 | 433 | 453 | 473 | 494 |
| Geothermal | 34 | 52 | 61 | 110 | 157 | 244 | 265 | 278 | 291 |
| Solar, wind, etc. | 2.5 | 8.2 | 48 | 385 | 867 | 1 127 | 1 328 | 1 526 | 1 729 |
| Biomass and waste | 836 | 912 | 1 075 | 1 338 | 1 468 | 1 483 | 1 458 | 1 420 | 1 391 |
| Hydrogen | - | - | - | - | - | - | - | - | - |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 6 183 | 6 927 | 8 720 | 10 249 | 10 930 | 11 246 | 11 469 | 11 674 | 11 857 |
| Coal | 752 | 541 | 1 046 | 882 | 894 | 860 | 827 | 799 | 772 |
| Oil | 2 608 | 3 128 | 3 622 | 4 122 | 4 268 | 4 321 | 4 378 | 4 410 | 4 413 |
| Natural gas | 947 | 1 122 | 1 349 | 1 680 | 1 776 | 1 814 | 1 828 | 1 830 | 1 827 |
| Electricity | 834 | 1 087 | 1 538 | 2 171 | 2 541 | 2 811 | 3 066 | 3 340 | 3 615 |
| Heat | 336 | 249 | 276 | 385 | 425 | 423 | 404 | 381 | 356 |
| Hydrogen | - | - | - | - | 0.2 | 0.2 | 2.2 | 7.0 | 14 |
| Renewables and waste | 707 | 801 | 889 | 1 009 | 1 025 | 1 016 | 964 | 908 | 861 |
| Industry | 1 797 | 1 864 | 2 620 | 3 080 | 3 393 | 3 533 | 3 604 | 3 652 | 3 659 |
| Transport | 1 578 | 1 965 | 2 431 | 2 936 | 3 080 | 3 131 | 3 198 | 3 264 | 3 324 |
| Buildings, etc. | 2 330 | 2 478 | 2 874 | 3 232 | 3 347 | 3 424 | 3 462 | 3 513 | 3 595 |
| Non-energy use | 478 | 619 | 795 | 1 002 | 1 110 | 1 158 | 1 206 | 1 244 | 1 279 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 11 850 | 15 425 | 21 523 | 29 978 | 34 966 | 38 716 | 42 170 | 45 921 | 49 664 |
| Coal | 4 436 | 5 993 | 8 682 | 10 687 | 8 648 | 8 023 | 7 773 | 7 792 | 7 596 |
| Oil | 1 322 | 1 187 | 968 | 778 | 594 | 538 | 476 | 419 | 343 |
| Natural gas | 1 743 | 2 765 | 4 820 | 6 648 | 6 887 | 7 547 | 8 339 | 9 395 | 10 581 |
| Nuclear | 2 013 | 2 591 | 2 756 | 2 740 | 3 186 | 3 460 | 3 630 | 3 664 | 3 726 |
| Hydro | 2 143 | 2 619 | 3 456 | 4 252 | 4 809 | 5 035 | 5 264 | 5 499 | 5 746 |
| Geothermal | 36 | 52 | 68 | 98 | 137 | 204 | 222 | 236 | 249 |
| Solar photovoltaics | 0.1 | 0.8 | 32 | 1 605 | 5 781 | 7 909 | 9 361 | 10 743 | 12 149 |
| Wind | 3.9 | 31 | 342 | 2 333 | 3 732 | 4 608 | 5 496 | 6 408 | 7 355 |
| Concentrated solar power and marine | 1.2 | 1.1 | 2.2 | 16 | 17 | 17 | 18 | 19 | 20 |
| Biomass and waste | 130 | 163 | 364 | 773 | 1 110 | 1 201 | 1 308 | 1 379 | 1 450 |
| Hydrogen | - | - | - | - | 17 | 126 | 236 | 319 | 401 |
| Others | 20 | 22 | 34 | 47 | 47 | 47 | 47 | 47 | 47 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 20 453 | 23 032 | 30 520 | 34 603 | 33 043 | 32 581 | 32 520 | 32 659 | 32 537 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 36 016 | 48 379 | 65 081 | 93 506 | 112 250 | 127 708 | 145 013 | 164 008 | 184 245 |
| Population (million) | 5 292 | 6 153 | 6 991 | 8 054 | 8 526 | 8 838 | 9 126 | 9 385 | 9 606 |
| GDP per capita ($2015 thousand) | 6.8 | 7.9 | 9.3 | 12 | 13 | 14 | 16 | 17 | 19 |
| Primary energy consumption per capita (toe/person) | 1.6 | 1.6 | 1.8 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Primary energy consumption per GDP (toe/$2015 million) | 242 | 205 | 196 | 162 | 140 | 127 | 114 | 103 | 94 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 568 | 476 | 469 | 370 | 294 | 255 | 224 | 199 | 177 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.3 | 2.4 | 2.3 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 1.7 | 0.5 | 0.4 | 0.5 | 100 | 100 | 100 | 100 | 15 305 | 15 099 | 14 691 | 14 435 | 14 282 | -0.2 | -0.3 | -0.2 | 100 | 100 |
| 2.0 | -1.3 | -0.6 | -1.1 | 26 | 28 | 20 | 18 | 3 431 | 2 872 | 2 421 | 2 057 | 1 698 | -3.2 | -3.5 | -3.3 | 16 | 12 |
| 1.1 | 0.2 | 0.0 | 0.1 | 37 | 30 | 29 | 28 | 4 425 | 4 025 | 3 593 | 3 135 | 2 715 | -1.4 | -2.8 | -1.9 | 24 | 19 |
| 2.2 | 0.9 | 1.2 | 1.0 | 19 | 23 | 24 | 26 | 3 566 | 3 617 | 3 552 | 3 497 | 3 423 | 0.2 | -0.4 | 0.0 | 24 | 24 |
| 0.9 | 1.7 | 0.3 | 1.1 | 6.0 | 4.7 | 5.7 | 5.6 | 880 | 1 077 | 1 243 | 1 393 | 1 545 | 3.3 | 2.2 | 2.9 | 8.5 | 11 |
| 2.1 | 1.3 | 0.9 | 1.1 | 2.1 | 2.4 | 2.7 | 2.9 | 422 | 448 | 477 | 509 | 544 | 1.6 | 1.3 | 1.5 | 3.2 | 3.8 |
| 3.6 | 5.3 | 0.9 | 3.7 | 0.4 | 0.7 | 1.6 | 1.7 | 154 | 261 | 298 | 328 | 359 | 6.0 | 1.9 | 4.5 | 2.0 | 2.5 |
| 16.4 | 7.5 | 2.7 | 5.7 | 0.0 | 2.5 | 8.0 | 10 | 950 | 1 352 | 1 702 | 2 125 | 2 584 | 9.1 | 4.3 | 7.3 | 12 | 18 |
| 1.4 | 0.5 | -0.5 | 0.1 | 9.6 | 8.8 | 8.8 | 8.1 | 1 477 | 1 446 | 1 406 | 1 391 | 1 415 | 0.3 | 0.1 | 0.2 | 9.6 | 9.9 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 1.5 | 0.7 | 0.3 | 0.5 | 100 | 100 | 100 | 100 | 10 575 | 10 277 | 9 852 | 9 502 | 9 282 | -0.2 | -0.6 | -0.4 | 100 | 100 |
| 0.5 | -0.4 | -0.7 | -0.5 | 12 | 8.6 | 7.2 | 6.5 | 821 | 697 | 595 | 518 | 460 | -2.3 | -2.6 | -2.4 | 6.0 | 5.0 |
| 1.4 | 0.4 | 0.1 | 0.3 | 42 | 40 | 38 | 37 | 4 066 | 3 757 | 3 404 | 3 048 | 2 702 | -1.1 | -2.3 | -1.6 | 35 | 29 |
| 1.8 | 0.5 | 0.0 | 0.3 | 15 | 16 | 16 | 15 | 1 687 | 1 566 | 1 397 | 1 228 | 1 075 | -1.1 | -2.6 | -1.6 | 14 | 12 |
| 2.9 | 2.1 | 1.7 | 1.9 | 13 | 21 | 27 | 30 | 2 608 | 2 911 | 3 169 | 3 436 | 3 692 | 2.2 | 1.5 | 2.0 | 32 | 40 |
| 0.4 | 0.3 | -1.3 | -0.3 | 5.4 | 3.8 | 3.5 | 3.0 | 396 | 368 | 329 | 290 | 255 | -0.9 | -2.5 | -1.5 | 3.3 | 2.8 |
| n.a. | n.a. | 20.4 | n.a. | - | - | 0.0 | 0.1 | 0.3 | 36 | 84 | 147 | 265 | n.a. | 12.2 | n.a. | 0.9 | 2.9 |
| 1.1 | -0.3 | -1.1 | -0.6 | 11 | 9.8 | 8.4 | 7.3 | 999 | 942 | 874 | 835 | 834 | -0.8 | -0.5 | -0.7 | 8.9 | 9.0 |
| 1.6 | 0.9 | 0.2 | 0.6 | 29 | 30 | 31 | 31 | 3 243 | 3 128 | 2 921 | 2 722 | 2 585 | -0.3 | -1.2 | -0.6 | 30 | 28 |
| 1.9 | 0.5 | 0.4 | 0.5 | 26 | 29 | 28 | 28 | 2 964 | 2 798 | 2 634 | 2 501 | 2 429 | -0.6 | -0.8 | -0.7 | 27 | 26 |
| 1.0 | 0.4 | 0.4 | 0.4 | 38 | 32 | 30 | 30 | 3 259 | 3 195 | 3 093 | 3 035 | 2 991 | -0.3 | -0.3 | -0.3 | 31 | 32 |
| 2.3 | 1.1 | 0.6 | 0.9 | 7.7 | 9.8 | 11 | 11 | 1 109 | 1 157 | 1 205 | 1 243 | 1 278 | 1.1 | 0.6 | 0.9 | 12 | 14 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.9 | 2.0 | 1.6 | 1.9 | 100 | 100 | 100 | 100 | 36 016 | 41 212 | 45 615 | 51 394 | 57 579 | 2.5 | 2.4 | 2.4 | 100 | 100 |
| 2.7 | -1.9 | -0.2 | -1.3 | 37 | 36 | 18 | 15 | 7 996 | 6 339 | 4 946 | 3 822 | 2 704 | -4.4 | -5.9 | -5.0 | 11 | 4.7 |
| -1.6 | -2.9 | -3.2 | -3.0 | 11 | 2.6 | 1.1 | 0.7 | 503 | 386 | 285 | 218 | 173 | -5.7 | -4.8 | -5.4 | 0.6 | 0.3 |
| 4.1 | 1.3 | 2.4 | 1.7 | 15 | 22 | 20 | 21 | 7 277 | 8 125 | 8 629 | 9 346 | 9 956 | 1.5 | 1.4 | 1.5 | 19 | 17 |
| 0.9 | 1.7 | 0.3 | 1.1 | 17 | 9.1 | 8.6 | 7.5 | 3 379 | 4 135 | 4 769 | 5 345 | 5 929 | 3.3 | 2.2 | 2.9 | 10 | 10 |
| 2.1 | 1.3 | 0.9 | 1.1 | 18 | 14 | 12 | 12 | 4 907 | 5 215 | 5 548 | 5 915 | 6 322 | 1.6 | 1.3 | 1.5 | 12 | 11 |
| 3.0 | 4.9 | 1.2 | 3.5 | 0.3 | 0.3 | 0.5 | 0.5 | 137 | 227 | 256 | 281 | 306 | 6.1 | 1.8 | 4.5 | 0.6 | 0.5 |
| 34.5 | 10.9 | 2.6 | 7.8 | 0.0 | 5.4 | 22 | 24 | 6 608 | 9 791 | 12 323 | 15 044 | 17 905 | 12.7 | 3.8 | 9.3 | 27 | 31 |
| 21.4 | 5.2 | 3.0 | 4.3 | 0.0 | 7.8 | 13 | 15 | 3 883 | 5 343 | 6 877 | 9 060 | 11 537 | 6.6 | 5.3 | 6.1 | 15 | 20 |
| 8.3 | 0.5 | 1.3 | 0.8 | 0.0 | 0.1 | 0.0 | 0.0 | 19 | 21 | 25 | 31 | 37 | 2.4 | 4.2 | 3.1 | 0.1 | 0.1 |
| 5.5 | 3.1 | 1.0 | 2.4 | 1.1 | 2.6 | 3.1 | 2.9 | 1 235 | 1 348 | 1 464 | 1 567 | 1 670 | 3.8 | 1.3 | 2.9 | 3.2 | 2.9 |
| n.a. | n.a. | 5.5 | n.a. | - | - | 0.6 | 0.8 | 26 | 236 | 446 | 718 | 991 | n.a. | 8.3 | n.a. | 1.0 | 1.7 |
| 2.7 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 | 47 | 47 | 47 | 47 | 47 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.6 | -0.4 | 0.0 | -0.2 | 31 201 | 26 128 | 21 684 | 17 523 | 14 135 | -2.7 | -4.2 | -3.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | 172 | 544 | 974 | n.a. | 18.9 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.9 | 2.6 | 2.4 | 2.5 | 112 250 | 127 708 | 145 013 | 164 008 | 184 245 | 2.6 | 2.4 | 2.5 |
| 1.3 | 0.7 | 0.5 | 0.7 | 8 526 | 8 838 | 9 126 | 9 385 | 9 606 | 0.7 | 0.5 | 0.7 |
| 1.6 | 1.9 | 1.9 | 1.9 | 13 | 14 | 16 | 17 | 19 | 1.9 | 1.9 | 1.9 |
| 0.4 | -0.2 | -0.1 | -0.2 | 1.8 | 1.7 | 1.6 | 1.5 | 1.5 | -0.9 | -0.8 | -0.9 |
| -1.2 | -2.0 | -1.9 | -2.0 | 136 | 118 | 101 | 88 | 78 | -2.7 | -2.6 | -2.7 |
| -1.3 | -2.9 | -2.4 | -2.7 | 278 | 205 | 150 | 107 | 77 | -5.2 | -6.5 | -5.7 |
| -0.1 | -0.9 | -0.4 | -0.7 | 2.0 | 1.7 | 1.5 | 1.2 | 1.0 | -2.5 | -3.9 | -3.1 |

## Table A24 | Asia

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 2 073 | 2 839 | 4 758 | 6 869 | 7 301 | 7 595 | 7 865 | 8 137 | 8 340 |
| Coal | 785 | 1 033 | 2 400 | 3 422 | 3 081 | 2 915 | 2 829 | 2 771 | 2 650 |
| Oil | 618 | 918 | 1 171 | 1 576 | 1 702 | 1 750 | 1 810 | 1 863 | 1 903 |
| Natural gas | 116 | 234 | 454 | 739 | 884 | 983 | 1 089 | 1 206 | 1 325 |
| Nuclear | 77 | 132 | 152 | 206 | 282 | 313 | 344 | 371 | 403 |
| Hydro | 32 | 41 | 92 | 151 | 174 | 184 | 194 | 203 | 212 |
| Geothermal | 8.2 | 23 | 30 | 61 | 86 | 152 | 165 | 171 | 176 |
| Solar, wind, etc. | 1.3 | 2.1 | 16 | 195 | 533 | 715 | 830 | 932 | 1 036 |
| Biomass and waste | 435 | 456 | 444 | 518 | 558 | 580 | 597 | 609 | 620 |
| Hydrogen | - | - | - | - | 0.8 | 3.0 | 7.7 | 11 | 15 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 515 | 1 952 | 3 128 | 4 280 | 4 774 | 4 996 | 5 179 | 5 350 | 5 488 |
| Coal | 423 | 372 | 885 | 746 | 757 | 729 | 702 | 678 | 654 |
| Oil | 465 | 743 | 992 | 1 405 | 1 524 | 1 569 | 1 625 | 1 675 | 1 714 |
| Natural gas | 46 | 90 | 201 | 414 | 483 | 517 | 540 | 555 | 561 |
| Electricity | 157 | 279 | 575 | 1 107 | 1 370 | 1 537 | 1 681 | 1 827 | 1 962 |
| Heat | 14 | 30 | 70 | 204 | 249 | 252 | 240 | 224 | 205 |
| Hydrogen | - | - | - | - | 0.2 | 0.2 | 0.8 | 2.2 | 3.9 |
| Renewables and waste | 409 | 437 | 405 | 403 | 389 | 393 | 390 | 390 | 388 |
| Industry | 512 | 654 | 1 396 | 1 811 | 2 055 | 2 151 | 2 195 | 2 223 | 2 212 |
| Transport | 189 | 323 | 493 | 795 | 898 | 936 | 986 | 1 039 | 1 091 |
| Buildings, etc. | 697 | 787 | 942 | 1 185 | 1 252 | 1 312 | 1 374 | 1 447 | 1 529 |
| Non-energy use | 117 | 188 | 298 | 489 | 569 | 597 | 624 | 642 | 657 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2 244 | 3 970 | 7 975 | 15 098 | 18 676 | 21 005 | 22 891 | 24 838 | 26 621 |
| Coal | 875 | 1 982 | 4 788 | 8 643 | 7 323 | 6 855 | 6 692 | 6 723 | 6 521 |
| Oil | 433 | 381 | 260 | 125 | 95 | 93 | 91 | 93 | 90 |
| Natural gas | 237 | 566 | 1 070 | 1 440 | 1 719 | 1 990 | 2 324 | 2 747 | 3 204 |
| Nuclear | 294 | 505 | 582 | 791 | 1 083 | 1 202 | 1 319 | 1 424 | 1 549 |
| Hydro | 368 | 478 | 1 072 | 1 754 | 2 021 | 2 138 | 2 251 | 2 359 | 2 465 |
| Geothermal | 8.4 | 20 | 22 | 31 | 43 | 81 | 90 | 94 | 98 |
| Solar photovoltaics | 0.1 | 0.4 | 5.2 | 888 | 3 854 | 5 399 | 6 185 | 6 877 | 7 582 |
| Wind | 0.0 | 2.4 | 70 | 1 022 | 1 963 | 2 537 | 3 080 | 3 574 | 4 078 |
| Concentrated solar power and marine | 0.0 | 0.0 | 0.0 | 2.5 | 2.8 | 2.8 | 2.9 | 2.9 | 3.0 |
| Biomass and waste | 9.0 | 15 | 83 | 382 | 545 | 605 | 681 | 726 | 771 |
| Hydrogen | - | - | - | - | 6.7 | 81 | 156 | 197 | 239 |
| Others | 20 | 20 | 21 | 20 | 20 | 20 | 20 | 20 | 20 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 4 688 | 6 748 | 12 915 | 17 810 | 17 091 | 16 702 | 16 677 | 16 752 | 16 545 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 6 719 | 10 478 | 18 086 | 32 734 | 42 276 | 50 161 | 59 295 | 69 593 | 80 766 |
| Population (million) | 2 954 | 3 461 | 3 891 | 4 350 | 4 500 | 4 589 | 4 656 | 4 700 | 4 718 |
| GDP per capita ($2015 thousand) | 2.3 | 3.0 | 4.6 | 7.5 | 9.4 | 11 | 13 | 15 | 17 |
| Primary energy consumption per capita (toe/person) | 0.7 | 0.8 | 1.2 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.8 |
| Primary energy consumption per GDP (toe/$2015 million) | 309 | 271 | 263 | 210 | 173 | 151 | 133 | 117 | 103 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 698 | 644 | 714 | 544 | 404 | 333 | 281 | 241 | 205 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.3 | 2.4 | 2.7 | 2.6 | 2.3 | 2.2 | 2.1 | 2.1 | 2.0 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 3.7 | 0.8 | 0.6 | 0.7 | 100 | 100 | 100 | 100 | 7 112 | 7 053 | 6 882 | 6 745 | 6 631 | 0.0 | -0.4 | -0.1 | 100 | 100 |
| 4.6 | -1.1 | -0.7 | -0.9 | 38 | 50 | 36 | 32 | 2 909 | 2 450 | 2 045 | 1 700 | 1 358 | -3.0 | -4.0 | -3.4 | 30 | 20 |
| 2.9 | 0.8 | 0.5 | 0.7 | 30 | 23 | 23 | 23 | 1 615 | 1 521 | 1 427 | 1 324 | 1 223 | -0.6 | -1.5 | -0.9 | 21 | 18 |
| 5.8 | 2.3 | 2.0 | 2.2 | 5.6 | 11 | 14 | 16 | 851 | 865 | 849 | 830 | 818 | 0.8 | -0.4 | 0.4 | 12 | 12 |
| 3.0 | 3.1 | 1.6 | 2.5 | 3.7 | 3.0 | 4.4 | 4.8 | 319 | 431 | 534 | 622 | 696 | 5.8 | 2.7 | 4.6 | 7.8 | 10 |
| 4.8 | 1.5 | 0.9 | 1.3 | 1.5 | 2.2 | 2.5 | 2.5 | 181 | 198 | 216 | 236 | 258 | 2.1 | 1.8 | 2.0 | 3.1 | 3.9 |
| 6.3 | 6.0 | 0.6 | 4.0 | 0.4 | 0.9 | 2.1 | 2.1 | 83 | 160 | 188 | 210 | 233 | 6.9 | 2.1 | 5.1 | 2.7 | 3.5 |
| 16.4 | 8.9 | 2.2 | 6.4 | 0.1 | 2.8 | 11 | 12 | 573 | 829 | 1 007 | 1 188 | 1 394 | 10.1 | 3.3 | 7.6 | 15 | 21 |
| 0.5 | 0.8 | 0.4 | 0.7 | 21 | 7.5 | 7.6 | 7.4 | 573 | 581 | 581 | 585 | 599 | 0.7 | 0.3 | 0.5 | 8.4 | 9.0 |
| n.a. | n.a. | 6.7 | n.a. | - | - | 0.1 | 0.2 | 6.2 | 18 | 34 | 48 | 53 | n.a. | 4.6 | n.a. | 0.5 | 0.8 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.2 | 1.1 | 0.6 | 0.9 | 100 | 100 | 100 | 100 | 4 609 | 4 554 | 4 433 | 4 322 | 4 260 | 0.2 | -0.4 | 0.0 | 100 | 100 |
| 1.7 | -0.4 | -0.7 | -0.5 | 28 | 17 | 14 | 12 | 699 | 596 | 510 | 444 | 394 | -2.2 | -2.6 | -2.3 | 12 | 9.2 |
| 3.4 | 0.9 | 0.5 | 0.7 | 31 | 33 | 31 | 31 | 1 449 | 1 374 | 1 295 | 1 210 | 1 124 | -0.5 | -1.4 | -0.8 | 29 | 26 |
| 6.9 | 1.6 | 0.4 | 1.1 | 3.1 | 9.7 | 10 | 10 | 453 | 432 | 389 | 342 | 301 | -0.4 | -2.5 | -1.2 | 8.8 | 7.1 |
| 6.1 | 2.5 | 1.6 | 2.1 | 10 | 26 | 32 | 36 | 1 402 | 1 569 | 1 695 | 1 812 | 1 934 | 2.5 | 1.3 | 2.1 | 38 | 45 |
| 8.4 | 1.0 | -1.6 | 0.0 | 0.9 | 4.8 | 4.6 | 3.7 | 224 | 207 | 181 | 155 | 132 | -0.7 | -3.1 | -1.6 | 4.1 | 3.1 |
| n.a. | n.a. | 17.5 | n.a. | - | - | 0.0 | 0.1 | 0.1 | 5.7 | 14 | 26 | 50 | n.a. | 13.9 | n.a. | 0.3 | 1.2 |
| 0.0 | -0.2 | -0.1 | -0.1 | 27 | 9.4 | 7.5 | 7.1 | 382 | 370 | 349 | 332 | 324 | -0.8 | -0.7 | -0.8 | 7.9 | 7.6 |
| 3.9 | 1.1 | 0.1 | 0.7 | 34 | 42 | 42 | 40 | 1 959 | 1 894 | 1 768 | 1 647 | 1 562 | -0.1 | -1.2 | -0.5 | 40 | 37 |
| 4.4 | 1.3 | 1.0 | 1.2 | 12 | 19 | 19 | 20 | 856 | 825 | 796 | 774 | 766 | 0.0 | -0.4 | -0.1 | 18 | 18 |
| 1.6 | 0.9 | 1.1 | 0.9 | 46 | 28 | 27 | 28 | 1 225 | 1 239 | 1 247 | 1 260 | 1 276 | 0.3 | 0.2 | 0.3 | 28 | 30 |
| 4.4 | 1.4 | 0.5 | 1.1 | 7.7 | 11 | 12 | 12 | 569 | 596 | 623 | 641 | 656 | 1.4 | 0.5 | 1.1 | 14 | 15 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 5.9 | 2.5 | 1.5 | 2.1 | 100 | 100 | 100 | 100 | 19 147 | 21 902 | 23 739 | 25 823 | 28 204 | 2.7 | 1.7 | 2.3 | 100 | 100 |
| 7.2 | -1.5 | -0.3 | -1.0 | 39 | 57 | 29 | 24 | 6 892 | 5 556 | 4 301 | 3 208 | 2 116 | -4.0 | -6.8 | -5.1 | 18 | 7.5 |
| -3.7 | -1.8 | -0.1 | -1.2 | 19 | 0.8 | 0.4 | 0.3 | 88 | 83 | 78 | 75 | 70 | -2.7 | -1.0 | -2.1 | 0.3 | 0.2 |
| 5.6 | 2.9 | 3.3 | 3.0 | 11 | 9.5 | 10 | 12 | 1 832 | 2 067 | 2 248 | 2 471 | 2 707 | 2.7 | 1.9 | 2.4 | 9.5 | 9.6 |
| 3.0 | 3.1 | 1.6 | 2.5 | 13 | 5.2 | 5.8 | 5.8 | 1 224 | 1 653 | 2 048 | 2 388 | 2 670 | 5.8 | 2.7 | 4.6 | 8.6 | 9.5 |
| 4.8 | 1.5 | 0.9 | 1.3 | 16 | 12 | 9.8 | 9.3 | 2 110 | 2 304 | 2 513 | 2 744 | 2 999 | 2.1 | 1.8 | 2.0 | 11 | 11 |
| 4.1 | 6.4 | 0.9 | 4.3 | 0.4 | 0.2 | 0.4 | 0.4 | 43 | 93 | 111 | 126 | 141 | 7.7 | 2.4 | 5.7 | 0.5 | 0.5 |
| 33.2 | 12.1 | 2.1 | 8.3 | 0.0 | 5.9 | 27 | 28 | 4 263 | 6 375 | 7 677 | 8 890 | 10 231 | 13.5 | 2.9 | 9.5 | 32 | 36 |
| 36.7 | 6.7 | 2.8 | 5.3 | 0.0 | 6.8 | 13 | 15 | 2 040 | 2 894 | 3 663 | 4 551 | 5 626 | 7.8 | 4.4 | 6.5 | 15 | 20 |
| 19.5 | 0.8 | 0.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 3.5 | 3.7 | 3.9 | 4.3 | 4.7 | 2.6 | 1.9 | 2.3 | 0.0 | 0.0 |
| 12.0 | 3.5 | 1.3 | 2.6 | 0.4 | 2.5 | 3.0 | 2.9 | 617 | 691 | 765 | 838 | 911 | 4.2 | 1.8 | 3.3 | 3.2 | 3.2 |
| n.a. | n.a. | 4.4 | n.a. | - | - | 0.7 | 0.9 | 14 | 162 | 310 | 509 | 707 | n.a. | 8.6 | n.a. | 1.3 | 2.5 |
| 0.1 | 0.0 | 0.0 | 0.0 | 0.9 | 0.1 | 0.1 | 0.1 | 20 | 20 | 20 | 20 | 20 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.1 | -0.4 | -0.1 | -0.3 | 16 099 | 12 915 | 10 443 | 8 445 | 6 987 | -3.1 | -3.9 | -3.4 |
| n.a. | n.a. | n.a. | n.a. | - | - | 82 | 191 | 313 | n.a. | 14.3 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.9 | 3.6 | 3.1 | 3.4 | 42 276 | 50 161 | 59 295 | 69 593 | 80 766 | 3.6 | 3.1 | 3.4 |
| 1.2 | 0.4 | 0.1 | 0.3 | 4 500 | 4 589 | 4 656 | 4 700 | 4 718 | 0.4 | 0.1 | 0.3 |
| 3.7 | 3.1 | 3.0 | 3.1 | 9.4 | 11 | 13 | 15 | 17 | 3.1 | 3.0 | 3.1 |
| 2.5 | 0.4 | 0.5 | 0.4 | 1.6 | 1.5 | 1.5 | 1.4 | 1.4 | -0.4 | -0.5 | -0.4 |
| -1.2 | -2.7 | -2.5 | -2.6 | 168 | 141 | 116 | 97 | 82 | -3.4 | -3.4 | -3.4 |
| -0.8 | -3.8 | -3.1 | -3.6 | 381 | 257 | 176 | 121 | 87 | -6.4 | -6.9 | -6.6 |
| 0.4 | -1.2 | -0.7 | -1.0 | 2.3 | 1.8 | 1.5 | 1.3 | 1.1 | -3.1 | -3.6 | -3.3 |

## Table A25 | China

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 878 | 1 134 | 2 541 | 4 022 | 4 032 | 3 930 | 3 842 | 3 722 | 3 528 |
| Coal | 531 | 665 | 1 790 | 2 449 | 2 030 | 1 776 | 1 606 | 1 441 | 1 224 |
| Oil | 119 | 221 | 428 | 736 | 785 | 756 | 730 | 697 | 659 |
| Natural gas | 13 | 21 | 89 | 319 | 370 | 382 | 386 | 378 | 354 |
| Nuclear | - | 4.4 | 19 | 113 | 149 | 171 | 193 | 214 | 236 |
| Hydro | 11 | 19 | 61 | 106 | 117 | 121 | 124 | 127 | 130 |
| Geothermal | - | 1.1 | 2.4 | 19 | 27 | 29 | 29 | 28 | 26 |
| Solar, wind, etc. | 0.0 | 1.0 | 12 | 154 | 408 | 541 | 609 | 666 | 725 |
| Biomass and waste | 205 | 203 | 140 | 127 | 146 | 155 | 166 | 171 | 176 |
| Hydrogen | - | - | - | - | -0.1 | 0.1 | 1.1 | 0.9 | 0.8 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 662 | 785 | 1 649 | 2 410 | 2 609 | 2 613 | 2 577 | 2 519 | 2 430 |
| Coal | 311 | 274 | 712 | 526 | 480 | 426 | 377 | 334 | 295 |
| Oil | 85 | 180 | 369 | 676 | 714 | 688 | 667 | 639 | 605 |
| Natural gas | 8.9 | 12 | 73 | 242 | 274 | 278 | 273 | 260 | 242 |
| Electricity | 39 | 89 | 297 | 689 | 844 | 922 | 973 | 1 012 | 1 032 |
| Heat | 13 | 26 | 63 | 194 | 238 | 240 | 229 | 213 | 195 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.4 | 1.2 | 2.1 |
| Renewables and waste | 205 | 202 | 135 | 83 | 59 | 58 | 58 | 58 | 58 |
| Industry | 238 | 301 | 923 | 1 166 | 1 226 | 1 200 | 1 139 | 1 063 | 962 |
| Transport | 30 | 83 | 195 | 376 | 424 | 413 | 403 | 391 | 378 |
| Buildings, etc. | 351 | 338 | 412 | 584 | 624 | 659 | 691 | 724 | 758 |
| Non-energy use | 43 | 62 | 120 | 285 | 335 | 341 | 345 | 340 | 331 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 621 | 1 356 | 4 197 | 9 492 | 11 567 | 12 651 | 13 279 | 13 796 | 14 057 |
| Coal | 441 | 1 060 | 3 240 | 5 857 | 4 528 | 3 837 | 3 440 | 3 116 | 2 574 |
| Oil | 50 | 47 | 15 | 9.1 | 6.2 | 4.7 | 3.6 | 2.8 | 1.9 |
| Natural gas | 2.8 | 5.8 | 78 | 283 | 336 | 359 | 390 | 418 | 400 |
| Nuclear | - | 17 | 74 | 435 | 574 | 656 | 741 | 822 | 904 |
| Hydro | 127 | 222 | 711 | 1 231 | 1 365 | 1 408 | 1 447 | 1 482 | 1 513 |
| Geothermal | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Solar photovoltaics | 0.0 | 0.0 | 0.7 | 584 | 2 781 | 3 855 | 4 192 | 4 469 | 4 750 |
| Wind | 0.0 | 0.6 | 45 | 886 | 1 625 | 2 097 | 2 549 | 2 942 | 3 341 |
| Concentrated solar power and marine | 0.0 | 0.0 | 0.0 | 2.1 | 1.9 | 2.0 | 2.0 | 2.0 | 2.1 |
| Biomass and waste | - | 2.4 | 34 | 206 | 351 | 391 | 431 | 457 | 482 |
| Hydrogen | - | - | - | - | - | 41 | 82 | 86 | 90 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 2 198 | 3 194 | 8 093 | 11 127 | 9 719 | 8 625 | 7 862 | 7 088 | 6 064 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 1 041 | 2 825 | 7 712 | 17 612 | 23 232 | 27 323 | 31 895 | 36 873 | 42 032 |
| Population (million) | 1 135 | 1 263 | 1 338 | 1 411 | 1 387 | 1 362 | 1 332 | 1 295 | 1 250 |
| GDP per capita ($2015 thousand) | 0.9 | 2.2 | 5.8 | 12 | 17 | 20 | 24 | 28 | 34 |
| Primary energy consumption per capita (toe/person) | 0.8 | 0.9 | 1.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 |
| Primary energy consumption per GDP (toe/$2015 million) | 843 | 401 | 330 | 228 | 174 | 144 | 120 | 101 | 84 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 2 111 | 1 131 | 1 049 | 632 | 418 | 316 | 247 | 192 | 144 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.5 | 2.8 | 3.2 | 2.8 | 2.4 | 2.2 | 2.0 | 1.9 | 1.7 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 4.7 | -0.3 | -0.8 | -0.5 | 100 | 100 | 100 | 100 | 3 935 | 3 625 | 3 290 | 3 001 | 2 710 | -1.2 | -1.9 | -1.5 | 100 | 100 |
| 4.7 | -2.5 | -2.7 | -2.5 | 60 | 61 | 42 | 35 | 1 949 | 1 524 | 1 165 | 884 | 581 | -4.3 | -6.7 | -5.2 | 35 | 21 |
| 5.7 | 0.0 | -1.0 | -0.4 | 14 | 18 | 19 | 19 | 751 | 664 | 584 | 509 | 445 | -1.3 | -2.7 | -1.8 | 18 | 16 |
| 10.2 | 1.1 | -0.9 | 0.4 | 1.5 | 7.9 | 10 | 10 | 371 | 339 | 279 | 206 | 124 | -0.8 | -7.8 | -3.4 | 8.5 | 4.6 |
| n.a. | 3.2 | 2.0 | 2.7 | - | 2.8 | 5.0 | 6.7 | 149 | 187 | 225 | 263 | 300 | 4.1 | 2.9 | 3.7 | 6.9 | 11 |
| 7.1 | 1.0 | 0.4 | 0.8 | 1.2 | 2.6 | 3.2 | 3.7 | 119 | 124 | 129 | 135 | 140 | 1.2 | 0.8 | 1.0 | 3.9 | 5.2 |
| n.a. | 2.4 | -0.8 | 1.2 | - | 0.5 | 0.7 | 0.7 | 24 | 26 | 24 | 22 | 20 | 1.5 | -2.0 | 0.2 | 0.7 | 0.7 |
| 29.2 | 8.4 | 1.8 | 5.9 | 0.0 | 3.8 | 16 | 21 | 419 | 594 | 697 | 786 | 895 | 9.3 | 2.5 | 6.7 | 21 | 33 |
| -1.4 | 1.6 | 0.6 | 1.2 | 23 | 3.2 | 4.3 | 5.0 | 154 | 168 | 184 | 199 | 215 | 2.2 | 1.6 | 2.0 | 5.6 | 7.9 |
| n.a. | n.a. | -3.2 | n.a. | - | - | 0.0 | 0.0 | -0.2 | -0.1 | 2.2 | -1.5 | -8.8 | n.a. | n.a. | n.a. | 0.1 | -0.3 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.0 | 0.4 | -0.6 | 0.0 | 100 | 100 | 100 | 100 | 2 510 | 2 368 | 2 191 | 2 029 | 1 897 | -0.6 | -1.4 | -0.9 | 100 | 100 |
| 1.6 | -1.9 | -2.4 | -2.1 | 47 | 22 | 15 | 12 | 444 | 351 | 280 | 228 | 189 | -3.6 | -3.8 | -3.7 | 13 | 10.0 |
| 6.5 | -0.1 | -1.0 | -0.4 | 13 | 28 | 26 | 25 | 682 | 608 | 538 | 474 | 418 | -1.3 | -2.5 | -1.8 | 25 | 22 |
| 10.5 | 0.7 | -1.2 | 0.0 | 1.3 | 10 | 11 | 9.9 | 257 | 227 | 184 | 142 | 108 | -1.6 | -5.2 | -3.0 | 8.4 | 5.7 |
| 9.1 | 2.1 | 0.6 | 1.5 | 5.9 | 29 | 38 | 42 | 854 | 917 | 939 | 948 | 946 | 1.8 | 0.1 | 1.2 | 43 | 50 |
| 8.5 | 1.0 | -1.6 | 0.0 | 2.0 | 8.1 | 8.9 | 8.0 | 213 | 196 | 171 | 146 | 123 | -0.7 | -3.3 | -1.7 | 7.8 | 6.5 |
| n.a. | n.a. | 18.9 | n.a. | - | - | 0.0 | 0.1 | 0.0 | 3.8 | 8.8 | 17 | 34 | n.a. | 14.5 | n.a. | 0.4 | 1.8 |
| -2.7 | -2.0 | -0.1 | -1.3 | 31 | 3.4 | 2.3 | 2.4 | 60 | 64 | 69 | 74 | 78 | -1.1 | 1.3 | -0.2 | 3.2 | 4.1 |
| 4.9 | -0.1 | -1.7 | -0.7 | 36 | 48 | 44 | 40 | 1 157 | 1 034 | 887 | 759 | 653 | -1.6 | -3.0 | -2.1 | 40 | 34 |
| 7.9 | 0.4 | -0.6 | 0.0 | 4.6 | 16 | 16 | 16 | 403 | 361 | 322 | 292 | 275 | -0.9 | -1.6 | -1.1 | 15 | 14 |
| 1.6 | 1.0 | 0.9 | 1.0 | 53 | 24 | 27 | 31 | 616 | 632 | 637 | 639 | 638 | 0.5 | 0.0 | 0.3 | 29 | 34 |
| 5.9 | 1.1 | -0.4 | 0.6 | 6.5 | 12 | 13 | 14 | 334 | 340 | 344 | 339 | 330 | 1.1 | -0.4 | 0.5 | 16 | 17 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 8.6 | 2.0 | 0.6 | 1.5 | 100 | 100 | 100 | 100 | 11 726 | 12 877 | 13 285 | 13 676 | 14 120 | 2.0 | 0.6 | 1.5 | 100 | 100 |
| 8.1 | -3.1 | -2.9 | -3.0 | 71 | 62 | 26 | 18 | 4 376 | 3 183 | 2 128 | 1 322 | 394 | -5.8 | -15.5 | -9.5 | 16 | 2.8 |
| -5.0 | -5.3 | -6.4 | -5.7 | 8.1 | 0.1 | 0.0 | 0.0 | 6.1 | 3.9 | 2.2 | 1.2 | 0.3 | -7.9 | -18.9 | -12.1 | 0.0 | 0.0 |
| 15.1 | 1.9 | 0.2 | 1.3 | 0.4 | 3.0 | 2.9 | 2.8 | 460 | 475 | 418 | 297 | 102 | 2.3 | -13.2 | -3.7 | 3.1 | 0.7 |
| n.a. | 3.2 | 2.0 | 2.7 | - | 4.6 | 5.6 | 6.4 | 574 | 718 | 865 | 1 008 | 1 152 | 4.1 | 2.9 | 3.7 | 6.5 | 8.2 |
| 7.1 | 1.0 | 0.4 | 0.8 | 20 | 13 | 11 | 11 | 1 380 | 1 440 | 1 502 | 1 565 | 1 629 | 1.2 | 0.8 | 1.0 | 11 | 12 |
| 3.8 | -2.6 | 0.0 | -1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.5 | 2.6 | 2.6 | 2.7 | 16.3 | 0.4 | 10.1 | 0.0 | 0.0 |
| 46.4 | 12.3 | 1.3 | 8.1 | 0.0 | 6.2 | 32 | 34 | 2 878 | 4 227 | 4 799 | 5 176 | 5 641 | 13.2 | 1.6 | 8.8 | 36 | 40 |
| 48.3 | 6.4 | 2.7 | 5.0 | 0.0 | 9.3 | 19 | 24 | 1 681 | 2 357 | 2 998 | 3 660 | 4 479 | 7.4 | 4.1 | 6.2 | 23 | 32 |
| 18.8 | -0.2 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.5 | 2.6 | 2.7 | 2.9 | 3.1 | 1.6 | 1.3 | 1.5 | 0.0 | 0.0 |
| n.a. | 4.5 | 1.1 | 3.2 | - | 2.2 | 3.2 | 3.4 | 368 | 412 | 455 | 498 | 540 | 4.8 | 1.7 | 3.6 | 3.4 | 3.8 |
| n.a. | n.a. | 0.9 | n.a. | - | - | 0.6 | 0.6 | - | 56 | 112 | 145 | 177 | n.a. | 4.6 | n.a. | 0.8 | 1.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.0 | -2.0 | -2.6 | -2.2 | 9 303 | 6 419 | 4 296 | 2 835 | 1 839 | -5.4 | -8.1 | -6.4 |
| n.a. | n.a. | n.a. | n.a. | - | - | 53 | 113 | 181 | n.a. | 13.1 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 8.9 | 3.6 | 2.8 | 3.3 | 23 232 | 27 323 | 31 895 | 36 873 | 42 032 | 3.6 | 2.8 | 3.3 |
| 0.7 | -0.3 | -0.6 | -0.4 | 1 387 | 1 362 | 1 332 | 1 295 | 1 250 | -0.3 | -0.6 | -0.4 |
| 8.2 | 3.9 | 3.5 | 3.7 | 17 | 20 | 24 | 28 | 34 | 3.9 | 3.5 | 3.7 |
| 4.0 | 0.1 | -0.2 | 0.0 | 2.8 | 2.7 | 2.5 | 2.3 | 2.2 | -0.8 | -1.3 | -1.0 |
| -3.9 | -3.7 | -3.5 | -3.6 | 169 | 133 | 103 | 81 | 64 | -4.6 | -4.6 | -4.6 |
| -3.6 | -5.4 | -5.2 | -5.3 | 400 | 235 | 135 | 77 | 44 | -8.7 | -10.6 | -9.4 |
| 0.3 | -1.8 | -1.7 | -1.7 | 2.4 | 1.8 | 1.3 | 0.9 | 0.7 | -4.3 | -6.3 | -5.1 |

## Table A26 | India

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 280 | 418 | 661 | 1 098 | 1 361 | 1 574 | 1 781 | 2 010 | 2 234 |
| Coal | 93 | 146 | 274 | 510 | 574 | 652 | 726 | 817 | 904 |
| Oil | 61 | 112 | 162 | 271 | 331 | 392 | 460 | 530 | 599 |
| Natural gas | 11 | 23 | 54 | 58 | 84 | 108 | 132 | 156 | 179 |
| Nuclear | 1.6 | 4.4 | 6.8 | 12 | 36 | 41 | 46 | 53 | 61 |
| Hydro | 6.2 | 6.4 | 11 | 12 | 19 | 22 | 25 | 29 | 33 |
| Geothermal | - | - | - | - | - | - | - | - | 0.0 |
| Solar, wind, etc. | 0.0 | 0.2 | 2.0 | 20 | 77 | 111 | 144 | 175 | 206 |
| Biomass and waste | 108 | 126 | 151 | 215 | 240 | 246 | 246 | 248 | 249 |
| Hydrogen | - | - | - | - | -0.0 | 0.6 | 2.7 | 3.7 | 4.8 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 215 | 291 | 440 | 724 | 924 | 1 069 | 1 210 | 1 362 | 1 511 |
| Coal | 38 | 33 | 83 | 125 | 170 | 191 | 208 | 224 | 238 |
| Oil | 50 | 94 | 138 | 224 | 285 | 340 | 402 | 465 | 527 |
| Natural gas | 6.1 | 12 | 19 | 46 | 65 | 83 | 100 | 117 | 132 |
| Electricity | 18 | 32 | 62 | 138 | 200 | 249 | 300 | 358 | 420 |
| Heat | - | - | - | - | - | - | - | - | 0.0 |
| Hydrogen | - | - | - | - | - | 0.0 | 0.1 | 0.5 | 1.0 |
| Renewables and waste | 102 | 119 | 138 | 191 | 204 | 206 | 200 | 198 | 194 |
| Industry | 59 | 85 | 157 | 287 | 413 | 491 | 553 | 614 | 664 |
| Transport | 21 | 32 | 65 | 125 | 163 | 200 | 244 | 292 | 343 |
| Buildings, etc. | 122 | 147 | 184 | 254 | 275 | 290 | 310 | 335 | 366 |
| Non-energy use | 13 | 27 | 34 | 57 | 74 | 88 | 104 | 121 | 138 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 289 | 561 | 972 | 1 987 | 2 886 | 3 599 | 4 291 | 5 075 | 5 880 |
| Coal | 189 | 387 | 658 | 1 479 | 1 500 | 1 717 | 1 925 | 2 229 | 2 538 |
| Oil | 13 | 25 | 19 | 4.2 | 5.6 | 6.7 | 7.8 | 9.3 | 11 |
| Natural gas | 10.0 | 56 | 107 | 59 | 85 | 107 | 132 | 166 | 205 |
| Nuclear | 6.1 | 17 | 26 | 48 | 138 | 156 | 178 | 202 | 233 |
| Hydro | 72 | 74 | 125 | 144 | 220 | 258 | 296 | 337 | 379 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | - | 0.0 | 0.1 | 119 | 726 | 1 072 | 1 402 | 1 710 | 2 020 |
| Wind | 0.0 | 1.7 | 20 | 93 | 145 | 191 | 234 | 285 | 337 |
| Concentrated solar power and marine | - | - | - | - | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Biomass and waste | - | 0.2 | 17 | 41 | 67 | 78 | 89 | 100 | 112 |
| Hydrogen | - | - | - | - | - | 13 | 27 | 36 | 45 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 518 | 872 | 1 541 | 2 771 | 3 218 | 3 722 | 4 218 | 4 784 | 5 322 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 475 | 817 | 1 567 | 3 333 | 5 148 | 6 930 | 9 163 | 11 880 | 15 058 |
| Population (million) | 865 | 1 058 | 1 243 | 1 438 | 1 525 | 1 579 | 1 623 | 1 656 | 1 680 |
| GDP per capita ($2015 thousand) | 0.5 | 0.8 | 1.3 | 2.3 | 3.4 | 4.4 | 5.6 | 7.2 | 9.0 |
| Primary energy consumption per capita (toe/person) | 0.3 | 0.4 | 0.5 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |
| Primary energy consumption per GDP (toe/$2015 million) | 590 | 511 | 422 | 329 | 264 | 227 | 194 | 169 | 148 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 1 092 | 1 067 | 983 | 831 | 625 | 537 | 460 | 403 | 353 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.9 | 2.1 | 2.3 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 4.2 | 2.9 | 2.3 | 2.7 | 100 | 100 | 100 | 100 | 1 324 | 1 459 | 1 558 | 1 636 | 1 725 | 2.1 | 1.0 | 1.7 | 100 | 100 |
| 5.3 | 2.1 | 2.2 | 2.1 | 33 | 46 | 41 | 40 | 535 | 548 | 536 | 492 | 469 | 0.3 | -1.3 | -0.3 | 34 | 27 |
| 4.6 | 3.2 | 2.7 | 3.0 | 22 | 25 | 26 | 27 | 310 | 335 | 357 | 369 | 371 | 1.6 | 0.4 | 1.2 | 23 | 21 |
| 5.3 | 4.9 | 3.1 | 4.3 | 3.8 | 5.3 | 7.4 | 8.0 | 88 | 105 | 115 | 116 | 118 | 4.1 | 0.3 | 2.7 | 7.4 | 6.9 |
| 6.4 | 8.0 | 2.7 | 6.0 | 0.6 | 1.1 | 2.6 | 2.7 | 37 | 62 | 92 | 130 | 158 | 12.5 | 5.5 | 9.9 | 5.9 | 9.2 |
| 2.1 | 4.3 | 2.5 | 3.7 | 2.2 | 1.1 | 1.4 | 1.5 | 23 | 30 | 37 | 47 | 58 | 6.7 | 4.4 | 5.9 | 2.4 | 3.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | 0.0 | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 25.9 | 12.4 | 3.7 | 9.1 | 0.0 | 1.8 | 8.1 | 9.2 | 97 | 151 | 197 | 255 | 314 | 14.5 | 4.8 | 10.8 | 13 | 18 |
| 2.1 | 0.8 | 0.1 | 0.5 | 38 | 20 | 14 | 11 | 234 | 226 | 211 | 202 | 199 | -0.1 | -0.6 | -0.3 | 14 | 12 |
| n.a. | n.a. | 5.8 | n.a. | - | - | 0.2 | 0.2 | -0.0 | 2.9 | 12 | 25 | 38 | n.a. | 12.1 | n.a. | 0.8 | 2.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.7 | 3.1 | 2.2 | 2.8 | 100 | 100 | 100 | 100 | 894 | 973 | 1 034 | 1 089 | 1 151 | 2.1 | 1.1 | 1.7 | 100 | 100 |
| 3.7 | 3.0 | 1.3 | 2.4 | 18 | 17 | 17 | 16 | 154 | 150 | 141 | 132 | 124 | 0.7 | -1.3 | 0.0 | 14 | 11 |
| 4.6 | 3.5 | 2.7 | 3.2 | 23 | 31 | 33 | 35 | 266 | 289 | 309 | 322 | 324 | 1.9 | 0.5 | 1.4 | 30 | 28 |
| 6.3 | 4.7 | 2.9 | 4.0 | 2.8 | 6.3 | 8.2 | 8.8 | 63 | 73 | 78 | 81 | 82 | 3.2 | 0.4 | 2.2 | 7.6 | 7.1 |
| 6.3 | 4.7 | 3.4 | 4.2 | 8.5 | 19 | 25 | 28 | 216 | 279 | 342 | 404 | 477 | 5.5 | 3.4 | 4.7 | 33 | 41 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | 0.0 | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | 24.0 | n.a. | - | - | 0.0 | 0.1 | 0.0 | 0.9 | 2.4 | 4.6 | 7.4 | n.a. | 11.7 | n.a. | 0.2 | 0.6 |
| 1.9 | 0.3 | -0.3 | 0.0 | 48 | 26 | 17 | 13 | 195 | 181 | 161 | 145 | 136 | -1.0 | -1.6 | -1.2 | 16 | 12 |
| 4.9 | 3.9 | 1.9 | 3.2 | 27 | 40 | 46 | 44 | 400 | 441 | 458 | 463 | 474 | 2.8 | 0.3 | 1.9 | 44 | 41 |
| 5.6 | 4.0 | 3.5 | 3.8 | 9.7 | 17 | 20 | 23 | 155 | 175 | 196 | 217 | 235 | 2.7 | 1.8 | 2.4 | 19 | 20 |
| 2.3 | 1.2 | 1.7 | 1.4 | 57 | 35 | 26 | 24 | 265 | 269 | 276 | 289 | 305 | 0.5 | 1.0 | 0.7 | 27 | 26 |
| 4.5 | 3.5 | 2.9 | 3.3 | 6.2 | 7.9 | 8.6 | 9.1 | 74 | 88 | 104 | 121 | 138 | 3.5 | 2.9 | 3.3 | 10 | 12 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 6.0 | 4.6 | 3.2 | 4.1 | 100 | 100 | 100 | 100 | 3 118 | 4 075 | 4 839 | 5 666 | 6 618 | 5.4 | 3.2 | 4.6 | 100 | 100 |
| 6.4 | 1.6 | 2.8 | 2.0 | 65 | 74 | 45 | 43 | 1 399 | 1 442 | 1 365 | 1 142 | 1 033 | -0.5 | -2.7 | -1.3 | 28 | 16 |
| -3.3 | 3.7 | 3.5 | 3.6 | 4.3 | 0.2 | 0.2 | 0.2 | 5.5 | 6.0 | 6.0 | 5.3 | 5.1 | 2.2 | -1.6 | 0.7 | 0.1 | 0.1 |
| 5.5 | 4.9 | 4.5 | 4.7 | 3.4 | 3.0 | 3.1 | 3.5 | 136 | 185 | 221 | 226 | 243 | 8.1 | 0.9 | 5.4 | 4.6 | 3.7 |
| 6.4 | 8.0 | 2.7 | 6.0 | 2.1 | 2.4 | 4.1 | 4.0 | 141 | 237 | 355 | 499 | 608 | 12.5 | 5.5 | 9.9 | 7.3 | 9.2 |
| 2.1 | 4.3 | 2.5 | 3.7 | 25 | 7.2 | 6.9 | 6.4 | 267 | 344 | 436 | 544 | 671 | 6.7 | 4.4 | 5.9 | 9.0 | 10 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 15.6 | 3.7 | 11.1 | - | 6.0 | 33 | 34 | 947 | 1 486 | 1 981 | 2 560 | 3 146 | 18.0 | 4.7 | 12.9 | 41 | 48 |
| 27.4 | 5.5 | 3.7 | 4.9 | 0.0 | 4.7 | 5.4 | 5.7 | 147 | 228 | 262 | 348 | 443 | 6.2 | 5.4 | 5.9 | 5.4 | 6.7 |
| n.a. | n.a. | 0.1 | n.a. | - | - | 0.0 | 0.0 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | n.a. | 0.4 | n.a. | 0.0 | 0.0 |
| n.a. | 4.6 | 2.4 | 3.8 | - | 2.1 | 2.1 | 1.9 | 76 | 91 | 106 | 122 | 138 | 5.7 | 2.7 | 4.6 | 2.2 | 2.1 |
| n.a. | n.a. | 5.3 | n.a. | - | - | 0.6 | 0.8 | - | 54 | 108 | 220 | 331 | n.a. | 11.8 | n.a. | 2.2 | 5.0 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.2 | 2.5 | 2.4 | 2.4 | 3 016 | 3 132 | 3 115 | 2 894 | 2 705 | 0.7 | -1.4 | -0.1 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 6.1 | 6.1 | 5.1 | 5.7 | 5 148 | 6 930 | 9 163 | 11 880 | 15 058 | 6.1 | 5.1 | 5.7 |
| 1.6 | 0.7 | 0.3 | 0.6 | 1 525 | 1 579 | 1 623 | 1 656 | 1 680 | 0.7 | 0.3 | 0.6 |
| 4.5 | 5.4 | 4.7 | 5.1 | 3.4 | 4.4 | 5.6 | 7.2 | 9.0 | 5.4 | 4.7 | 5.1 |
| 2.6 | 2.2 | 1.9 | 2.1 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 1.4 | 0.7 | 1.1 |
| -1.7 | -3.1 | -2.7 | -2.9 | 257 | 211 | 170 | 138 | 115 | -3.8 | -3.9 | -3.8 |
| -0.8 | -3.4 | -2.6 | -3.1 | 586 | 452 | 340 | 244 | 180 | -5.1 | -6.2 | -5.5 |
| 0.9 | -0.4 | 0.1 | -0.2 | 2.3 | 2.1 | 2.0 | 1.8 | 1.6 | -1.4 | -2.4 | -1.7 |

## Table A27 | Japan

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 437 | 516 | 500 | 378 | 358 | 339 | 320 | 305 | 293 |
| Coal | 77 | 97 | 115 | 99 | 73 | 63 | 53 | 48 | 45 |
| Oil | 249 | 253 | 201 | 141 | 128 | 118 | 107 | 97 | 86 |
| Natural gas | 44 | 66 | 86 | 80 | 72 | 70 | 64 | 60 | 57 |
| Nuclear | 53 | 84 | 75 | 22 | 47 | 42 | 42 | 42 | 42 |
| Hydro | 7.6 | 7.2 | 7.2 | 6.5 | 7.2 | 7.3 | 7.4 | 7.5 | 7.5 |
| Geothermal | 1.6 | 3.1 | 2.4 | 3.1 | 3.7 | 4.8 | 5.5 | 5.9 | 6.3 |
| Solar, wind, etc. | 1.2 | 0.9 | 1.1 | 9.3 | 14 | 18 | 22 | 25 | 27 |
| Biomass and waste | 4.2 | 5.0 | 11 | 17 | 14 | 14 | 17 | 17 | 17 |
| Hydrogen | - | - | - | - | 0.4 | 1.0 | 1.6 | 3.2 | 4.8 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 291 | 336 | 314 | 250 | 235 | 223 | 211 | 200 | 189 |
| Coal | 27 | 21 | 23 | 17 | 15 | 14 | 13 | 12 | 11 |
| Oil | 180 | 206 | 166 | 124 | 113 | 104 | 95 | 85 | 75 |
| Natural gas | 14 | 21 | 29 | 26 | 24 | 23 | 21 | 19 | 18 |
| Electricity | 66 | 84 | 89 | 76 | 75 | 75 | 75 | 75 | 77 |
| Heat | 0.2 | 0.5 | 0.6 | 0.7 | 0.7 | 0.6 | 0.5 | 0.5 | 0.4 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| Renewables and waste | 3.8 | 4.1 | 6.1 | 6.6 | 6.4 | 6.6 | 7.1 | 7.2 | 7.2 |
| Industry | 107 | 103 | 91 | 73 | 66 | 63 | 60 | 57 | 54 |
| Transport | 72 | 89 | 79 | 64 | 59 | 54 | 50 | 45 | 40 |
| Buildings, etc. | 77 | 107 | 108 | 87 | 85 | 81 | 78 | 74 | 71 |
| Non-energy use | 34 | 37 | 36 | 26 | 24 | 24 | 24 | 23 | 23 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 862 | 1 055 | 1 164 | 993 | 983 | 983 | 983 | 991 | 1 006 |
| Coal | 125 | 228 | 317 | 284 | 180 | 141 | 98 | 85 | 73 |
| Oil | 250 | 133 | 91 | 30 | 18 | 14 | 8.8 | 5.6 | 2.9 |
| Natural gas | 168 | 255 | 332 | 331 | 296 | 301 | 278 | 262 | 248 |
| Nuclear | 202 | 322 | 288 | 84 | 179 | 162 | 163 | 162 | 162 |
| Hydro | 88 | 84 | 84 | 75 | 84 | 85 | 86 | 87 | 87 |
| Geothermal | 1.7 | 3.3 | 2.6 | 3.4 | 4.2 | 5.4 | 6.2 | 6.7 | 7.2 |
| Solar photovoltaics | 0.1 | 0.4 | 3.5 | 96 | 123 | 160 | 202 | 224 | 247 |
| Wind | - | 0.1 | 4.0 | 10 | 37 | 47 | 54 | 61 | 68 |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | 8.1 | 9.2 | 21 | 63 | 43 | 44 | 59 | 59 | 59 |
| Hydrogen | - | - | - | - | 2.5 | 7.1 | 12 | 23 | 34 |
| Others | 20 | 20 | 21 | 16 | 16 | 16 | 16 | 16 | 16 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 1 046 | 1 149 | 1 126 | 928 | 775 | 703 | 615 | 548 | 487 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 3 510 | 3 987 | 4 219 | 4 601 | 4 764 | 4 942 | 5 131 | 5 317 | 5 500 |
| Population (million) | 123 | 127 | 128 | 125 | 120 | 116 | 112 | 109 | 105 |
| GDP per capita ($2015 thousand) | 28 | 31 | 33 | 37 | 40 | 43 | 46 | 49 | 52 |
| Primary energy consumption per capita (toe/person) | 3.5 | 4.1 | 3.9 | 3.0 | 3.0 | 2.9 | 2.9 | 2.8 | 2.8 |
| Primary energy consumption per GDP (toe/$2015 million) | 124 | 129 | 118 | 82 | 75 | 69 | 62 | 57 | 53 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 298 | 288 | 267 | 202 | 163 | 142 | 120 | 103 | 89 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.2 | 2.3 | 2.5 | 2.2 | 2.1 | 1.9 | 1.8 | 1.7 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| -0.4 | -1.0 | -0.9 | -0.9 | 100 | 100 | 100 | 100 | 355 | 326 | 296 | 278 | 263 | -1.4 | -1.2 | -1.3 | 100 | 100 |
| 0.8 | -3.7 | -1.5 | -2.9 | 18 | 26 | 16 | 15 | 62 | 49 | 38 | 33 | 32 | -5.5 | -1.8 | -4.2 | 13 | 12 |
| -1.7 | -1.6 | -2.2 | -1.8 | 57 | 37 | 34 | 29 | 120 | 101 | 82 | 65 | 53 | -3.2 | -4.3 | -3.6 | 28 | 20 |
| 1.8 | -1.2 | -1.3 | -1.3 | 10 | 21 | 20 | 19 | 62 | 53 | 42 | 34 | 22 | -3.7 | -6.3 | -4.7 | 14 | 8.3 |
| -2.6 | 4.0 | 0.0 | 2.5 | 12 | 5.8 | 13 | 14 | 62 | 63 | 65 | 65 | 65 | 6.6 | 0.0 | 4.1 | 22 | 25 |
| -0.5 | 0.8 | 0.1 | 0.6 | 1.7 | 1.7 | 2.3 | 2.6 | 7.3 | 7.4 | 7.6 | 7.7 | 7.7 | 0.9 | 0.2 | 0.7 | 2.6 | 2.9 |
| 2.0 | 3.5 | 1.4 | 2.7 | 0.4 | 0.8 | 1.7 | 2.2 | 3.7 | 5.2 | 6.0 | 6.4 | 6.8 | 4.1 | 1.2 | 3.0 | 2.0 | 2.6 |
| 6.4 | 5.2 | 2.1 | 4.0 | 0.3 | 2.5 | 6.9 | 9.3 | 15 | 22 | 28 | 33 | 37 | 6.7 | 2.9 | 5.3 | 9.5 | 14 |
| 4.4 | -0.2 | 0.0 | -0.1 | 1.0 | 4.6 | 5.2 | 5.7 | 21 | 22 | 22 | 22 | 21 | 1.5 | -0.4 | 0.8 | 7.6 | 8.2 |
| n.a. | n.a. | 11.7 | n.a. | - | - | 0.5 | 1.7 | 1.7 | 4.0 | 5.9 | 13 | 19 | n.a. | 12.3 | n.a. | 2.0 | 7.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| -0.5 | -1.0 | -1.1 | -1.0 | 100 | 100 | 100 | 100 | 227 | 205 | 182 | 165 | 153 | -1.8 | -1.7 | -1.8 | 100 | 100 |
| -1.4 | -1.5 | -1.5 | -1.5 | 9.3 | 6.7 | 6.1 | 5.9 | 13 | 11 | 8.7 | 7.3 | 6.3 | -3.8 | -3.2 | -3.6 | 4.8 | 4.1 |
| -1.1 | -1.6 | -2.2 | -1.8 | 62 | 50 | 45 | 40 | 107 | 90 | 72 | 58 | 48 | -3.1 | -4.0 | -3.5 | 40 | 31 |
| 2.0 | -1.2 | -1.6 | -1.4 | 4.7 | 10 | 10 | 9.5 | 24 | 20 | 17 | 13 | 10.0 | -2.6 | -5.0 | -3.5 | 9.2 | 6.5 |
| 0.4 | -0.1 | 0.2 | 0.0 | 23 | 30 | 35 | 41 | 76 | 76 | 76 | 77 | 78 | 0.0 | 0.3 | 0.1 | 42 | 51 |
| 4.0 | -1.6 | -2.9 | -2.1 | 0.1 | 0.3 | 0.3 | 0.2 | 0.7 | 0.6 | 0.5 | 0.5 | 0.4 | -1.9 | -2.8 | -2.2 | 0.3 | 0.3 |
| n.a. | n.a. | 19.5 | n.a. | - | - | 0.0 | 0.1 | 0.0 | 0.4 | 0.9 | 1.9 | 4.1 | n.a. | 16.0 | n.a. | 0.5 | 2.7 |
| 1.7 | 0.4 | 0.1 | 0.3 | 1.3 | 2.6 | 3.3 | 3.8 | 6.3 | 7.0 | 7.1 | 6.8 | 6.2 | 0.5 | -1.3 | -0.2 | 3.9 | 4.1 |
| -1.2 | -1.1 | -1.0 | -1.1 | 37 | 29 | 29 | 29 | 63 | 56 | 49 | 44 | 40 | -2.2 | -2.1 | -2.2 | 27 | 26 |
| -0.4 | -1.5 | -2.2 | -1.7 | 25 | 26 | 24 | 21 | 56 | 47 | 38 | 31 | 27 | -3.1 | -3.5 | -3.2 | 21 | 17 |
| 0.4 | -0.7 | -0.8 | -0.7 | 27 | 35 | 37 | 38 | 84 | 78 | 71 | 67 | 64 | -1.2 | -1.1 | -1.2 | 39 | 42 |
| -0.9 | -0.4 | -0.3 | -0.4 | 12 | 10 | 11 | 12 | 24 | 24 | 24 | 23 | 23 | -0.4 | -0.3 | -0.4 | 13 | 15 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.4 | -0.1 | 0.2 | 0.0 | 100 | 100 | 100 | 100 | 994 | 1 009 | 1 016 | 1 053 | 1 081 | 0.1 | 0.6 | 0.3 | 100 | 100 |
| 2.5 | -6.0 | -2.9 | -4.9 | 14 | 29 | 10 | 7.3 | 137 | 90 | 50 | 34 | 33 | -9.8 | -3.9 | -7.6 | 4.9 | 3.1 |
| -6.2 | -7.0 | -10.7 | -8.4 | 29 | 3.0 | 0.9 | 0.3 | 12 | 8.9 | 4.8 | 2.7 | 1.0 | -10.2 | -14.4 | -11.8 | 0.5 | 0.1 |
| 2.1 | -1.0 | -1.1 | -1.1 | 19 | 33 | 28 | 25 | 238 | 208 | 167 | 145 | 93 | -3.9 | -5.7 | -4.6 | 16 | 8.6 |
| -2.6 | 4.0 | 0.0 | 2.5 | 23 | 8.5 | 17 | 16 | 238 | 243 | 250 | 249 | 249 | 6.6 | 0.0 | 4.1 | 25 | 23 |
| -0.5 | 0.8 | 0.1 | 0.6 | 10 | 7.6 | 8.8 | 8.7 | 85 | 87 | 88 | 89 | 90 | 0.9 | 0.2 | 0.7 | 8.7 | 8.3 |
| 2.0 | 3.6 | 1.5 | 2.8 | 0.2 | 0.3 | 0.6 | 0.7 | 4.2 | 6.0 | 6.9 | 7.4 | 7.9 | 4.3 | 1.3 | 3.2 | 0.7 | 0.7 |
| 24.7 | 4.5 | 2.0 | 3.5 | 0.0 | 9.7 | 21 | 25 | 134 | 195 | 255 | 292 | 333 | 5.9 | 2.7 | 4.7 | 25 | 31 |
| n.a. | 10.1 | 2.3 | 7.1 | - | 1.1 | 5.5 | 6.7 | 40 | 58 | 72 | 86 | 102 | 12.0 | 3.6 | 8.8 | 7.0 | 9.4 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 6.4 | -0.4 | 0.1 | -0.2 | 0.9 | 6.3 | 6.0 | 5.9 | 80 | 82 | 84 | 86 | 88 | 1.8 | 0.4 | 1.3 | 8.3 | 8.1 |
| n.a. | n.a. | 11.4 | n.a. | - | - | 1.2 | 3.4 | 9.3 | 16 | 23 | 45 | 67 | n.a. | 11.4 | n.a. | 2.3 | 6.2 |
| -0.6 | 0.0 | 0.0 | 0.0 | 2.3 | 1.6 | 1.6 | 1.6 | 16 | 16 | 16 | 16 | 16 | 0.0 | 0.0 | 0.0 | 1.6 | 1.5 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.4 | -2.4 | -2.3 | -2.4 | 686 | 516 | 364 | 216 | 99 | -5.4 | -12.2 | -7.9 |
| n.a. | n.a. | n.a. | n.a. | - | - | 14 | 44 | 79 | n.a. | 18.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 0.8 | 0.6 | 0.7 | 0.7 | 4 764 | 4 942 | 5 131 | 5 317 | 5 500 | 0.6 | 0.7 | 0.7 |
| 0.0 | -0.6 | -0.6 | -0.6 | 120 | 116 | 112 | 109 | 105 | -0.6 | -0.6 | -0.6 |
| 0.8 | 1.3 | 1.4 | 1.3 | 40 | 43 | 46 | 49 | 52 | 1.3 | 1.4 | 1.3 |
| -0.5 | -0.4 | -0.2 | -0.3 | 3.0 | 2.8 | 2.6 | 2.6 | 2.5 | -0.8 | -0.5 | -0.7 |
| -1.2 | -1.6 | -1.6 | -1.6 | 74 | 66 | 58 | 52 | 48 | -2.1 | -1.9 | -2.0 |
| -1.2 | -3.0 | -3.0 | -3.0 | 144 | 104 | 71 | 41 | 18 | -6.0 | -12.8 | -8.5 |
| 0.1 | -1.4 | -1.4 | -1.4 | 1.9 | 1.6 | 1.2 | 0.8 | 0.4 | -4.0 | -11.1 | -6.7 |

## Table A28 | Korea

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 90 | 186 | 244 | 276 | 263 | 261 | 252 | 242 | 232 |
| Coal | 22 | 39 | 68 | 66 | 62 | 56 | 54 | 50 | 45 |
| Oil | 50 | 99 | 95 | 101 | 96 | 92 | 88 | 83 | 78 |
| Natural gas | 2.7 | 18 | 38 | 51 | 52 | 51 | 54 | 55 | 54 |
| Nuclear | 14 | 28 | 39 | 47 | 37 | 42 | 35 | 29 | 28 |
| Hydro | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Geothermal | - | - | 0.0 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Solar, wind, etc. | 0.0 | 0.0 | 0.2 | 3.3 | 7.4 | 9.1 | 11 | 13 | 15 |
| Biomass and waste | 0.7 | 1.4 | 3.5 | 6.8 | 8.4 | 8.7 | 9.0 | 9.1 | 9.2 |
| Hydrogen | - | - | - | - | 0.4 | 0.7 | 1.0 | 1.7 | 2.5 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 65 | 127 | 161 | 174 | 174 | 172 | 167 | 162 | 156 |
| Coal | 12 | 8.3 | 13 | 8.0 | 7.9 | 7.4 | 6.7 | 6.1 | 5.6 |
| Oil | 44 | 80 | 82 | 88 | 86 | 82 | 79 | 75 | 70 |
| Natural gas | 0.9 | 11 | 21 | 22 | 21 | 21 | 20 | 19 | 18 |
| Electricity | 8.1 | 23 | 39 | 46 | 49 | 51 | 52 | 53 | 53 |
| Heat | - | 3.3 | 4.3 | 6.1 | 5.9 | 5.7 | 5.3 | 4.9 | 4.6 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 |
| Renewables and waste | 0.7 | 1.3 | 2.7 | 3.9 | 4.1 | 4.0 | 4.0 | 4.0 | 3.9 |
| Industry | 20 | 38 | 48 | 46 | 47 | 47 | 46 | 45 | 43 |
| Transport | 15 | 26 | 30 | 36 | 34 | 31 | 29 | 26 | 23 |
| Buildings, etc. | 24 | 38 | 44 | 44 | 43 | 42 | 41 | 40 | 39 |
| Non-energy use | 6.7 | 25 | 38 | 48 | 50 | 51 | 51 | 52 | 51 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 109 | 288 | 472 | 607 | 648 | 673 | 688 | 700 | 706 |
| Coal | 21 | 110 | 220 | 205 | 200 | 179 | 177 | 167 | 148 |
| Oil | 19 | 35 | 19 | 7.3 | 5.6 | 3.9 | 2.7 | 1.2 | - |
| Natural gas | 9.7 | 30 | 78 | 161 | 187 | 190 | 213 | 228 | 230 |
| Nuclear | 53 | 109 | 149 | 180 | 142 | 161 | 134 | 113 | 106 |
| Hydro | 6.4 | 4.0 | 3.7 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | 0.0 | 0.0 | 0.8 | 30 | 61 | 74 | 89 | 105 | 121 |
| Wind | - | 0.0 | 0.8 | 3.4 | 24 | 30 | 36 | 42 | 50 |
| Concentrated solar power and marine | - | - | - | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Biomass and waste | - | 0.1 | 1.1 | 11 | 18 | 20 | 22 | 23 | 24 |
| Hydrogen | - | - | - | - | 2.7 | 4.9 | 7.1 | 13 | 18 |
| Others | - | - | 0.3 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 208 | 391 | 531 | 533 | 494 | 460 | 441 | 411 | 370 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 402 | 799 | 1 261 | 1 764 | 1 997 | 2 175 | 2 343 | 2 495 | 2 623 |
| Population (million) | 43 | 47 | 50 | 52 | 51 | 50 | 49 | 47 | 45 |
| GDP per capita ($2015 thousand) | 9.4 | 17 | 25 | 34 | 39 | 43 | 48 | 53 | 58 |
| Primary energy consumption per capita (toe/person) | 2.1 | 4.0 | 4.9 | 5.3 | 5.1 | 5.2 | 5.2 | 5.1 | 5.1 |
| Primary energy consumption per GDP (toe/$2015 million) | 223 | 233 | 193 | 156 | 132 | 120 | 108 | 97 | 88 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 517 | 489 | 421 | 302 | 248 | 212 | 188 | 165 | 141 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.3 | 2.1 | 2.2 | 1.9 | 1.9 | 1.8 | 1.8 | 1.7 | 1.6 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 3.5 | -0.5 | -0.8 | -0.6 | 100 | 100 | 100 | 100 | 262 | 253 | 241 | 227 | 209 | -0.8 | -1.4 | -1.0 | 100 | 100 |
| 3.4 | -1.2 | -1.9 | -1.5 | 25 | 24 | 21 | 19 | 51 | 40 | 29 | 22 | 17 | -4.8 | -5.0 | -4.9 | 12 | 8.3 |
| 2.2 | -0.8 | -1.2 | -0.9 | 56 | 37 | 35 | 34 | 93 | 84 | 74 | 64 | 56 | -1.8 | -2.7 | -2.1 | 31 | 27 |
| 9.4 | 0.3 | 0.1 | 0.2 | 3.0 | 18 | 21 | 23 | 46 | 44 | 38 | 33 | 32 | -1.8 | -1.6 | -1.7 | 16 | 15 |
| 3.8 | -1.7 | -2.3 | -2.0 | 15 | 17 | 14 | 12 | 53 | 58 | 67 | 65 | 55 | 2.1 | -2.0 | 0.6 | 28 | 26 |
| -1.6 | -0.3 | 0.0 | -0.2 | 0.6 | 0.1 | 0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | -0.3 | 0.0 | -0.2 | 0.1 | 0.1 |
| n.a. | 2.2 | -0.5 | 1.2 | - | 0.1 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 2.5 | -0.8 | 1.2 | 0.2 | 0.2 |
| 19.2 | 7.2 | 3.2 | 5.7 | 0.0 | 1.2 | 4.3 | 6.4 | 9.0 | 12 | 15 | 19 | 23 | 9.4 | 4.1 | 7.4 | 6.3 | 11 |
| 7.0 | 1.7 | 0.3 | 1.2 | 0.8 | 2.4 | 3.6 | 4.0 | 9.0 | 9.6 | 11 | 12 | 13 | 2.7 | 2.2 | 2.5 | 4.4 | 6.2 |
| n.a. | n.a. | 10.2 | n.a. | - | - | 0.4 | 1.1 | 1.2 | 4.2 | 6.8 | 10 | 13 | n.a. | 6.4 | n.a. | 2.8 | 6.1 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.0 | -0.2 | -0.7 | -0.4 | 100 | 100 | 100 | 100 | 171 | 162 | 151 | 140 | 131 | -0.8 | -1.4 | -1.0 | 100 | 100 |
| -1.2 | -1.0 | -1.9 | -1.3 | 18 | 4.6 | 4.0 | 3.6 | 7.1 | 5.7 | 4.5 | 3.6 | 3.0 | -3.4 | -4.1 | -3.6 | 3.0 | 2.3 |
| 2.2 | -0.7 | -1.2 | -0.9 | 67 | 51 | 47 | 45 | 84 | 77 | 68 | 61 | 54 | -1.5 | -2.3 | -1.8 | 45 | 42 |
| 10.1 | -0.3 | -1.1 | -0.6 | 1.4 | 12 | 12 | 12 | 20 | 18 | 15 | 12 | 9.0 | -2.1 | -5.1 | -3.2 | 10 | 6.8 |
| 5.4 | 0.7 | 0.2 | 0.6 | 12 | 26 | 31 | 34 | 49 | 51 | 52 | 52 | 52 | 0.7 | -0.1 | 0.4 | 35 | 39 |
| n.a. | -0.8 | -1.5 | -1.0 | - | 3.5 | 3.2 | 2.9 | 5.8 | 5.4 | 4.9 | 4.3 | 3.7 | -1.3 | -2.6 | -1.8 | 3.2 | 2.9 |
| n.a. | n.a. | 12.8 | n.a. | - | - | 0.0 | 0.1 | 0.1 | 0.5 | 1.0 | 1.8 | 3.0 | n.a. | 11.5 | n.a. | 0.7 | 2.3 |
| 5.2 | 0.2 | -0.3 | 0.0 | 1.1 | 2.2 | 2.4 | 2.5 | 4.1 | 4.3 | 4.7 | 5.5 | 6.4 | 1.2 | 3.1 | 1.9 | 3.1 | 4.9 |
| 2.5 | 0.0 | -0.8 | -0.3 | 31 | 26 | 28 | 27 | 46 | 43 | 39 | 35 | 31 | -1.0 | -2.1 | -1.4 | 26 | 24 |
| 2.8 | -1.4 | -2.1 | -1.7 | 22 | 21 | 17 | 15 | 33 | 27 | 22 | 18 | 15 | -2.9 | -3.7 | -3.2 | 15 | 12 |
| 1.9 | -0.3 | -0.7 | -0.5 | 36 | 25 | 25 | 25 | 42 | 41 | 38 | 36 | 33 | -0.8 | -1.5 | -1.0 | 26 | 25 |
| 6.1 | 0.4 | 0.0 | 0.3 | 10 | 27 | 31 | 33 | 50 | 51 | 51 | 52 | 51 | 0.4 | 0.0 | 0.3 | 34 | 39 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 5.3 | 0.7 | 0.3 | 0.6 | 100 | 100 | 100 | 100 | 649 | 687 | 708 | 727 | 741 | 0.9 | 0.5 | 0.7 | 100 | 100 |
| 7.1 | -0.9 | -1.8 | -1.2 | 20 | 34 | 26 | 21 | 152 | 117 | 74 | 51 | 35 | -5.8 | -7.4 | -6.4 | 11 | 4.7 |
| -2.8 | -5.8 | -100 | -100 | 17 | 1.2 | 0.4 | - | 4.5 | 2.9 | 1.4 | 0.5 | - | -9.2 | -100 | -100 | 0.2 | - |
| 8.9 | 1.7 | 0.8 | 1.3 | 8.9 | 26 | 31 | 33 | 156 | 164 | 146 | 146 | 163 | -0.6 | 1.1 | 0.1 | 21 | 22 |
| 3.8 | -1.7 | -2.3 | -2.0 | 48 | 30 | 19 | 15 | 202 | 221 | 256 | 251 | 210 | 2.1 | -2.0 | 0.6 | 36 | 28 |
| -1.6 | -0.3 | 0.0 | -0.2 | 5.8 | 0.6 | 0.5 | 0.5 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | -0.3 | 0.0 | -0.2 | 0.5 | 0.5 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 36.7 | 6.6 | 3.1 | 5.3 | 0.0 | 4.9 | 13 | 17 | 76 | 100 | 126 | 154 | 185 | 8.8 | 3.9 | 7.0 | 18 | 25 |
| n.a. | 14.9 | 3.3 | 10.5 | - | 0.6 | 5.3 | 7.1 | 28 | 38 | 49 | 61 | 76 | 17.0 | 4.5 | 12.2 | 6.9 | 10 |
| n.a. | 0.9 | 0.2 | 0.7 | - | 0.1 | 0.1 | 0.1 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 1.6 | 0.2 | 1.1 | 0.1 | 0.1 |
| n.a. | 4.1 | 1.2 | 3.0 | - | 1.8 | 3.2 | 3.5 | 19 | 22 | 24 | 27 | 29 | 4.7 | 1.8 | 3.6 | 3.4 | 3.9 |
| n.a. | n.a. | 10.0 | n.a. | - | - | 1.0 | 2.6 | 2.9 | 13 | 22 | 28 | 34 | n.a. | 4.3 | n.a. | 3.2 | 4.6 |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.7 | 0.6 | 0.6 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.9 | -1.1 | -1.7 | -1.3 | 434 | 329 | 227 | 145 | 84 | -4.9 | -9.4 | -6.6 |
| n.a. | n.a. | n.a. | n.a. | - | - | 4.5 | 9.8 | 16 | n.a. | 13.2 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.6 | 1.7 | 1.1 | 1.5 | 1 997 | 2 175 | 2 343 | 2 495 | 2 623 | 1.7 | 1.1 | 1.5 |
| 0.6 | -0.3 | -0.8 | -0.5 | 51 | 50 | 49 | 47 | 45 | -0.3 | -0.8 | -0.5 |
| 4.0 | 2.0 | 2.0 | 2.0 | 39 | 43 | 48 | 53 | 58 | 2.0 | 2.0 | 2.0 |
| 2.9 | -0.2 | 0.0 | -0.1 | 5.1 | 5.0 | 4.9 | 4.8 | 4.6 | -0.5 | -0.6 | -0.5 |
| -1.1 | -2.2 | -2.0 | -2.1 | 131 | 116 | 103 | 91 | 80 | -2.4 | -2.5 | -2.5 |
| -1.6 | -2.7 | -2.8 | -2.8 | 217 | 151 | 97 | 58 | 32 | -6.5 | -10.4 | -8.0 |
| -0.6 | -0.6 | -0.9 | -0.7 | 1.7 | 1.3 | 0.9 | 0.6 | 0.4 | -4.1 | -8.1 | -5.6 |

## Table A29 | Chinese Taipei

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 51 | 90 | 118 | 111 | 117 | 116 | 114 | 111 | 108 |
| Coal | 11 | 30 | 42 | 38 | 37 | 35 | 32 | 29 | 26 |
| Oil | 28 | 42 | 48 | 37 | 43 | 42 | 40 | 39 | 36 |
| Natural gas | 1.6 | 6.2 | 15 | 26 | 29 | 30 | 30 | 30 | 30 |
| Nuclear | 8.6 | 10 | 11 | 4.6 | - | - | - | - | - |
| Hydro | 0.5 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Geothermal | 0.0 | - | - | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Solar, wind, etc. | 0.0 | 0.1 | 0.2 | 1.7 | 5.9 | 7.1 | 8.3 | 9.7 | 11 |
| Biomass and waste | 0.1 | 0.9 | 1.8 | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 | 1.9 |
| Hydrogen | - | - | - | - | 0.2 | 0.4 | 0.5 | 0.9 | 1.4 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 32 | 54 | 74 | 69 | 81 | 81 | 80 | 78 | 76 |
| Coal | 3.5 | 5.4 | 6.5 | 4.3 | 4.9 | 4.7 | 4.5 | 4.1 | 3.8 |
| Oil | 21 | 32 | 44 | 35 | 41 | 41 | 40 | 38 | 36 |
| Natural gas | 1.0 | 1.8 | 2.4 | 5.3 | 6.1 | 6.0 | 5.9 | 5.8 | 5.7 |
| Electricity | 6.6 | 14 | 19 | 22 | 25 | 26 | 26 | 27 | 27 |
| Heat | - | 0.0 | 1.6 | 1.7 | 2.5 | 2.5 | 2.4 | 2.2 | 2.1 |
| Hydrogen | - | - | - | - | - | - | 0.0 | 0.1 | 0.1 |
| Renewables and waste | 0.0 | 0.4 | 0.7 | 0.4 | 0.6 | 0.6 | 0.7 | 0.7 | 0.8 |
| Industry | 13 | 21 | 25 | 24 | 29 | 30 | 29 | 29 | 28 |
| Transport | 7.3 | 12 | 13 | 13 | 12 | 12 | 11 | 9.6 | 8.4 |
| Buildings, etc. | 6.9 | 11 | 12 | 13 | 13 | 13 | 13 | 13 | 12 |
| Non-energy use | 4.9 | 9.4 | 23 | 19 | 26 | 27 | 27 | 27 | 27 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 90 | 181 | 244 | 279 | 315 | 327 | 335 | 342 | 349 |
| Coal | 27 | 87 | 122 | 119 | 110 | 101 | 91 | 80 | 69 |
| Oil | 22 | 31 | 11 | 3.8 | 2.9 | 2.2 | 1.5 | 0.9 | 0.3 |
| Natural gas | 1.2 | 18 | 60 | 112 | 124 | 130 | 134 | 134 | 133 |
| Nuclear | 33 | 39 | 42 | 18 | - | - | - | - | - |
| Hydro | 6.2 | 4.6 | 4.2 | 4.0 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| Geothermal | 0.0 | - | - | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Solar photovoltaics | - | - | 0.0 | 13 | 25 | 29 | 33 | 39 | 45 |
| Wind | - | 0.0 | 1.0 | 6.2 | 43 | 53 | 63 | 73 | 82 |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | 0.2 | 1.8 | 3.4 | 3.6 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 |
| Hydrogen | - | - | - | - | 1.5 | 2.8 | 4.0 | 7.2 | 10 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 108 | 213 | 252 | 257 | 253 | 243 | 229 | 212 | 195 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 161 | 307 | 463 | 688 | 826 | 913 | 999 | 1 083 | 1 159 |
| Population (million) | 20 | 22 | 23 | 23 | 23 | 22 | 21 | 20 | 19 |
| GDP per capita ($2015 thousand) | 7.9 | 14 | 20 | 29 | 37 | 41 | 47 | 53 | 60 |
| Primary energy consumption per capita (toe/person) | 2.5 | 4.0 | 5.1 | 4.7 | 5.2 | 5.3 | 5.4 | 5.4 | 5.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 315 | 292 | 254 | 161 | 142 | 127 | 114 | 102 | 93 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 672 | 694 | 545 | 374 | 306 | 267 | 229 | 196 | 168 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.1 | 2.4 | 2.1 | 2.3 | 2.2 | 2.1 | 2.0 | 1.9 | 1.8 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 2.4 | 0.2 | -0.6 | -0.1 | 100 | 100 | 100 | 100 | 115 | 109 | 102 | 95 | 90 | -0.5 | -1.2 | -0.8 | 100 | 100 |
| 3.7 | -1.0 | -1.9 | -1.4 | 23 | 35 | 28 | 25 | 32 | 28 | 23 | 19 | 15 | -3.0 | -4.0 | -3.3 | 22 | 17 |
| 0.8 | 0.5 | -1.1 | -0.1 | 56 | 34 | 36 | 34 | 41 | 38 | 35 | 31 | 27 | -0.5 | -2.3 | -1.1 | 34 | 31 |
| 8.9 | 0.8 | 0.0 | 0.5 | 3.1 | 24 | 27 | 28 | 27 | 25 | 23 | 21 | 18 | -0.8 | -2.7 | -1.5 | 23 | 20 |
| -1.8 | -100 | n.a. | -100 | 17 | 4.2 | - | - | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 0.4 | 0.0 | 0.3 | 4.9 | 5.5 |
| -1.3 | 1.0 | 0.0 | 0.6 | 1.1 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 1.0 | 0.0 | 0.6 | 0.4 | 0.5 |
| 5.9 | 6.2 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 6.2 | 0.0 | 3.9 | 0.1 | 0.1 |
| 14.5 | 9.6 | 2.9 | 7.1 | 0.0 | 1.6 | 7.3 | 10 | 6.8 | 8.7 | 11 | 13 | 16 | 11.3 | 3.8 | 8.5 | 11 | 18 |
| 11.3 | 0.2 | 0.3 | 0.3 | 0.1 | 1.6 | 1.6 | 1.7 | 1.8 | 2.1 | 2.6 | 3.1 | 3.7 | 2.3 | 3.8 | 2.8 | 2.5 | 4.1 |
| n.a. | n.a. | 10.6 | n.a. | - | - | 0.4 | 1.3 | 0.3 | 1.4 | 2.3 | 3.7 | 4.7 | n.a. | 7.4 | n.a. | 2.3 | 5.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.4 | 0.8 | -0.5 | 0.3 | 100 | 100 | 100 | 100 | 78 | 75 | 70 | 66 | 62 | 0.1 | -1.2 | -0.4 | 100 | 100 |
| 0.7 | 0.1 | -1.5 | -0.5 | 11 | 6.3 | 5.6 | 5.0 | 4.5 | 3.9 | 3.2 | 2.7 | 2.3 | -1.7 | -3.2 | -2.3 | 4.6 | 3.7 |
| 1.6 | 0.7 | -1.0 | 0.1 | 65 | 51 | 50 | 47 | 41 | 38 | 35 | 31 | 29 | -0.1 | -1.9 | -0.7 | 49 | 46 |
| 5.2 | 0.7 | -0.5 | 0.2 | 3.1 | 7.7 | 7.4 | 7.5 | 5.3 | 4.3 | 3.4 | 2.5 | 1.8 | -2.6 | -6.3 | -4.0 | 4.8 | 2.8 |
| 3.7 | 1.0 | 0.4 | 0.8 | 21 | 32 | 33 | 36 | 25 | 26 | 26 | 25 | 25 | 0.9 | -0.2 | 0.5 | 37 | 40 |
| n.a. | 2.0 | -1.2 | 0.8 | - | 2.5 | 3.0 | 2.8 | 2.3 | 2.1 | 1.7 | 1.4 | 1.1 | 0.0 | -4.0 | -1.5 | 2.4 | 1.8 |
| n.a. | n.a. | 21.1 | n.a. | - | - | 0.0 | 0.2 | - | 0.1 | 0.3 | 0.6 | 1.0 | n.a. | 12.6 | n.a. | 0.4 | 1.6 |
| 9.8 | 2.7 | 1.0 | 2.1 | 0.1 | 0.6 | 0.9 | 1.0 | 0.7 | 1.0 | 1.4 | 1.9 | 2.5 | 7.0 | 6.1 | 6.7 | 2.0 | 4.0 |
| 1.9 | 1.2 | -0.3 | 0.6 | 40 | 35 | 37 | 38 | 28 | 26 | 24 | 22 | 20 | 0.0 | -1.7 | -0.6 | 34 | 33 |
| 1.8 | -1.2 | -2.4 | -1.6 | 23 | 19 | 13 | 11 | 12 | 9.8 | 7.8 | 6.2 | 5.2 | -3.0 | -3.9 | -3.3 | 11 | 8.4 |
| 2.0 | -0.2 | -0.5 | -0.3 | 22 | 19 | 16 | 16 | 13 | 12 | 12 | 11 | 10 | -0.8 | -1.4 | -1.0 | 16 | 16 |
| 4.2 | 2.1 | 0.0 | 1.3 | 15 | 27 | 34 | 35 | 26 | 27 | 27 | 27 | 27 | 2.1 | 0.0 | 1.3 | 38 | 43 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.5 | 1.1 | 0.4 | 0.8 | 100 | 100 | 100 | 100 | 315 | 326 | 332 | 342 | 352 | 1.0 | 0.6 | 0.9 | 100 | 100 |
| 4.5 | -1.5 | -2.7 | -2.0 | 30 | 43 | 27 | 20 | 90 | 72 | 53 | 37 | 23 | -4.7 | -8.0 | -5.9 | 16 | 6.5 |
| -5.2 | -5.2 | -16.2 | -9.4 | 25 | 1.4 | 0.5 | 0.1 | 2.5 | 1.8 | 1.1 | 0.6 | 0.2 | -6.8 | -18.3 | -11.2 | 0.3 | 0.0 |
| 14.7 | 1.1 | 0.0 | 0.7 | 1.3 | 40 | 40 | 38 | 115 | 118 | 114 | 107 | 95 | 0.1 | -1.8 | -0.6 | 34 | 27 |
| -1.8 | -100 | n.a. | -100 | 36 | 6.4 | - | - | 19 | 19 | 19 | 19 | 19 | 0.4 | 0.0 | 0.3 | 5.8 | 5.4 |
| -1.3 | 1.0 | 0.0 | 0.6 | 6.8 | 1.4 | 1.4 | 1.4 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 1.0 | 0.0 | 0.6 | 1.4 | 1.3 |
| 6.4 | 6.4 | 0.0 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 6.4 | 0.0 | 4.0 | 0.0 | 0.0 |
| n.a. | 5.7 | 3.2 | 4.7 | - | 4.6 | 9.8 | 13 | 29 | 36 | 43 | 53 | 64 | 7.4 | 4.0 | 6.1 | 13 | 18 |
| n.a. | 14.5 | 2.8 | 10.0 | - | 2.2 | 19 | 24 | 48 | 64 | 81 | 98 | 118 | 16.3 | 3.8 | 11.5 | 24 | 33 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 9.0 | 0.4 | 0.1 | 0.3 | 0.2 | 1.3 | 1.2 | 1.1 | 3.9 | 4.0 | 4.2 | 4.3 | 4.4 | 0.9 | 0.5 | 0.8 | 1.3 | 1.3 |
| n.a. | n.a. | 10.0 | n.a. | - | - | 1.2 | 3.0 | 1.6 | 6.7 | 12 | 18 | 24 | n.a. | 7.3 | n.a. | 3.5 | 6.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.7 | -0.7 | -1.6 | -1.0 | 225 | 192 | 155 | 115 | 81 | -2.9 | -6.3 | -4.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | 0.7 | 1.4 | 2.1 | n.a. | 11.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 4.5 | 2.2 | 1.5 | 2.0 | 826 | 913 | 999 | 1 083 | 1 159 | 2.2 | 1.5 | 2.0 |
| 0.4 | -0.5 | -0.9 | -0.7 | 23 | 22 | 21 | 20 | 19 | -0.5 | -0.9 | -0.7 |
| 4.1 | 2.8 | 2.4 | 2.6 | 37 | 41 | 47 | 53 | 60 | 2.8 | 2.4 | 2.6 |
| 2.0 | 0.7 | 0.3 | 0.6 | 5.1 | 5.0 | 4.8 | 4.7 | 4.6 | 0.1 | -0.3 | -0.1 |
| -2.0 | -2.0 | -2.0 | -2.0 | 139 | 119 | 102 | 88 | 78 | -2.6 | -2.7 | -2.7 |
| -1.8 | -2.8 | -3.1 | -2.9 | 272 | 211 | 155 | 106 | 70 | -5.0 | -7.7 | -6.0 |
| 0.3 | -0.8 | -1.1 | -0.9 | 2.0 | 1.8 | 1.5 | 1.2 | 0.9 | -2.5 | -5.1 | -3.5 |

## Table A30 | ASEAN

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 217 | 355 | 506 | 757 | 919 | 1 090 | 1 229 | 1 369 | 1 513 |
| Coal | 12 | 31 | 79 | 218 | 262 | 282 | 301 | 317 | 325 |
| Oil | 88 | 154 | 191 | 236 | 260 | 282 | 307 | 329 | 347 |
| Natural gas | 30 | 74 | 125 | 147 | 207 | 257 | 321 | 399 | 494 |
| Nuclear | - | - | - | - | - | 2.2 | 7.9 | 14 | 18 |
| Hydro | 2.3 | 4.4 | 6.8 | 18 | 21 | 23 | 25 | 27 | 28 |
| Geothermal | 6.6 | 18 | 25 | 38 | 54 | 117 | 129 | 136 | 142 |
| Solar, wind, etc. | - | - | 0.0 | 5.3 | 14 | 21 | 25 | 31 | 37 |
| Biomass and waste | 78 | 73 | 80 | 94 | 100 | 106 | 111 | 116 | 120 |
| Hydrogen | - | - | - | - | -0.0 | 0.3 | 1.1 | 1.1 | 1.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 149 | 245 | 343 | 477 | 559 | 624 | 692 | 759 | 822 |
| Coal | 5.4 | 14 | 29 | 45 | 54 | 59 | 62 | 64 | 65 |
| Oil | 67 | 124 | 165 | 216 | 237 | 258 | 281 | 303 | 321 |
| Natural gas | 7.5 | 17 | 29 | 47 | 58 | 66 | 73 | 80 | 85 |
| Electricity | 11 | 28 | 53 | 107 | 142 | 170 | 201 | 235 | 272 |
| Heat | - | - | - | - | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| Hydrogen | - | - | - | - | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |
| Renewables and waste | 58 | 63 | 67 | 63 | 68 | 72 | 74 | 77 | 78 |
| Industry | 41 | 76 | 112 | 168 | 214 | 246 | 277 | 305 | 331 |
| Transport | 33 | 62 | 88 | 148 | 168 | 184 | 201 | 219 | 235 |
| Buildings, etc. | 64 | 86 | 102 | 113 | 124 | 136 | 149 | 164 | 179 |
| Non-energy use | 11 | 21 | 40 | 47 | 53 | 59 | 65 | 71 | 77 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 154 | 374 | 692 | 1 365 | 1 810 | 2 196 | 2 599 | 3 053 | 3 549 |
| Coal | 28 | 79 | 192 | 635 | 745 | 806 | 868 | 926 | 961 |
| Oil | 66 | 72 | 60 | 19 | 12 | 11 | 9.3 | 7.0 | 3.4 |
| Natural gas | 26 | 154 | 335 | 361 | 549 | 714 | 929 | 1 199 | 1 536 |
| Nuclear | - | - | - | - | - | 8.4 | 30 | 53 | 71 |
| Hydro | 27 | 51 | 80 | 207 | 244 | 268 | 290 | 311 | 330 |
| Geothermal | 6.6 | 16 | 19 | 28 | 38 | 75 | 83 | 86 | 90 |
| Solar photovoltaics | - | 0.0 | 0.0 | 42 | 103 | 158 | 202 | 253 | 308 |
| Wind | - | - | 0.1 | 17 | 58 | 76 | 89 | 105 | 122 |
| Concentrated solar power and marine | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Biomass and waste | 0.6 | 1.1 | 6.4 | 56 | 60 | 67 | 74 | 81 | 87 |
| Hydrogen | - | - | - | - | 0.0 | 12 | 24 | 32 | 41 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 334 | 649 | 1 006 | 1 716 | 2 098 | 2 323 | 2 578 | 2 837 | 3 080 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 739 | 1 180 | 1 975 | 3 377 | 4 537 | 5 645 | 6 955 | 8 443 | 10 075 |
| Population (million) | 439 | 526 | 603 | 689 | 721 | 740 | 756 | 767 | 773 |
| GDP per capita ($2015 thousand) | 1.7 | 2.2 | 3.3 | 4.9 | 6.3 | 7.6 | 9.2 | 11 | 13 |
| Primary energy consumption per capita (toe/person) | 0.5 | 0.7 | 0.8 | 1.1 | 1.3 | 1.5 | 1.6 | 1.8 | 2.0 |
| Primary energy consumption per GDP (toe/$2015 million) | 294 | 301 | 256 | 224 | 203 | 193 | 177 | 162 | 150 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 452 | 550 | 510 | 508 | 462 | 412 | 371 | 336 | 306 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.5 | 1.8 | 2.0 | 2.3 | 2.3 | 2.1 | 2.1 | 2.1 | 2.0 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 3.9 | 2.9 | 2.1 | 2.6 | 100 | 100 | 100 | 100 | 875 | 1 013 | 1 101 | 1 183 | 1 271 | 2.2 | 1.4 | 1.9 | 100 | 100 |
| 9.1 | 1.9 | 0.8 | 1.5 | 5.7 | 29 | 24 | 21 | 239 | 216 | 205 | 195 | 178 | -0.4 | -1.4 | -0.8 | 19 | 14 |
| 3.0 | 1.5 | 1.2 | 1.4 | 40 | 31 | 25 | 23 | 243 | 237 | 233 | 222 | 207 | -0.1 | -1.2 | -0.5 | 21 | 16 |
| 4.9 | 4.7 | 4.4 | 4.6 | 14 | 19 | 26 | 33 | 191 | 220 | 261 | 309 | 370 | 3.4 | 3.6 | 3.5 | 24 | 29 |
| n.a. | n.a. | 8.9 | n.a. | - | - | 0.6 | 1.2 | - | 37 | 54 | 67 | 83 | n.a. | 4.5 | n.a. | 4.9 | 6.5 |
| 6.3 | 2.0 | 1.3 | 1.7 | 1.1 | 2.4 | 2.0 | 1.9 | 23 | 26 | 29 | 32 | 35 | 2.9 | 1.7 | 2.5 | 2.7 | 2.7 |
| 5.5 | 7.4 | 0.9 | 5.0 | 3.1 | 5.1 | 11 | 9.4 | 54 | 127 | 156 | 180 | 205 | 8.6 | 2.7 | 6.4 | 14 | 16 |
| n.a. | 9.6 | 3.9 | 7.5 | - | 0.7 | 2.1 | 2.5 | 19 | 32 | 45 | 65 | 88 | 13.4 | 6.9 | 10.9 | 4.1 | 6.9 |
| 0.6 | 1.0 | 0.8 | 0.9 | 36 | 12 | 9.1 | 8.0 | 104 | 111 | 112 | 113 | 113 | 1.0 | 0.1 | 0.7 | 10 | 8.9 |
| n.a. | n.a. | -0.8 | n.a. | - | - | 0.1 | 0.1 | 2.7 | 6.1 | 5.3 | 0.2 | -7.6 | n.a. | n.a. | n.a. | 0.5 | -0.6 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.6 | 2.2 | 1.7 | 2.0 | 100 | 100 | 100 | 100 | 542 | 574 | 595 | 611 | 626 | 1.3 | 0.5 | 1.0 | 100 | 100 |
| 6.6 | 2.0 | 0.5 | 1.4 | 3.6 | 9.4 | 9.0 | 7.9 | 51 | 50 | 47 | 44 | 42 | 0.3 | -1.1 | -0.3 | 7.9 | 6.7 |
| 3.6 | 1.6 | 1.3 | 1.5 | 45 | 45 | 41 | 39 | 223 | 223 | 220 | 212 | 201 | 0.1 | -0.9 | -0.3 | 37 | 32 |
| 5.7 | 2.7 | 1.5 | 2.2 | 5.0 | 9.8 | 11 | 10 | 54 | 57 | 57 | 56 | 54 | 1.1 | -0.5 | 0.5 | 9.6 | 8.7 |
| 7.1 | 3.8 | 3.1 | 3.5 | 7.5 | 22 | 29 | 33 | 145 | 173 | 201 | 232 | 265 | 3.8 | 2.8 | 3.4 | 34 | 42 |
| n.a. | n.a. | 5.0 | n.a. | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | n.a. | 4.3 | n.a. | 0.0 | 0.0 |
| n.a. | n.a. | 2.7 | n.a. | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | n.a. | 14.0 | n.a. | 0.0 | 0.0 |
| 0.2 | 1.0 | 0.6 | 0.8 | 39 | 13 | 11 | 9.5 | 69 | 72 | 70 | 67 | 64 | 0.6 | -0.9 | 0.1 | 12 | 10 |
| 4.3 | 3.0 | 1.8 | 2.5 | 28 | 35 | 40 | 40 | 206 | 221 | 228 | 231 | 236 | 1.8 | 0.4 | 1.3 | 38 | 38 |
| 4.7 | 1.8 | 1.6 | 1.7 | 22 | 31 | 29 | 29 | 162 | 167 | 168 | 166 | 163 | 0.7 | -0.3 | 0.4 | 28 | 26 |
| 1.7 | 1.6 | 1.9 | 1.7 | 43 | 24 | 22 | 22 | 121 | 127 | 134 | 142 | 149 | 1.0 | 1.1 | 1.0 | 23 | 24 |
| 4.5 | 1.9 | 1.8 | 1.9 | 7.4 | 9.9 | 9.4 | 9.4 | 53 | 59 | 65 | 71 | 77 | 1.9 | 1.8 | 1.9 | 11 | 12 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 6.8 | 3.9 | 3.2 | 3.6 | 100 | 100 | 100 | 100 | 1 854 | 2 291 | 2 740 | 3 312 | 3 971 | 4.2 | 3.8 | 4.0 | 100 | 100 |
| 10.0 | 1.9 | 1.0 | 1.5 | 18 | 47 | 33 | 27 | 682 | 593 | 556 | 518 | 456 | -0.8 | -2.0 | -1.2 | 20 | 11 |
| -3.7 | -4.1 | -9.6 | -6.2 | 43 | 1.4 | 0.4 | 0.1 | 13 | 10 | 8.9 | 6.9 | 3.8 | -4.4 | -8.2 | -5.8 | 0.3 | 0.1 |
| 8.3 | 5.7 | 5.2 | 5.5 | 17 | 26 | 36 | 43 | 568 | 695 | 888 | 1 143 | 1 464 | 5.4 | 5.1 | 5.3 | 32 | 37 |
| n.a. | n.a. | 8.9 | n.a. | - | - | 1.2 | 2.0 | - | 142 | 206 | 258 | 318 | n.a. | 4.5 | n.a. | 7.5 | 8.0 |
| 6.3 | 2.0 | 1.3 | 1.7 | 18 | 15 | 11 | 9.3 | 267 | 305 | 339 | 372 | 403 | 2.9 | 1.7 | 2.5 | 12 | 10 |
| 4.4 | 6.7 | 0.9 | 4.5 | 4.3 | 2.0 | 3.2 | 2.5 | 38 | 83 | 100 | 115 | 129 | 7.9 | 2.5 | 5.9 | 3.7 | 3.2 |
| n.a. | 9.7 | 4.3 | 7.7 | - | 3.1 | 7.8 | 8.7 | 155 | 266 | 382 | 539 | 719 | 13.9 | 6.5 | 11.1 | 14 | 18 |
| n.a. | 10.3 | 3.2 | 7.6 | - | 1.2 | 3.4 | 3.4 | 64 | 102 | 138 | 208 | 294 | 13.1 | 7.9 | 11.2 | 5.0 | 7.4 |
| n.a. | n.a. | 0.0 | n.a. | - | - | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.7 | n.a. | 9.6 | n.a. | 0.0 | 0.0 |
| 14.7 | 1.7 | 1.6 | 1.7 | 0.4 | 4.1 | 2.8 | 2.5 | 68 | 78 | 88 | 99 | 109 | 2.7 | 2.1 | 2.5 | 3.2 | 2.7 |
| n.a. | n.a. | 5.5 | n.a. | - | - | 0.9 | 1.1 | 0.0 | 16 | 33 | 53 | 74 | n.a. | 8.5 | n.a. | 1.2 | 1.9 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.1 | 2.4 | 1.8 | 2.2 | 1 920 | 1 775 | 1 694 | 1 594 | 1 474 | -0.1 | -1.4 | -0.6 |
| n.a. | n.a. | n.a. | n.a. | - | - | 10 | 22 | 35 | n.a. | 13.2 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 4.7 | 4.3 | 3.8 | 4.1 | 4 537 | 5 645 | 6 955 | 8 443 | 10 075 | 4.3 | 3.8 | 4.1 |
| 1.4 | 0.5 | 0.2 | 0.4 | 721 | 740 | 756 | 767 | 773 | 0.5 | 0.2 | 0.4 |
| 3.3 | 3.8 | 3.5 | 3.7 | 6.3 | 7.6 | 9.2 | 11 | 13 | 3.8 | 3.5 | 3.7 |
| 2.5 | 2.3 | 1.9 | 2.2 | 1.2 | 1.4 | 1.5 | 1.5 | 1.6 | 1.7 | 1.2 | 1.5 |
| -0.8 | -1.4 | -1.6 | -1.5 | 193 | 179 | 158 | 140 | 126 | -2.0 | -2.2 | -2.1 |
| 0.4 | -1.8 | -1.9 | -1.9 | 423 | 315 | 244 | 189 | 146 | -4.2 | -5.0 | -4.5 |
| 1.2 | -0.5 | -0.3 | -0.4 | 2.2 | 1.8 | 1.5 | 1.3 | 1.2 | -2.3 | -2.8 | -2.4 |

## Table A31 | Indonesia

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total[*1] | 85 | 127 | 166 | 276 | 360 | 470 | 542 | 615 | 695 |
| Coal | 3.5 | 12 | 25 | 98 | 119 | 124 | 132 | 137 | 136 |
| Oil | 33 | 58 | 67 | 73 | 79 | 86 | 93 | 99 | 103 |
| Natural gas | 16 | 27 | 39 | 43 | 77 | 106 | 147 | 199 | 264 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 0.5 | 0.9 | 1.5 | 2.1 | 2.9 | 3.2 | 3.6 | 4.0 | 4.3 |
| Geothermal | 1.9 | 8.4 | 16 | 29 | 42 | 105 | 117 | 122 | 128 |
| Solar, wind, etc. | - | - | - | 0.4 | 2.2 | 4.3 | 5.6 | 7.5 | 9.5 |
| Biomass and waste | 30 | 21 | 17 | 31 | 39 | 42 | 45 | 47 | 49 |
| Hydrogen | - | - | - | - | -0.0 | -0.0 | - | - | - |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 57 | 91 | 106 | 161 | 196 | 223 | 250 | 277 | 303 |
| Coal | 1.5 | 4.6 | 5.9 | 17 | 22 | 24 | 26 | 27 | 27 |
| Oil | 27 | 48 | 55 | 68 | 73 | 80 | 87 | 93 | 98 |
| Natural gas | 6.0 | 12 | 16 | 20 | 26 | 30 | 34 | 37 | 40 |
| Electricity | 2.4 | 6.8 | 13 | 35 | 48 | 60 | 73 | 88 | 105 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Renewables and waste | 20 | 20 | 16 | 20 | 27 | 29 | 30 | 32 | 33 |
| Industry | 17 | 30 | 38 | 65 | 84 | 99 | 112 | 125 | 137 |
| Transport | 11 | 21 | 30 | 58 | 67 | 73 | 78 | 84 | 90 |
| Buildings, etc. | 22 | 30 | 27 | 33 | 38 | 44 | 50 | 57 | 65 |
| Non-energy use | 7.4 | 9.8 | 10 | 5.3 | 6.6 | 7.6 | 8.8 | 10 | 11 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 33 | 93 | 177 | 433 | 599 | 753 | 921 | 1 121 | 1 348 |
| Coal | 9.8 | 34 | 76 | 300 | 345 | 357 | 383 | 401 | 403 |
| Oil | 15 | 18 | 34 | 8.6 | 8.5 | 7.4 | 6.1 | 3.7 | - |
| Natural gas | 0.7 | 26 | 40 | 56 | 133 | 205 | 313 | 460 | 651 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 5.7 | 10 | 17 | 25 | 33 | 37 | 42 | 46 | 50 |
| Geothermal | 1.1 | 4.9 | 9.4 | 17 | 25 | 61 | 68 | 71 | 75 |
| Solar photovoltaics | - | - | 0.0 | 0.7 | 17 | 37 | 49 | 67 | 86 |
| Wind | - | - | 0.0 | 0.5 | 4.8 | 8.7 | 11 | 16 | 21 |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | - | 0.0 | 0.1 | 27 | 32 | 35 | 38 | 41 | 43 |
| Hydrogen | - | - | - | - | - | 5.0 | 10.0 | 15 | 20 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions[*2] | 125 | 239 | 346 | 672 | 858 | 949 | 1 071 | 1 194 | 1 312 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 270 | 395 | 658 | 1 179 | 1 649 | 2 085 | 2 606 | 3 221 | 3 929 |
| Population (million) | 184 | 216 | 246 | 281 | 296 | 305 | 312 | 317 | 321 |
| GDP per capita ($2015 thousand) | 1.5 | 1.8 | 2.7 | 4.2 | 5.6 | 6.8 | 8.4 | 10 | 12 |
| Primary energy consumption per capita (toe/person) | 0.5 | 0.6 | 0.7 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.2 |
| Primary energy consumption per GDP (toe/$2015 million) | 314 | 320 | 253 | 234 | 218 | 225 | 208 | 191 | 177 |
| Energy-related $CO_2$ emissions per GDP[*2] (t/$2015 million) | 462 | 606 | 526 | 570 | 520 | 455 | 411 | 371 | 334 |
| Energy-related $CO_2$ per primary energy consumption[*2] (t/toe) | 1.5 | 1.9 | 2.1 | 2.4 | 2.4 | 2.0 | 2.0 | 1.9 | 1.9 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 3.6 | 4.0 | 2.5 | 3.5 | 100 | 100 | 100 | 100 | 345 | 444 | 503 | 557 | 613 | 3.6 | 2.0 | 3.0 | 100 | 100 |
| 10.6 | 1.8 | 0.3 | 1.2 | 4.2 | 36 | 24 | 20 | 111 | 100 | 97 | 90 | 76 | -0.1 | -2.4 | -0.9 | 19 | 12 |
| 2.4 | 1.4 | 1.1 | 1.3 | 39 | 26 | 17 | 15 | 71 | 68 | 66 | 61 | 55 | -0.6 | -1.8 | -1.1 | 13 | 8.9 |
| 3.1 | 7.5 | 6.1 | 6.9 | 19 | 16 | 27 | 38 | 70 | 88 | 118 | 155 | 201 | 6.1 | 5.5 | 5.9 | 24 | 33 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | 15 | 15 | 15 | 15 | n.a. | 0.0 | n.a. | 2.9 | 2.4 |
| 4.5 | 3.2 | 1.9 | 2.7 | 0.6 | 0.8 | 0.7 | 0.6 | 3.0 | 3.5 | 4.0 | 4.4 | 4.9 | 3.8 | 2.2 | 3.2 | 0.8 | 0.8 |
| 8.6 | 8.5 | 1.0 | 5.6 | 2.3 | 11 | 22 | 18 | 42 | 111 | 140 | 164 | 187 | 9.7 | 3.0 | 7.1 | 28 | 31 |
| n.a. | 17.0 | 5.5 | 12.6 | - | 0.1 | 1.0 | 1.4 | 3.9 | 8.6 | 13 | 20 | 29 | 23.1 | 8.2 | 17.3 | 2.6 | 4.7 |
| 0.1 | 2.3 | 0.9 | 1.8 | 35 | 11 | 8.2 | 7.0 | 45 | 50 | 51 | 51 | 50 | 3.1 | -0.1 | 1.9 | 10 | 8.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | -0.1 | -0.4 | -0.5 | -2.5 | -5.5 | n.a. | 26.1 | n.a. | -0.1 | -0.9 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.2 | 2.6 | 1.9 | 2.4 | 100 | 100 | 100 | 100 | 190 | 206 | 217 | 224 | 231 | 1.8 | 0.7 | 1.4 | 100 | 100 |
| 7.7 | 2.4 | 0.5 | 1.7 | 2.6 | 11 | 10 | 8.9 | 20 | 19 | 18 | 16 | 15 | 0.1 | -1.6 | -0.5 | 8.2 | 6.5 |
| 2.8 | 1.5 | 1.2 | 1.4 | 48 | 42 | 35 | 32 | 66 | 65 | 62 | 59 | 54 | -0.5 | -1.5 | -0.8 | 29 | 23 |
| 3.7 | 3.1 | 1.5 | 2.5 | 11 | 13 | 14 | 13 | 24 | 26 | 26 | 25 | 25 | 1.5 | -0.6 | 0.7 | 12 | 11 |
| 8.5 | 4.3 | 3.7 | 4.1 | 4.3 | 22 | 29 | 35 | 50 | 63 | 77 | 92 | 108 | 4.7 | 3.4 | 4.2 | 36 | 47 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | n.a. | 0.0 | n.a. | 0.0 | 0.0 |
| 0.1 | 2.4 | 0.9 | 1.8 | 35 | 13 | 12 | 11 | 30 | 33 | 33 | 32 | 30 | 2.9 | -1.1 | 1.4 | 15 | 13 |
| 4.1 | 3.3 | 2.0 | 2.8 | 31 | 40 | 45 | 45 | 82 | 90 | 96 | 99 | 102 | 2.3 | 0.7 | 1.7 | 44 | 44 |
| 5.2 | 1.8 | 1.4 | 1.6 | 19 | 36 | 31 | 30 | 64 | 66 | 65 | 63 | 61 | 0.7 | -0.6 | 0.2 | 30 | 27 |
| 1.3 | 2.5 | 2.6 | 2.6 | 38 | 20 | 20 | 21 | 38 | 42 | 47 | 52 | 56 | 2.1 | 1.9 | 2.0 | 22 | 24 |
| -1.0 | 3.0 | 2.6 | 2.9 | 13 | 3.3 | 3.5 | 3.8 | 6.6 | 7.6 | 8.8 | 10 | 11 | 3.0 | 2.6 | 2.9 | 4.1 | 4.9 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 8.1 | 4.5 | 3.9 | 4.3 | 100 | 100 | 100 | 100 | 628 | 823 | 1 031 | 1 291 | 1 586 | 5.2 | 4.4 | 4.9 | 100 | 100 |
| 10.9 | 1.5 | 0.5 | 1.1 | 30 | 69 | 42 | 30 | 326 | 285 | 278 | 255 | 203 | -0.4 | -3.1 | -1.4 | 27 | 13 |
| -1.7 | -2.0 | -100 | -100 | 47 | 2.0 | 0.7 | - | 8.5 | 6.6 | 5.4 | 3.2 | - | -2.7 | -100 | -100 | 0.5 | - |
| 14.0 | 10.7 | 7.6 | 9.5 | 2.2 | 13 | 34 | 48 | 153 | 223 | 352 | 521 | 739 | 11.4 | 7.7 | 10.0 | 34 | 47 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | 56 | 56 | 56 | 56 | n.a. | 0.0 | n.a. | 5.5 | 3.5 |
| 4.5 | 3.2 | 1.9 | 2.7 | 17 | 5.7 | 4.5 | 3.7 | 35 | 41 | 46 | 52 | 57 | 3.8 | 2.2 | 3.2 | 4.5 | 3.6 |
| 8.6 | 8.5 | 1.0 | 5.6 | 3.4 | 3.9 | 7.4 | 5.5 | 25 | 65 | 81 | 95 | 109 | 9.7 | 3.0 | 7.1 | 7.9 | 6.9 |
| n.a. | 28.3 | 5.7 | 19.4 | - | 0.2 | 5.4 | 6.4 | 35 | 71 | 106 | 147 | 192 | 34.2 | 6.1 | 23.0 | 10 | 12 |
| n.a. | 20.2 | 6.7 | 15.0 | - | 0.1 | 1.2 | 1.6 | 6.3 | 25 | 41 | 84 | 138 | 29.9 | 12.8 | 23.3 | 4.0 | 8.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 2.2 | 1.2 | 1.8 | - | 6.1 | 4.2 | 3.2 | 39 | 44 | 49 | 54 | 59 | 3.7 | 1.8 | 3.0 | 4.8 | 3.7 |
| n.a. | n.a. | 7.1 | n.a. | - | - | 1.1 | 1.5 | - | 7.3 | 15 | 24 | 33 | n.a. | 8.6 | n.a. | 1.4 | 2.1 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.2 | 2.8 | 2.0 | 2.5 | 790 | 734 | 715 | 674 | 615 | 0.4 | -1.5 | -0.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | 10 | 22 | 34 | n.a. | 13.2 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.6 | 4.8 | 4.2 | 4.6 | 1 649 | 2 085 | 2 606 | 3 221 | 3 929 | 4.8 | 4.2 | 4.6 |
| 1.3 | 0.6 | 0.3 | 0.5 | 296 | 305 | 312 | 317 | 321 | 0.6 | 0.3 | 0.5 |
| 3.2 | 4.1 | 3.9 | 4.0 | 5.6 | 6.8 | 8.4 | 10 | 12 | 4.1 | 3.9 | 4.0 |
| 2.3 | 3.4 | 2.2 | 3.0 | 1.2 | 1.5 | 1.6 | 1.8 | 1.9 | 3.0 | 1.7 | 2.5 |
| -0.9 | -0.7 | -1.6 | -1.0 | 209 | 213 | 193 | 173 | 156 | -1.1 | -2.1 | -1.5 |
| 0.6 | -1.9 | -2.1 | -2.0 | 479 | 352 | 275 | 209 | 157 | -4.2 | -5.5 | -4.7 |
| 1.5 | -1.2 | -0.5 | -0.9 | 2.3 | 1.7 | 1.4 | 1.2 | 1.0 | -3.1 | -3.4 | -3.2 |

## Table A32 | Malaysia

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 21 | 48 | 73 | 106 | 118 | 128 | 138 | 147 | 155 |
| Coal | 1.4 | 2.3 | 15 | 24 | 26 | 26 | 24 | 22 | 19 |
| Oil | 11 | 19 | 25 | 33 | 33 | 33 | 34 | 33 | 32 |
| Natural gas | 6.8 | 25 | 31 | 44 | 52 | 61 | 69 | 79 | 89 |
| Nuclear | - | - | - | - | - | - | 1.8 | 3.7 | 3.7 |
| Hydro | 0.3 | 0.6 | 0.6 | 2.7 | 3.2 | 3.7 | 4.1 | 4.5 | 4.8 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar, wind, etc. | - | - | - | 0.3 | 0.5 | 0.9 | 1.3 | 1.8 | 2.4 |
| Biomass and waste | 1.2 | 1.3 | 0.9 | 1.7 | 2.8 | 3.5 | 3.5 | 3.4 | 3.3 |
| Hydrogen | - | - | - | - | -0.0 | 0.0 | 0.1 | - | -0.1 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 13 | 29 | 42 | 61 | 70 | 76 | 81 | 87 | 91 |
| Coal | 0.5 | 1.0 | 1.8 | 0.8 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 |
| Oil | 9.3 | 18 | 24 | 28 | 28 | 28 | 28 | 28 | 27 |
| Natural gas | 1.1 | 3.9 | 6.3 | 15 | 18 | 21 | 23 | 24 | 26 |
| Electricity | 1.7 | 5.3 | 9.5 | 16 | 20 | 23 | 27 | 31 | 35 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Renewables and waste | 0.8 | 0.7 | 0.2 | 1.3 | 2.4 | 3.0 | 3.0 | 2.9 | 2.7 |
| Industry | 5.5 | 12 | 15 | 19 | 25 | 29 | 33 | 37 | 40 |
| Transport | 4.9 | 11 | 15 | 23 | 23 | 23 | 23 | 22 | 21 |
| Buildings, etc. | 2.1 | 4.3 | 8.2 | 11 | 13 | 14 | 15 | 16 | 17 |
| Non-energy use | 0.8 | 2.3 | 3.7 | 8.2 | 9.4 | 10 | 11 | 12 | 12 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 23 | 69 | 125 | 193 | 247 | 294 | 342 | 394 | 448 |
| Coal | 2.9 | 7.7 | 43 | 87 | 104 | 105 | 101 | 94 | 84 |
| Oil | 11 | 3.6 | 3.7 | 2.1 | 2.4 | 2.5 | 2.6 | 2.6 | 2.6 |
| Natural gas | 5.5 | 51 | 71 | 67 | 97 | 130 | 164 | 206 | 259 |
| Nuclear | - | - | - | - | - | - | 7.0 | 14 | 14 |
| Hydro | 4.0 | 7.0 | 6.5 | 32 | 38 | 43 | 48 | 52 | 56 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | - | - | - | 3.4 | 5.4 | 11 | 15 | 21 | 27 |
| Wind | - | - | - | - | - | - | - | - | - |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | - | - | 1.0 | 1.3 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 |
| Hydrogen | - | - | - | - | - | 1.3 | 2.5 | 2.9 | 3.2 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 48 | 102 | 177 | 240 | 264 | 279 | 289 | 296 | 301 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 75 | 148 | 233 | 401 | 533 | 646 | 775 | 920 | 1 076 |
| Population (million) | 18 | 23 | 29 | 35 | 38 | 40 | 42 | 43 | 44 |
| GDP per capita ($2015 thousand) | 4.2 | 6.5 | 8.1 | 11 | 14 | 16 | 19 | 21 | 24 |
| Primary energy consumption per capita (toe/person) | 1.2 | 2.1 | 2.5 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 284 | 326 | 312 | 263 | 221 | 198 | 178 | 160 | 144 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 637 | 687 | 761 | 598 | 496 | 431 | 373 | 322 | 279 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.2 | 2.1 | 2.4 | 2.3 | 2.2 | 2.2 | 2.1 | 2.0 | 1.9 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 5.0 | 1.6 | 1.2 | 1.4 | 100 | 100 | 100 | 100 | 111 | 117 | 120 | 122 | 124 | 0.8 | 0.3 | 0.6 | 100 | 100 |
| 9.0 | 0.2 | -2.3 | -0.7 | 6.4 | 22 | 18 | 13 | 24 | 22 | 18 | 13 | 8.2 | -1.6 | -7.5 | -3.8 | 15 | 6.6 |
| 3.3 | 0.0 | -0.4 | -0.1 | 54 | 32 | 24 | 21 | 32 | 29 | 25 | 21 | 18 | -1.6 | -3.5 | -2.3 | 21 | 14 |
| 5.8 | 2.7 | 2.6 | 2.6 | 32 | 42 | 50 | 58 | 48 | 56 | 62 | 68 | 75 | 2.0 | 1.8 | 2.0 | 52 | 60 |
| n.a. | n.a. | 7.1 | n.a. | - | - | 1.3 | 2.4 | - | - | 3.8 | 6.3 | 8.9 | n.a. | 8.9 | n.a. | 3.1 | 7.2 |
| 6.5 | 2.4 | 1.6 | 2.1 | 1.6 | 2.6 | 3.0 | 3.1 | 3.6 | 4.2 | 4.8 | 5.3 | 5.8 | 3.4 | 1.9 | 2.8 | 4.0 | 4.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 9.1 | 6.1 | 8.0 | - | 0.3 | 0.9 | 1.5 | 0.6 | 1.8 | 3.1 | 5.6 | 9.0 | 14.9 | 11.1 | 13.5 | 2.6 | 7.2 |
| 1.0 | 4.2 | -0.7 | 2.4 | 5.8 | 1.6 | 2.5 | 2.1 | 2.9 | 3.3 | 3.6 | 3.8 | 3.9 | 4.5 | 0.8 | 3.1 | 3.0 | 3.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | 0.1 | -0.1 | -0.0 | -0.2 | -0.5 | -1.9 | -3.9 | n.a. | 21.8 | n.a. | -0.5 | -3.1 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.7 | 1.7 | 1.1 | 1.5 | 100 | 100 | 100 | 100 | 68 | 69 | 68 | 66 | 65 | 0.6 | -0.4 | 0.2 | 100 | 100 |
| 1.4 | 2.1 | -0.4 | 1.2 | 3.8 | 1.3 | 1.4 | 1.2 | 1.1 | 0.9 | 0.8 | 0.7 | 0.7 | 0.1 | -2.0 | -0.7 | 1.2 | 1.0 |
| 3.4 | 0.0 | -0.5 | -0.2 | 70 | 46 | 34 | 29 | 27 | 24 | 21 | 17 | 14 | -1.7 | -3.7 | -2.5 | 31 | 22 |
| 8.3 | 2.3 | 1.3 | 1.9 | 8.2 | 25 | 28 | 28 | 17 | 18 | 17 | 16 | 16 | 0.7 | -0.9 | 0.1 | 25 | 24 |
| 6.9 | 3.2 | 2.6 | 3.0 | 13 | 26 | 33 | 38 | 20 | 23 | 26 | 29 | 31 | 3.1 | 1.8 | 2.6 | 39 | 48 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 1.7 | 5.1 | -0.9 | 2.8 | 5.6 | 2.1 | 3.7 | 3.0 | 2.5 | 2.8 | 3.0 | 3.1 | 3.1 | 5.1 | 0.3 | 3.3 | 4.4 | 4.8 |
| 3.8 | 3.2 | 1.9 | 2.8 | 41 | 31 | 41 | 44 | 24 | 25 | 25 | 25 | 24 | 1.6 | -0.3 | 0.9 | 37 | 37 |
| 4.8 | 0.0 | -0.6 | -0.3 | 36 | 37 | 28 | 23 | 22 | 20 | 18 | 16 | 14 | -1.3 | -2.7 | -1.8 | 27 | 21 |
| 5.1 | 1.8 | 1.4 | 1.7 | 16 | 18 | 18 | 19 | 12 | 13 | 14 | 14 | 14 | 1.3 | 0.5 | 1.0 | 20 | 22 |
| 7.2 | 1.7 | 1.3 | 1.5 | 6.3 | 13 | 13 | 14 | 9.4 | 10 | 11 | 12 | 12 | 1.7 | 1.3 | 1.5 | 16 | 19 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 6.7 | 3.4 | 2.8 | 3.2 | 100 | 100 | 100 | 100 | 252 | 307 | 360 | 426 | 502 | 3.7 | 3.4 | 3.6 | 100 | 100 |
| 10.8 | 0.9 | -1.8 | -0.1 | 13 | 45 | 29 | 19 | 95 | 86 | 70 | 53 | 32 | -1.2 | -7.6 | -3.6 | 20 | 6.4 |
| -4.8 | 1.3 | 0.1 | 0.9 | 46 | 1.1 | 0.8 | 0.6 | 2.4 | 2.4 | 2.3 | 2.2 | 2.1 | 0.7 | -1.1 | 0.0 | 0.6 | 0.4 |
| 7.9 | 5.4 | 4.7 | 5.1 | 24 | 35 | 48 | 58 | 105 | 144 | 174 | 212 | 254 | 5.7 | 3.8 | 5.0 | 48 | 51 |
| n.a. | n.a. | 7.1 | n.a. | - | - | 2.1 | 3.1 | - | - | 15 | 24 | 34 | n.a. | 8.9 | n.a. | 4.0 | 6.8 |
| 6.5 | 2.4 | 1.6 | 2.1 | 17 | 17 | 14 | 13 | 42 | 49 | 56 | 62 | 67 | 3.4 | 1.9 | 2.8 | 16 | 13 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 9.2 | 6.1 | 8.0 | - | 1.8 | 4.4 | 6.1 | 7.2 | 21 | 36 | 66 | 104 | 14.9 | 11.1 | 13.5 | 10 | 21 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 0.9 | 1.2 | 1.0 | - | 0.7 | 0.4 | 0.4 | 1.3 | 1.7 | 2.1 | 2.5 | 2.9 | 2.8 | 3.3 | 3.0 | 0.6 | 0.6 |
| n.a. | n.a. | 2.5 | n.a. | - | - | 0.7 | 0.7 | - | 2.0 | 4.0 | 4.7 | 5.3 | n.a. | 2.9 | n.a. | 1.1 | 1.1 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.0 | 1.1 | 0.4 | 0.8 | 246 | 231 | 203 | 175 | 148 | -1.0 | -3.1 | -1.8 |
| n.a. | n.a. | n.a. | n.a. | - | - | 0.2 | 0.6 | 1.0 | n.a. | 14.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 5.2 | 3.9 | 3.3 | 3.7 | 533 | 646 | 775 | 920 | 1 076 | 3.9 | 3.3 | 3.7 |
| 2.1 | 1.0 | 0.7 | 0.9 | 38 | 40 | 42 | 43 | 44 | 1.0 | 0.7 | 0.9 |
| 3.1 | 2.9 | 2.7 | 2.8 | 14 | 16 | 19 | 21 | 24 | 2.9 | 2.7 | 2.8 |
| 2.9 | 0.6 | 0.5 | 0.6 | 2.9 | 2.9 | 2.9 | 2.8 | 2.8 | -0.2 | -0.3 | -0.3 |
| -0.2 | -2.3 | -2.1 | -2.2 | 209 | 180 | 155 | 133 | 115 | -3.1 | -2.9 | -3.0 |
| -0.2 | -2.7 | -2.8 | -2.8 | 461 | 357 | 262 | 190 | 138 | -4.7 | -6.2 | -5.3 |
| 0.0 | -0.5 | -0.8 | -0.6 | 2.2 | 2.0 | 1.7 | 1.4 | 1.2 | -1.7 | -3.4 | -2.4 |

## Table A33 | Myanmar

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 11 | 14 | 14 | 22 | 23 | 25 | 28 | 32 | 36 |
| Coal | 0.1 | 0.3 | 0.4 | 0.9 | 1.1 | 1.3 | 1.5 | 1.7 | 2.0 |
| Oil | 0.7 | 2.0 | 1.3 | 6.2 | 6.5 | 7.8 | 9.7 | 12 | 14 |
| Natural gas | 0.8 | 1.2 | 1.3 | 3.2 | 4.4 | 5.7 | 7.0 | 8.7 | 11 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 0.1 | 0.2 | 0.5 | 0.8 | 1.2 | 1.4 | 1.5 | 1.7 | 1.8 |
| Geothermal | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| Solar, wind, etc. | - | - | - | 0.0 | 0.1 | 0.1 | 0.3 | 0.4 | 0.6 |
| Biomass and waste | 9.1 | 10.0 | 11 | 11 | 9.7 | 8.7 | 8.0 | 7.5 | 7.0 |
| Hydrogen | - | - | - | - | - | -0.0 | -0.1 | -0.1 | -0.2 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 9.5 | 12 | 13 | 20 | 20 | 21 | 23 | 25 | 28 |
| Coal | 0.1 | 0.3 | 0.2 | 0.7 | 0.6 | 0.7 | 0.7 | 0.7 | 0.8 |
| Oil | 0.6 | 1.5 | 1.0 | 5.9 | 6.2 | 7.5 | 9.2 | 11 | 13 |
| Natural gas | 0.2 | 0.3 | 0.6 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 |
| Electricity | 0.1 | 0.3 | 0.6 | 1.8 | 2.7 | 3.4 | 4.2 | 5.0 | 6.0 |
| Heat | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Renewables and waste | 8.5 | 9.7 | 11 | 11 | 9.6 | 8.6 | 7.9 | 7.4 | 6.9 |
| Industry | 0.5 | 1.9 | 2.0 | 2.0 | 2.2 | 2.5 | 2.8 | 3.0 | 3.2 |
| Transport | 0.4 | 1.2 | 0.8 | 4.7 | 5.2 | 6.5 | 8.2 | 10 | 12 |
| Buildings, etc. | 8.5 | 9.1 | 10 | 13 | 12 | 11 | 11 | 12 | 12 |
| Non-energy use | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2.5 | 5.2 | 8.8 | 21 | 33 | 42 | 52 | 64 | 79 |
| Coal | 0.0 | - | 0.6 | 1.1 | 2.0 | 2.9 | 4.0 | 5.3 | 7.2 |
| Oil | 0.3 | 0.7 | 0.0 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| Natural gas | 1.0 | 2.5 | 1.8 | 10 | 16 | 22 | 28 | 35 | 44 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 1.2 | 1.9 | 6.2 | 9.3 | 14 | 16 | 18 | 20 | 21 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | - | - | - | 0.2 | 0.6 | 1.2 | 2.5 | 3.9 | 5.6 |
| Wind | - | - | - | - | - | - | - | - | - |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | - | 0.1 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 4.0 | 9.3 | 7.6 | 28 | 32 | 39 | 49 | 60 | 73 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 7.1 | 14 | 44 | 67 | 74 | 90 | 113 | 140 | 172 |
| Population (million) | 40 | 45 | 49 | 54 | 56 | 57 | 58 | 59 | 59 |
| GDP per capita ($2015 thousand) | 0.2 | 0.3 | 0.9 | 1.2 | 1.3 | 1.6 | 1.9 | 2.4 | 2.9 |
| Primary energy consumption per capita (toe/person) | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 |
| Primary energy consumption per GDP (toe/$2015 million) | 1 514 | 960 | 329 | 333 | 312 | 277 | 247 | 227 | 210 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 567 | 653 | 172 | 415 | 433 | 436 | 432 | 429 | 421 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 0.4 | 0.7 | 0.5 | 1.2 | 1.4 | 1.6 | 1.7 | 1.9 | 2.0 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 2.2 | 1.3 | 2.6 | 1.8 | 100 | 100 | 100 | 100 | 21 | 21 | 22 | 25 | 27 | 0.0 | 1.9 | 0.7 | 100 | 100 |
| 8.4 | 2.6 | 3.1 | 2.8 | 0.6 | 4.3 | 5.2 | 5.5 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | -1.2 | 0.9 | -0.4 | 3.5 | 3.1 |
| 6.7 | 2.7 | 3.8 | 3.1 | 6.8 | 28 | 35 | 39 | 6.1 | 6.9 | 7.8 | 8.8 | 9.7 | 1.4 | 2.2 | 1.7 | 35 | 36 |
| 4.5 | 4.7 | 4.5 | 4.6 | 7.1 | 14 | 25 | 30 | 4.4 | 5.6 | 6.7 | 8.1 | 9.7 | 4.4 | 3.8 | 4.2 | 30 | 36 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 6.4 | 3.9 | 1.8 | 3.1 | 1.0 | 3.6 | 5.5 | 5.1 | 1.4 | 1.6 | 1.9 | 2.1 | 2.3 | 5.1 | 2.3 | 4.1 | 8.4 | 8.7 |
| n.a. | n.a. | 5.4 | n.a. | - | - | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | n.a. | 3.1 | n.a. | 0.1 | 0.1 |
| n.a. | 18.8 | 7.9 | 14.6 | - | 0.1 | 0.9 | 1.5 | 0.1 | 0.4 | 0.9 | 2.0 | 3.2 | 28.1 | 13.0 | 22.3 | 4.2 | 12 |
| 0.6 | -1.9 | -1.3 | -1.7 | 85 | 50 | 29 | 19 | 8.4 | 6.0 | 4.8 | 4.1 | 3.4 | -4.8 | -3.4 | -4.3 | 21 | 13 |
| n.a. | n.a. | 11.8 | n.a. | - | - | -0.2 | -0.5 | -0.0 | -0.2 | -0.6 | -1.3 | -2.2 | n.a. | 14.1 | n.a. | -2.6 | -8.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.2 | 0.9 | 2.1 | 1.3 | 100 | 100 | 100 | 100 | 18 | 17 | 17 | 19 | 20 | -0.7 | 1.3 | 0.1 | 100 | 100 |
| 8.1 | 0.4 | 0.4 | 0.4 | 0.5 | 3.4 | 3.2 | 2.7 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | -5.1 | -0.7 | -3.5 | 1.6 | 1.3 |
| 7.3 | 2.6 | 3.8 | 3.1 | 6.2 | 30 | 41 | 48 | 5.9 | 6.6 | 7.6 | 8.6 | 9.4 | 1.5 | 2.2 | 1.7 | 43 | 47 |
| 1.6 | 1.6 | 1.8 | 1.7 | 2.4 | 1.9 | 2.2 | 2.1 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | -0.5 | 0.4 | -0.2 | 2.0 | 1.8 |
| 7.9 | 5.0 | 3.8 | 4.6 | 1.6 | 9.3 | 18 | 22 | 2.9 | 3.8 | 4.6 | 5.5 | 6.6 | 5.6 | 3.7 | 4.9 | 26 | 33 |
| n.a. | n.a. | 5.4 | n.a. | - | - | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | n.a. | 3.1 | n.a. | 0.2 | 0.2 |
| n.a. | n.a. | 5.5 | n.a. | - | - | 0.1 | 0.2 | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 0.7 | -1.8 | -1.3 | -1.6 | 89 | 55 | 35 | 25 | 8.2 | 5.8 | 4.6 | 4.0 | 3.3 | -4.8 | -3.5 | -4.3 | 27 | 16 |
| 4.5 | 1.9 | 1.6 | 1.8 | 4.9 | 10 | 12 | 12 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | -0.4 | 0.9 | 0.1 | 11 | 10 |
| 7.4 | 3.3 | 4.1 | 3.6 | 4.7 | 24 | 36 | 44 | 5.0 | 5.9 | 7.1 | 8.3 | 9.5 | 2.4 | 3.0 | 2.6 | 40 | 48 |
| 1.2 | -0.6 | 0.6 | -0.2 | 89 | 64 | 50 | 43 | 11 | 8.9 | 8.2 | 8.1 | 8.1 | -2.5 | -0.2 | -1.6 | 47 | 40 |
| 2.9 | 1.0 | 1.8 | 1.3 | 1.0 | 1.2 | 1.3 | 1.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 1.0 | 1.8 | 1.3 | 1.6 | 1.7 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 6.7 | 5.5 | 4.2 | 5.0 | 100 | 100 | 100 | 100 | 35 | 50 | 67 | 90 | 120 | 7.0 | 6.0 | 6.7 | 100 | 100 |
| 10.6 | 7.7 | 6.1 | 7.1 | 1.6 | 5.3 | 7.6 | 9.1 | 1.7 | 2.3 | 2.7 | 3.1 | 3.5 | 5.3 | 2.7 | 4.3 | 4.0 | 2.9 |
| -2.3 | 4.5 | 2.6 | 3.8 | 11 | 0.6 | 0.5 | 0.4 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 4.9 | 2.7 | 4.1 | 0.4 | 0.3 |
| 7.3 | 6.2 | 4.8 | 5.7 | 39 | 48 | 53 | 56 | 16 | 24 | 31 | 40 | 52 | 6.9 | 5.2 | 6.3 | 47 | 43 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 6.4 | 3.9 | 1.8 | 3.1 | 48 | 44 | 34 | 27 | 16 | 19 | 22 | 25 | 27 | 5.1 | 2.3 | 4.1 | 33 | 23 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 17.6 | 8.4 | 14.1 | - | 0.8 | 4.8 | 7.1 | 1.0 | 4.6 | 11 | 22 | 37 | 28.0 | 13.2 | 22.3 | 16 | 31 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | -16.3 | 0.0 | -10.6 | - | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -16.3 | 0.0 | -10.6 | 0.0 | 0.0 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 6.0 | 3.4 | 4.1 | 3.6 | 30 | 35 | 41 | 47 | 54 | 2.3 | 2.8 | 2.5 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 7.0 | 3.1 | 4.3 | 3.6 | 74 | 90 | 113 | 140 | 172 | 3.1 | 4.3 | 3.6 |
| 0.9 | 0.4 | 0.1 | 0.3 | 56 | 57 | 58 | 59 | 59 | 0.4 | 0.1 | 0.3 |
| 6.0 | 2.7 | 4.2 | 3.3 | 1.3 | 1.6 | 1.9 | 2.4 | 2.9 | 2.7 | 4.2 | 3.3 |
| 1.3 | 0.9 | 2.5 | 1.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | -0.4 | 1.8 | 0.4 |
| -4.5 | -1.7 | -1.6 | -1.7 | 286 | 233 | 198 | 176 | 157 | -3.0 | -2.3 | -2.7 |
| -0.9 | 0.2 | -0.3 | 0.1 | 404 | 387 | 360 | 336 | 311 | -0.8 | -1.5 | -1.1 |
| 3.7 | 2.0 | 1.4 | 1.8 | 1.4 | 1.7 | 1.8 | 1.9 | 2.0 | 2.2 | 0.9 | 1.7 |

## Table A34 | Philippines

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 27 | 39 | 42 | 67 | 85 | 100 | 115 | 127 | 137 |
| Coal | 1.3 | 4.6 | 7.0 | 23 | 29 | 35 | 37 | 38 | 38 |
| Oil | 9.9 | 16 | 14 | 20 | 27 | 33 | 39 | 45 | 50 |
| Natural gas | - | 0.0 | 3.1 | 2.6 | 4.6 | 7.0 | 11 | 16 | 21 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 0.5 | 0.7 | 0.7 | 0.9 | 1.3 | 1.5 | 1.8 | 2.1 | 2.5 |
| Geothermal | 4.7 | 10 | 8.5 | 9.2 | 12 | 12 | 13 | 13 | 13 |
| Solar, wind, etc. | - | - | 0.0 | 0.3 | 1.7 | 2.3 | 2.6 | 3.1 | 3.6 |
| Biomass and waste | 10 | 7.6 | 8.7 | 11 | 10.0 | 9.7 | 9.5 | 9.2 | 9.0 |
| Hydrogen | - | - | - | - | -0.0 | 0.1 | 0.3 | 0.3 | 0.3 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 19 | 23 | 25 | 37 | 48 | 58 | 67 | 76 | 83 |
| Coal | 0.7 | 0.8 | 1.9 | 2.0 | 3.2 | 3.5 | 3.7 | 3.8 | 3.6 |
| Oil | 8.1 | 13 | 11 | 19 | 26 | 32 | 38 | 44 | 48 |
| Natural gas | - | - | 0.1 | - | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 |
| Electricity | 1.8 | 3.1 | 4.8 | 8.2 | 13 | 16 | 19 | 22 | 25 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Renewables and waste | 8.4 | 6.4 | 6.9 | 7.9 | 6.7 | 6.4 | 6.1 | 5.9 | 5.6 |
| Industry | 4.1 | 4.6 | 5.9 | 7.0 | 11 | 14 | 16 | 18 | 19 |
| Transport | 4.5 | 8.3 | 8.0 | 13 | 18 | 22 | 27 | 32 | 35 |
| Buildings, etc. | 10.0 | 9.9 | 11 | 16 | 17 | 19 | 21 | 23 | 25 |
| Non-energy use | 0.4 | 0.4 | 0.2 | 1.4 | 2.0 | 2.5 | 3.0 | 3.7 | 4.3 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 26 | 45 | 68 | 118 | 180 | 226 | 269 | 314 | 355 |
| Coal | 1.9 | 17 | 23 | 74 | 100 | 122 | 134 | 140 | 139 |
| Oil | 12 | 9.2 | 7.1 | 1.3 | 1.0 | 0.5 | - | - | - |
| Natural gas | - | 0.0 | 20 | 17 | 29 | 43 | 66 | 93 | 124 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 6.1 | 7.8 | 7.8 | 10 | 15 | 18 | 20 | 24 | 29 |
| Geothermal | 5.5 | 12 | 9.9 | 11 | 14 | 14 | 15 | 15 | 15 |
| Solar photovoltaics | - | - | 0.0 | 2.6 | 14 | 19 | 22 | 26 | 31 |
| Wind | - | - | 0.1 | 1.3 | 5.9 | 7.7 | 8.8 | 10 | 12 |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | 0.4 | - | 0.0 | 1.4 | 0.8 | 0.9 | 1.1 | 1.2 | 1.2 |
| Hydrogen | - | - | - | - | - | 1.3 | 2.7 | 3.3 | 4.0 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 35 | 65 | 75 | 153 | 204 | 248 | 286 | 317 | 339 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 107 | 143 | 229 | 430 | 646 | 853 | 1 087 | 1 324 | 1 535 |
| Population (million) | 63 | 80 | 96 | 115 | 121 | 126 | 130 | 132 | 134 |
| GDP per capita ($2015 thousand) | 1.7 | 1.8 | 2.4 | 3.7 | 5.3 | 6.8 | 8.4 | 10.0 | 11 |
| Primary energy consumption per capita (toe/person) | 0.4 | 0.5 | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.0 |
| Primary energy consumption per GDP (toe/$2015 million) | 251 | 272 | 182 | 155 | 132 | 118 | 106 | 96 | 90 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 329 | 452 | 327 | 355 | 316 | 291 | 263 | 240 | 221 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.3 | 1.7 | 1.8 | 2.3 | 2.4 | 2.5 | 2.5 | 2.5 | 2.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 2.8 | 3.2 | 1.8 | 2.7 | 100 | 100 | 100 | 100 | 82 | 97 | 105 | 112 | 117 | 2.7 | 1.0 | 2.1 | 100 | 100 |
| 9.1 | 3.0 | 0.1 | 1.9 | 4.7 | 34 | 33 | 28 | 26 | 26 | 26 | 26 | 25 | 0.8 | -0.2 | 0.4 | 25 | 22 |
| 2.1 | 4.2 | 2.4 | 3.5 | 37 | 30 | 34 | 36 | 25 | 29 | 31 | 31 | 28 | 2.8 | -1.2 | 1.3 | 30 | 24 |
| n.a. | 9.0 | 6.7 | 8.1 | - | 3.8 | 9.6 | 15 | 4.0 | 5.3 | 8.1 | 13 | 17 | 7.0 | 7.6 | 7.2 | 7.6 | 14 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | 4.4 | 6.6 | 6.6 | 8.8 | n.a. | 2.9 | n.a. | 6.3 | 7.5 |
| 1.6 | 4.1 | 3.4 | 3.9 | 1.9 | 1.3 | 1.5 | 1.8 | 1.4 | 1.6 | 1.9 | 2.2 | 2.7 | 4.5 | 3.7 | 4.2 | 1.8 | 2.3 |
| 2.1 | 1.9 | 0.4 | 1.4 | 18 | 14 | 11 | 9.6 | 12 | 16 | 16 | 17 | 17 | 3.4 | 0.5 | 2.3 | 16 | 15 |
| n.a. | 12.9 | 3.3 | 9.3 | - | 0.5 | 2.3 | 2.6 | 2.8 | 4.2 | 5.3 | 6.9 | 8.6 | 17.7 | 4.9 | 12.8 | 5.1 | 7.4 |
| 0.3 | -1.1 | -0.5 | -0.9 | 39 | 17 | 8.2 | 6.6 | 10 | 9.9 | 9.5 | 9.1 | 8.8 | -1.1 | -0.8 | -1.0 | 9.0 | 7.5 |
| n.a. | n.a. | 1.1 | n.a. | - | - | 0.3 | 0.2 | - | 0.1 | 0.3 | 0.5 | 0.6 | n.a. | 5.1 | n.a. | 0.3 | 0.5 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.0 | 3.6 | 2.2 | 3.1 | 100 | 100 | 100 | 100 | 47 | 54 | 59 | 62 | 63 | 2.8 | 0.6 | 2.0 | 100 | 100 |
| 3.2 | 3.8 | -0.3 | 2.2 | 3.7 | 5.4 | 5.5 | 4.3 | 3.1 | 3.1 | 2.9 | 2.7 | 2.4 | 2.3 | -2.0 | 0.7 | 5.0 | 3.8 |
| 2.6 | 4.3 | 2.4 | 3.5 | 43 | 51 | 57 | 58 | 25 | 29 | 31 | 31 | 28 | 3.0 | -1.0 | 1.5 | 52 | 44 |
| n.a. | n.a. | 6.2 | n.a. | - | - | 0.1 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | n.a. | 2.7 | n.a. | 0.1 | 0.1 |
| 4.7 | 5.1 | 2.9 | 4.3 | 9.6 | 22 | 28 | 31 | 13 | 16 | 19 | 23 | 27 | 5.1 | 3.5 | 4.5 | 33 | 43 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| -0.2 | -1.5 | -0.8 | -1.2 | 44 | 21 | 9.1 | 6.8 | 6.7 | 6.5 | 6.1 | 5.6 | 5.3 | -1.5 | -1.3 | -1.4 | 10 | 8.4 |
| 1.6 | 5.1 | 1.6 | 3.8 | 22 | 19 | 24 | 23 | 11 | 13 | 14 | 14 | 14 | 4.1 | 0.3 | 2.7 | 23 | 22 |
| 3.2 | 4.5 | 2.7 | 3.8 | 24 | 35 | 40 | 42 | 17 | 21 | 24 | 25 | 24 | 3.7 | 0.3 | 2.4 | 40 | 39 |
| 1.4 | 1.7 | 1.6 | 1.7 | 52 | 42 | 31 | 30 | 17 | 18 | 19 | 20 | 20 | 1.1 | 0.8 | 1.0 | 32 | 32 |
| 3.9 | 4.6 | 3.5 | 4.2 | 2.1 | 3.8 | 4.5 | 5.1 | 2.0 | 2.5 | 3.0 | 3.7 | 4.3 | 4.6 | 3.5 | 4.2 | 5.1 | 6.8 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.7 | 5.0 | 2.8 | 4.2 | 100 | 100 | 100 | 100 | 183 | 234 | 285 | 350 | 419 | 5.3 | 3.9 | 4.8 | 100 | 100 |
| 11.7 | 3.6 | 0.4 | 2.4 | 7.3 | 62 | 50 | 39 | 92 | 91 | 94 | 99 | 101 | 1.5 | 0.6 | 1.2 | 33 | 24 |
| -6.6 | -100 | n.a. | -100 | 47 | 1.1 | - | - | 0.9 | 0.4 | - | - | - | -100 | n.a. | -100 | - | - |
| n.a. | 8.4 | 6.6 | 7.7 | - | 14 | 24 | 35 | 27 | 36 | 56 | 89 | 118 | 7.4 | 7.7 | 7.5 | 20 | 28 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | 17 | 25 | 25 | 34 | n.a. | 2.9 | n.a. | 8.9 | 8.0 |
| 1.6 | 4.1 | 3.4 | 3.9 | 23 | 8.7 | 7.6 | 8.1 | 16 | 18 | 22 | 26 | 31 | 4.5 | 3.7 | 4.2 | 7.6 | 7.4 |
| 2.1 | 1.9 | 0.4 | 1.4 | 21 | 9.1 | 5.5 | 4.3 | 14 | 19 | 19 | 20 | 20 | 3.5 | 0.5 | 2.3 | 6.7 | 4.8 |
| n.a. | 13.4 | 3.5 | 9.6 | - | 2.2 | 8.1 | 8.6 | 26 | 40 | 52 | 67 | 84 | 19.4 | 4.9 | 13.8 | 18 | 20 |
| n.a. | 11.9 | 2.9 | 8.5 | - | 1.1 | 3.3 | 3.3 | 6.0 | 8.2 | 9.8 | 13 | 16 | 12.6 | 5.0 | 9.7 | 3.5 | 3.8 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 3.7 | -1.6 | 1.3 | -0.5 | 1.6 | 1.2 | 0.4 | 0.3 | 0.9 | 1.1 | 1.3 | 1.4 | 1.4 | -0.4 | 0.8 | 0.1 | 0.5 | 0.3 |
| n.a. | n.a. | 4.0 | n.a. | - | - | 1.0 | 1.1 | - | 2.4 | 4.8 | 9.5 | 14 | n.a. | 11.4 | n.a. | 1.7 | 3.4 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.5 | 3.7 | 1.7 | 3.0 | 187 | 186 | 186 | 182 | 168 | 1.2 | -1.0 | 0.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.3 | 5.6 | 3.5 | 4.8 | 646 | 853 | 1 087 | 1 324 | 1 535 | 5.6 | 3.5 | 4.8 |
| 1.8 | 0.7 | 0.4 | 0.6 | 121 | 126 | 130 | 132 | 134 | 0.7 | 0.4 | 0.6 |
| 2.4 | 4.9 | 3.1 | 4.2 | 5.3 | 6.8 | 8.4 | 10.0 | 11 | 4.9 | 3.1 | 4.2 |
| 0.9 | 2.5 | 1.5 | 2.1 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 2.0 | 0.7 | 1.5 |
| -1.4 | -2.2 | -1.6 | -2.0 | 126 | 113 | 97 | 84 | 76 | -2.7 | -2.4 | -2.6 |
| 0.2 | -1.8 | -1.7 | -1.7 | 290 | 218 | 171 | 138 | 109 | -4.2 | -4.4 | -4.3 |
| 1.7 | 0.5 | -0.1 | 0.3 | 2.3 | 1.9 | 1.8 | 1.6 | 1.4 | -1.5 | -2.0 | -1.7 |

## Table A35 | Thailand

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 42 | 73 | 118 | 133 | 139 | 146 | 155 | 163 | 170 |
| Coal | 3.8 | 7.7 | 16 | 15 | 15 | 15 | 15 | 14 | 14 |
| Oil | 18 | 32 | 45 | 54 | 54 | 55 | 57 | 58 | 59 |
| Natural gas | 5.0 | 17 | 33 | 35 | 41 | 44 | 45 | 47 | 49 |
| Nuclear | - | - | - | - | - | - | 1.8 | 3.7 | 6.2 |
| Hydro | 0.4 | 0.5 | 0.5 | 0.6 | 1.0 | 1.1 | 1.1 | 1.2 | 1.2 |
| Geothermal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Solar, wind, etc. | - | - | 0.0 | 0.8 | 2.0 | 3.0 | 3.9 | 4.9 | 5.9 |
| Biomass and waste | 15 | 15 | 23 | 25 | 23 | 26 | 28 | 31 | 33 |
| Hydrogen | - | - | - | - | -0.0 | -0.0 | 0.0 | -0.0 | -0.1 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 29 | 51 | 85 | 99 | 101 | 106 | 112 | 116 | 120 |
| Coal | 1.3 | 3.6 | 9.2 | 7.1 | 6.9 | 6.9 | 6.9 | 6.7 | 6.5 |
| Oil | 15 | 29 | 43 | 55 | 55 | 56 | 58 | 59 | 60 |
| Natural gas | 0.1 | 1.1 | 4.6 | 7.2 | 7.5 | 8.0 | 8.5 | 8.9 | 9.2 |
| Electricity | 3.3 | 7.6 | 13 | 18 | 20 | 22 | 24 | 27 | 29 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Renewables and waste | 9.3 | 9.4 | 15 | 12 | 12 | 13 | 14 | 15 | 15 |
| Industry | 8.7 | 17 | 27 | 30 | 33 | 36 | 38 | 40 | 42 |
| Transport | 9.2 | 15 | 19 | 29 | 28 | 28 | 28 | 28 | 28 |
| Buildings, etc. | 11 | 14 | 20 | 17 | 17 | 17 | 17 | 18 | 18 |
| Non-energy use | 0.4 | 5.8 | 18 | 23 | 24 | 26 | 28 | 30 | 32 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 44 | 96 | 159 | 196 | 229 | 257 | 285 | 315 | 347 |
| Coal | 11 | 18 | 30 | 29 | 31 | 32 | 33 | 33 | 34 |
| Oil | 10 | 10.0 | 1.1 | 3.2 | - | - | - | - | - |
| Natural gas | 18 | 62 | 119 | 126 | 144 | 154 | 159 | 166 | 172 |
| Nuclear | - | - | - | - | - | - | 7.0 | 14 | 24 |
| Hydro | 5.0 | 6.0 | 5.6 | 6.8 | 11 | 12 | 13 | 14 | 14 |
| Geothermal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Solar photovoltaics | - | - | 0.0 | 5.3 | 15 | 26 | 36 | 46 | 56 |
| Wind | - | - | - | 3.5 | 7.8 | 8.9 | 9.9 | 11 | 12 |
| Concentrated solar power and marine | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Biomass and waste | - | 0.5 | 3.8 | 23 | 20 | 23 | 26 | 30 | 33 |
| Hydrogen | - | - | - | - | - | 0.4 | 0.9 | 1.1 | 1.3 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 79 | 148 | 219 | 239 | 249 | 254 | 256 | 258 | 257 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 144 | 221 | 347 | 459 | 531 | 625 | 738 | 862 | 995 |
| Population (million) | 55 | 63 | 69 | 72 | 71 | 71 | 70 | 68 | 66 |
| GDP per capita ($2015 thousand) | 2.6 | 3.5 | 5.1 | 6.4 | 7.5 | 8.9 | 11 | 13 | 15 |
| Primary energy consumption per capita (toe/person) | 0.8 | 1.2 | 1.7 | 1.9 | 1.9 | 2.1 | 2.2 | 2.4 | 2.6 |
| Primary energy consumption per GDP (toe/$2015 million) | 294 | 328 | 340 | 289 | 261 | 234 | 210 | 189 | 171 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 547 | 670 | 632 | 520 | 469 | 406 | 347 | 299 | 258 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.9 | 2.0 | 1.9 | 1.8 | 1.8 | 1.7 | 1.7 | 1.6 | 1.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 3.5 | 0.9 | 1.0 | 0.9 | 100 | 100 | 100 | 100 | 135 | 137 | 139 | 140 | 142 | 0.3 | 0.3 | 0.3 | 100 | 100 |
| 4.3 | -0.1 | -0.5 | -0.3 | 9.0 | 11 | 9.5 | 8.3 | 14 | 13 | 11 | 10.0 | 8.9 | -1.7 | -2.2 | -1.9 | 8.1 | 6.3 |
| 3.3 | 0.3 | 0.4 | 0.3 | 43 | 40 | 37 | 35 | 52 | 49 | 46 | 43 | 40 | -0.8 | -1.5 | -1.1 | 33 | 28 |
| 6.1 | 1.5 | 0.7 | 1.2 | 12 | 26 | 29 | 29 | 39 | 39 | 38 | 38 | 38 | 0.5 | 0.0 | 0.3 | 28 | 27 |
| n.a. | n.a. | 13.0 | n.a. | - | - | 1.2 | 3.6 | - | 1.8 | 3.9 | 6.4 | 9.0 | n.a. | 8.8 | n.a. | 2.8 | 6.3 |
| 0.9 | 4.0 | 0.9 | 2.8 | 1.0 | 0.4 | 0.7 | 0.7 | 1.0 | 1.2 | 1.3 | 1.4 | 1.4 | 4.7 | 1.1 | 3.3 | 0.9 | 1.0 |
| 0.0 | 4.2 | 0.0 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 2.6 | 0.0 | 0.0 |
| n.a. | 10.1 | 4.1 | 7.8 | - | 0.6 | 2.5 | 3.5 | 2.6 | 4.2 | 6.1 | 8.2 | 11 | 12.9 | 5.7 | 10.2 | 4.4 | 7.4 |
| 1.6 | 0.7 | 1.4 | 1.0 | 35 | 19 | 18 | 19 | 23 | 27 | 29 | 30 | 32 | 0.8 | 1.1 | 0.9 | 21 | 22 |
| n.a. | n.a. | n.a. | n.a. | - | - | 0.0 | -0.0 | 0.1 | 0.1 | -0.0 | -0.1 | -0.4 | n.a. | 40.4 | n.a. | -0.0 | -0.3 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.8 | 0.7 | 0.7 | 0.7 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 99 | 98 | 0.1 | -0.2 | 0.0 | 100 | 100 |
| 5.2 | -0.2 | -0.5 | -0.3 | 4.6 | 7.2 | 6.1 | 5.4 | 7.2 | 6.8 | 6.3 | 5.9 | 5.6 | -0.7 | -1.1 | -0.9 | 6.3 | 5.7 |
| 4.0 | 0.3 | 0.3 | 0.3 | 52 | 56 | 52 | 50 | 53 | 50 | 48 | 45 | 43 | -0.8 | -1.2 | -1.0 | 48 | 44 |
| 12.7 | 1.0 | 0.9 | 0.9 | 0.5 | 7.3 | 7.6 | 7.7 | 7.3 | 7.3 | 7.2 | 7.0 | 6.9 | 0.0 | -0.5 | -0.2 | 7.2 | 7.0 |
| 5.2 | 2.0 | 1.8 | 1.9 | 11 | 18 | 22 | 24 | 20 | 22 | 25 | 27 | 29 | 2.0 | 1.7 | 1.9 | 25 | 30 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 0.7 | 1.1 | 0.9 | 1.0 | 32 | 12 | 12 | 13 | 12 | 14 | 14 | 13 | 13 | 1.0 | -0.2 | 0.5 | 14 | 14 |
| 3.8 | 1.4 | 0.9 | 1.2 | 30 | 30 | 34 | 35 | 32 | 33 | 33 | 32 | 31 | 0.5 | -0.4 | 0.2 | 33 | 32 |
| 3.5 | -0.2 | 0.1 | -0.1 | 32 | 29 | 25 | 23 | 27 | 25 | 24 | 21 | 20 | -1.2 | -1.9 | -1.5 | 24 | 20 |
| 1.4 | 0.1 | 0.5 | 0.2 | 37 | 17 | 16 | 15 | 16 | 16 | 16 | 15 | 15 | -0.5 | -0.6 | -0.5 | 16 | 15 |
| 12.8 | 1.2 | 1.3 | 1.3 | 1.5 | 23 | 25 | 27 | 24 | 26 | 28 | 30 | 32 | 1.2 | 1.3 | 1.3 | 28 | 33 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.6 | 2.2 | 2.0 | 2.1 | 100 | 100 | 100 | 100 | 229 | 257 | 288 | 327 | 373 | 2.3 | 2.6 | 2.4 | 100 | 100 |
| 2.9 | 0.8 | 0.3 | 0.6 | 25 | 15 | 12 | 9.7 | 26 | 22 | 18 | 15 | 12 | -2.9 | -3.8 | -3.2 | 6.1 | 3.2 |
| -3.5 | -100 | n.a. | -100 | 23 | 1.7 | - | - | - | - | - | - | - | -100 | n.a. | -100 | - | - |
| 6.1 | 1.4 | 0.7 | 1.2 | 40 | 64 | 56 | 50 | 140 | 141 | 141 | 143 | 148 | 0.7 | 0.5 | 0.6 | 49 | 40 |
| n.a. | n.a. | 13.0 | n.a. | - | - | 2.5 | 6.9 | - | 7.0 | 15 | 25 | 34 | n.a. | 8.8 | n.a. | 5.1 | 9.2 |
| 0.9 | 4.0 | 0.9 | 2.8 | 11 | 3.4 | 4.6 | 4.2 | 12 | 14 | 15 | 16 | 16 | 4.7 | 1.0 | 3.3 | 5.1 | 4.4 |
| 0.0 | 4.2 | 0.0 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 2.6 | 0.0 | 0.0 |
| n.a. | 11.8 | 4.7 | 9.1 | - | 2.7 | 13 | 16 | 22 | 39 | 59 | 81 | 106 | 15.2 | 6.0 | 11.7 | 20 | 28 |
| n.a. | 6.2 | 2.0 | 4.6 | - | 1.8 | 3.5 | 3.5 | 7.9 | 9.3 | 11 | 13 | 16 | 6.9 | 3.6 | 5.7 | 3.8 | 4.2 |
| n.a. | n.a. | 0.0 | n.a. | - | - | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.7 | n.a. | 9.6 | n.a. | 0.1 | 0.2 |
| n.a. | 0.9 | 2.4 | 1.4 | - | 12 | 9.2 | 9.6 | 21 | 25 | 29 | 33 | 37 | 1.4 | 2.7 | 1.9 | 9.9 | 10 |
| n.a. | n.a. | 3.9 | n.a. | - | - | 0.3 | 0.4 | - | 0.6 | 1.2 | 1.8 | 2.5 | n.a. | 8.1 | n.a. | 0.4 | 0.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 3.4 | 0.4 | 0.0 | 0.3 | 236 | 214 | 194 | 172 | 152 | -1.2 | -2.4 | -1.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 3.6 | 2.8 | 3.0 | 2.9 | 531 | 625 | 738 | 862 | 995 | 2.8 | 3.0 | 2.9 |
| 0.8 | -0.2 | -0.5 | -0.3 | 71 | 71 | 70 | 68 | 66 | -0.2 | -0.5 | -0.3 |
| 2.7 | 3.0 | 3.5 | 3.2 | 7.5 | 8.9 | 11 | 13 | 15 | 3.0 | 3.5 | 3.2 |
| 2.7 | 1.1 | 1.4 | 1.2 | 1.9 | 1.9 | 2.0 | 2.1 | 2.1 | 0.4 | 0.7 | 0.5 |
| -0.1 | -1.9 | -2.0 | -1.9 | 254 | 220 | 188 | 163 | 143 | -2.5 | -2.7 | -2.6 |
| -0.2 | -2.4 | -2.9 | -2.6 | 444 | 343 | 263 | 199 | 152 | -3.9 | -5.3 | -4.4 |
| -0.1 | -0.5 | -0.9 | -0.7 | 1.7 | 1.6 | 1.4 | 1.2 | 1.1 | -1.5 | -2.7 | -1.9 |

## Table A36 | Viet Nam

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 18 | 29 | 59 | 102 | 134 | 158 | 184 | 214 | 245 |
| Coal | 2.2 | 4.4 | 15 | 51 | 63 | 71 | 80 | 92 | 103 |
| Oil | 2.7 | 7.8 | 18 | 25 | 31 | 35 | 40 | 45 | 51 |
| Natural gas | 0.0 | 1.1 | 8.1 | 6.5 | 15 | 21 | 28 | 36 | 45 |
| Nuclear | - | - | - | - | - | 2.2 | 4.2 | 6.4 | 8.6 |
| Hydro | 0.5 | 1.3 | 2.4 | 6.9 | 7.7 | 8.1 | 8.4 | 8.6 | 8.8 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar, wind, etc. | - | - | 0.0 | 3.3 | 7.2 | 9.1 | 11 | 12 | 14 |
| Biomass and waste | 12 | 14 | 15 | 9.3 | 9.8 | 11 | 12 | 13 | 14 |
| Hydrogen | - | - | - | - | -0.0 | 0.1 | 0.3 | 0.3 | 0.3 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 16 | 25 | 48 | 69 | 87 | 101 | 116 | 132 | 149 |
| Coal | 1.3 | 3.2 | 9.8 | 16 | 20 | 21 | 23 | 24 | 25 |
| Oil | 2.3 | 6.5 | 17 | 23 | 29 | 33 | 37 | 42 | 47 |
| Natural gas | - | 0.0 | 0.5 | 2.0 | 3.2 | 4.0 | 5.0 | 6.0 | 7.0 |
| Electricity | 0.5 | 1.9 | 7.5 | 21 | 29 | 35 | 43 | 51 | 59 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Renewables and waste | 12 | 13 | 14 | 6.9 | 6.9 | 7.7 | 8.6 | 9.4 | 10 |
| Industry | 4.5 | 7.9 | 17 | 34 | 44 | 51 | 58 | 66 | 73 |
| Transport | 1.4 | 3.5 | 10 | 15 | 20 | 23 | 26 | 30 | 34 |
| Buildings, etc. | 10 | 13 | 18 | 17 | 20 | 23 | 26 | 30 | 34 |
| Non-energy use | 0.0 | 0.1 | 2.3 | 2.7 | 3.5 | 4.3 | 5.3 | 6.4 | 7.7 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 8.7 | 27 | 95 | 274 | 376 | 461 | 552 | 656 | 769 |
| Coal | 2.0 | 3.1 | 20 | 123 | 131 | 150 | 171 | 205 | 243 |
| Oil | 1.3 | 4.5 | 3.4 | 3.5 | 0.1 | - | - | - | - |
| Natural gas | 0.0 | 4.4 | 44 | 26 | 68 | 98 | 135 | 174 | 220 |
| Nuclear | - | - | - | - | - | 8.4 | 16 | 25 | 33 |
| Hydro | 5.4 | 15 | 28 | 81 | 89 | 94 | 97 | 100 | 102 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | - | - | - | 27 | 44 | 56 | 66 | 74 | 82 |
| Wind | - | - | 0.1 | 12 | 40 | 50 | 59 | 68 | 77 |
| Concentrated solar power and marine | - | - | - | - | - | - | - | - | - |
| Biomass and waste | - | - | 0.1 | 2.1 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| Hydrogen | - | - | - | - | - | 2.3 | 4.6 | 6.1 | 7.6 |
| Others | - | - | - | - | - | - | - | - | - |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 17 | 42 | 123 | 293 | 379 | 434 | 498 | 576 | 656 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 45 | 94 | 177 | 379 | 545 | 711 | 924 | 1 186 | 1 496 |
| Population (million) | 66 | 77 | 87 | 100 | 104 | 107 | 108 | 110 | 110 |
| GDP per capita ($2015 thousand) | 0.7 | 1.2 | 2.0 | 3.8 | 5.2 | 6.7 | 8.5 | 11 | 14 |
| Primary energy consumption per capita (toe/person) | 0.3 | 0.4 | 0.7 | 1.0 | 1.3 | 1.5 | 1.7 | 1.9 | 2.2 |
| Primary energy consumption per GDP (toe/$2015 million) | 397 | 307 | 330 | 270 | 246 | 222 | 199 | 180 | 164 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 367 | 448 | 693 | 773 | 695 | 611 | 539 | 485 | 439 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 0.9 | 1.5 | 2.1 | 2.9 | 2.8 | 2.8 | 2.7 | 2.7 | 2.7 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 5.4 | 3.5 | 2.9 | 3.3 | 100 | 100 | 100 | 100 | 123 | 137 | 150 | 166 | 185 | 2.3 | 2.1 | 2.2 | 100 | 100 |
| 9.9 | 2.7 | 2.6 | 2.7 | 12 | 50 | 44 | 42 | 54 | 46 | 43 | 45 | 49 | -0.9 | 1.3 | -0.1 | 29 | 27 |
| 7.0 | 2.8 | 2.4 | 2.6 | 15 | 25 | 22 | 21 | 29 | 31 | 32 | 33 | 32 | 1.5 | 0.0 | 0.9 | 22 | 18 |
| 26.2 | 9.0 | 4.8 | 7.4 | 0.0 | 6.3 | 15 | 18 | 13 | 13 | 14 | 15 | 18 | 4.7 | 2.3 | 3.8 | 9.4 | 9.5 |
| n.a. | n.a. | 7.4 | n.a. | - | - | 2.3 | 3.5 | - | 16 | 25 | 33 | 42 | n.a. | 5.4 | n.a. | 17 | 23 |
| 8.6 | 1.1 | 0.5 | 0.9 | 2.6 | 6.8 | 4.5 | 3.6 | 8.8 | 9.8 | 11 | 11 | 12 | 2.6 | 1.3 | 2.1 | 7.1 | 6.6 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 7.1 | 2.4 | 5.4 | - | 3.3 | 5.8 | 5.6 | 8.7 | 12 | 15 | 20 | 26 | 9.4 | 5.2 | 7.8 | 10 | 14 |
| -0.9 | 1.5 | 1.6 | 1.5 | 70 | 9.1 | 6.5 | 5.7 | 9.5 | 9.3 | 9.2 | 9.3 | 9.7 | -0.1 | 0.5 | 0.1 | 6.1 | 5.2 |
| n.a. | n.a. | -0.5 | n.a. | - | - | 0.2 | 0.1 | -0.1 | -0.4 | -0.9 | -2.3 | -4.3 | n.a. | 17.2 | n.a. | -0.6 | -2.3 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.5 | 3.1 | 2.5 | 2.9 | 100 | 100 | 100 | 100 | 85 | 91 | 97 | 103 | 110 | 2.0 | 1.2 | 1.7 | 100 | 100 |
| 7.8 | 2.1 | 0.9 | 1.7 | 8.3 | 23 | 19 | 17 | 19 | 19 | 18 | 17 | 17 | 0.8 | -0.5 | 0.3 | 18 | 16 |
| 7.2 | 2.9 | 2.4 | 2.7 | 15 | 33 | 32 | 32 | 27 | 29 | 30 | 31 | 31 | 1.6 | 0.1 | 1.1 | 31 | 28 |
| n.a. | 5.4 | 3.5 | 4.7 | - | 3.0 | 4.3 | 4.7 | 3.1 | 3.7 | 4.2 | 4.7 | 5.2 | 4.4 | 2.1 | 3.5 | 4.4 | 4.8 |
| 11.8 | 4.2 | 3.3 | 3.9 | 3.3 | 31 | 37 | 40 | 29 | 34 | 39 | 44 | 51 | 3.6 | 2.8 | 3.3 | 40 | 47 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| -1.6 | 1.3 | 1.7 | 1.5 | 74 | 9.9 | 7.4 | 6.8 | 6.5 | 6.1 | 5.8 | 5.6 | 5.7 | -1.0 | -0.1 | -0.7 | 5.9 | 5.2 |
| 6.3 | 3.2 | 2.2 | 2.8 | 28 | 50 | 50 | 49 | 43 | 45 | 46 | 47 | 50 | 1.8 | 0.9 | 1.4 | 48 | 46 |
| 7.5 | 3.2 | 2.6 | 3.0 | 8.7 | 22 | 22 | 23 | 19 | 20 | 22 | 22 | 23 | 2.1 | 0.6 | 1.5 | 22 | 21 |
| 1.6 | 2.7 | 2.6 | 2.7 | 63 | 24 | 23 | 23 | 19 | 22 | 24 | 26 | 29 | 2.1 | 1.8 | 2.0 | 25 | 26 |
| 14.8 | 4.2 | 3.9 | 4.0 | 0.2 | 3.9 | 4.6 | 5.2 | 3.5 | 4.3 | 5.3 | 6.4 | 7.7 | 4.2 | 3.9 | 4.0 | 5.5 | 7.1 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 11.0 | 4.2 | 3.4 | 3.9 | 100 | 100 | 100 | 100 | 374 | 449 | 527 | 635 | 768 | 3.9 | 3.8 | 3.9 | 100 | 100 |
| 13.3 | 2.0 | 3.6 | 2.6 | 23 | 45 | 31 | 32 | 104 | 69 | 54 | 55 | 63 | -4.7 | 1.5 | -2.4 | 10 | 8.2 |
| 3.1 | -100 | n.a. | -100 | 15 | 1.3 | - | - | 0.1 | - | - | - | - | -100 | n.a. | -100 | - | - |
| 28.9 | 10.1 | 5.0 | 8.2 | 0.1 | 9.6 | 24 | 29 | 64 | 60 | 67 | 72 | 88 | 5.6 | 2.8 | 4.6 | 13 | 11 |
| n.a. | n.a. | 7.4 | n.a. | - | - | 2.9 | 4.3 | - | 62 | 95 | 127 | 160 | n.a. | 5.4 | n.a. | 18 | 21 |
| 8.6 | 1.1 | 0.5 | 0.9 | 62 | 29 | 18 | 13 | 102 | 114 | 124 | 133 | 141 | 2.6 | 1.3 | 2.1 | 24 | 18 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 5.3 | 2.2 | 4.2 | - | 9.9 | 12 | 11 | 57 | 79 | 103 | 135 | 172 | 8.1 | 5.3 | 7.1 | 20 | 22 |
| n.a. | 10.1 | 2.7 | 7.3 | - | 4.2 | 11 | 10 | 44 | 59 | 75 | 99 | 125 | 11.7 | 5.1 | 9.2 | 14 | 16 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 3.9 | 2.4 | 3.3 | - | 0.8 | 0.7 | 0.6 | 3.3 | 3.7 | 4.1 | 4.8 | 5.4 | 4.1 | 2.8 | 3.6 | 0.8 | 0.7 |
| n.a. | n.a. | 5.1 | n.a. | - | - | 0.8 | 1.0 | - | 2.5 | 5.0 | 9.1 | 13 | n.a. | 10.2 | n.a. | 0.9 | 1.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 9.1 | 3.2 | 2.8 | 3.0 | 330 | 287 | 271 | 264 | 261 | -0.4 | -0.4 | -0.4 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 6.7 | 5.4 | 4.9 | 5.2 | 545 | 711 | 924 | 1 186 | 1 496 | 5.4 | 4.9 | 5.2 |
| 1.3 | 0.5 | 0.1 | 0.3 | 104 | 107 | 108 | 110 | 110 | 0.5 | 0.1 | 0.3 |
| 5.3 | 4.9 | 4.8 | 4.9 | 5.2 | 6.7 | 8.5 | 11 | 14 | 4.9 | 4.8 | 4.9 |
| 4.1 | 3.1 | 2.7 | 2.9 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 1.8 | 2.0 | 1.9 |
| -1.2 | -1.8 | -1.9 | -1.8 | 226 | 193 | 162 | 140 | 124 | -3.0 | -2.7 | -2.8 |
| 2.3 | -2.1 | -2.0 | -2.1 | 605 | 403 | 293 | 223 | 174 | -5.5 | -5.1 | -5.4 |
| 3.5 | -0.3 | -0.1 | -0.2 | 2.7 | 2.1 | 1.8 | 1.6 | 1.4 | -2.7 | -2.5 | -2.6 |

## Table A37 | North America

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 2 126 | 2 525 | 2 476 | 2 437 | 2 329 | 2 292 | 2 240 | 2 191 | 2 158 |
| Coal | 484 | 565 | 525 | 210 | 115 | 88 | 74 | 63 | 52 |
| Oil | 833 | 958 | 901 | 858 | 764 | 719 | 668 | 613 | 558 |
| Natural gas | 493 | 622 | 635 | 885 | 896 | 895 | 883 | 870 | 867 |
| Nuclear | 179 | 227 | 242 | 234 | 236 | 234 | 223 | 215 | 211 |
| Hydro | 49 | 53 | 53 | 52 | 61 | 62 | 63 | 63 | 64 |
| Geothermal | 14 | 13 | 8.4 | 9.7 | 12 | 14 | 15 | 16 | 16 |
| Solar, wind, etc. | 0.3 | 2.1 | 11 | 63 | 121 | 159 | 196 | 234 | 274 |
| Biomass and waste | 73 | 86 | 101 | 126 | 125 | 122 | 121 | 119 | 117 |
| Hydrogen | - | - | - | - | -0.2 | -0.5 | -0.7 | -0.5 | -0.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 452 | 1 728 | 1 699 | 1 757 | 1 723 | 1 700 | 1 662 | 1 623 | 1 590 |
| Coal | 59 | 36 | 30 | 14 | 13 | 13 | 12 | 11 | 11 |
| Oil | 749 | 870 | 851 | 823 | 754 | 713 | 667 | 617 | 567 |
| Natural gas | 346 | 413 | 364 | 423 | 433 | 426 | 409 | 388 | 369 |
| Electricity | 262 | 338 | 367 | 380 | 411 | 442 | 471 | 506 | 546 |
| Heat | 2.8 | 6.1 | 7.1 | 6.1 | 6.0 | 6.0 | 5.8 | 5.5 | 5.2 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.5 | 1.8 | 3.6 |
| Renewables and waste | 33 | 64 | 80 | 110 | 105 | 100 | 97 | 93 | 89 |
| Industry | 331 | 386 | 312 | 324 | 328 | 329 | 326 | 320 | 314 |
| Transport | 531 | 640 | 655 | 679 | 622 | 584 | 548 | 509 | 473 |
| Buildings, etc. | 456 | 528 | 572 | 573 | 585 | 594 | 592 | 593 | 599 |
| Non-energy use | 134 | 173 | 160 | 181 | 187 | 192 | 197 | 201 | 204 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 3 686 | 4 632 | 4 958 | 5 063 | 5 460 | 5 881 | 6 285 | 6 781 | 7 331 |
| Coal | 1 782 | 2 247 | 2 074 | 766 | 376 | 267 | 213 | 169 | 125 |
| Oil | 147 | 133 | 56 | 38 | 28 | 25 | 23 | 21 | 19 |
| Natural gas | 391 | 668 | 1 070 | 1 962 | 1 952 | 2 003 | 2 031 | 2 116 | 2 228 |
| Nuclear | 685 | 871 | 930 | 897 | 904 | 899 | 856 | 824 | 811 |
| Hydro | 570 | 612 | 614 | 607 | 711 | 721 | 730 | 738 | 746 |
| Geothermal | 16 | 15 | 18 | 20 | 25 | 29 | 30 | 32 | 33 |
| Solar photovoltaics | 0.0 | 0.2 | 3.3 | 222 | 682 | 971 | 1 267 | 1 577 | 1 891 |
| Wind | 3.1 | 5.9 | 104 | 466 | 670 | 819 | 951 | 1 091 | 1 232 |
| Concentrated solar power and marine | 0.7 | 0.6 | 0.9 | 3.1 | 3.0 | 3.1 | 3.1 | 3.1 | 3.2 |
| Biomass and waste | 91 | 81 | 82 | 72 | 90 | 100 | 109 | 118 | 127 |
| Hydrogen | - | - | - | - | 7.8 | 33 | 59 | 82 | 105 |
| Others | - | - | 6.8 | 11 | 11 | 11 | 11 | 11 | 11 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 5 117 | 6 075 | 5 690 | 4 938 | 4 264 | 4 012 | 3 770 | 3 528 | 3 310 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 10 663 | 14 881 | 17 739 | 23 868 | 27 532 | 30 218 | 33 051 | 35 972 | 38 929 |
| Population (million) | 277 | 313 | 343 | 377 | 391 | 400 | 408 | 415 | 420 |
| GDP per capita ($2015 thousand) | 38 | 48 | 52 | 63 | 70 | 76 | 81 | 87 | 93 |
| Primary energy consumption per capita (toe/person) | 7.7 | 8.1 | 7.2 | 6.5 | 6.0 | 5.7 | 5.5 | 5.3 | 5.1 |
| Primary energy consumption per GDP (toe/$2015 million) | 199 | 170 | 140 | 102 | 85 | 76 | 68 | 61 | 55 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 480 | 408 | 321 | 207 | 155 | 133 | 114 | 98 | 85 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.4 | 2.3 | 2.0 | 1.8 | 1.8 | 1.7 | 1.6 | 1.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 0.4 | -0.5 | -0.4 | -0.4 | 100 | 100 | 100 | 100 | 2 271 | 2 157 | 2 021 | 1 926 | 1 853 | -1.1 | -0.9 | -1.0 | 100 | 100 |
| -2.5 | -6.0 | -3.4 | -5.0 | 23 | 8.6 | 3.3 | 2.4 | 82 | 36 | 25 | 25 | 24 | -11.7 | -0.8 | -7.8 | 1.3 | 1.3 |
| 0.1 | -1.5 | -1.8 | -1.6 | 39 | 35 | 30 | 26 | 725 | 613 | 485 | 353 | 250 | -3.3 | -6.4 | -4.5 | 24 | 13 |
| 1.8 | 0.0 | -0.2 | -0.1 | 23 | 36 | 39 | 40 | 896 | 886 | 818 | 745 | 649 | -0.5 | -2.3 | -1.1 | 40 | 35 |
| 0.8 | -0.3 | -0.5 | -0.4 | 8.4 | 9.6 | 10.0 | 9.8 | 236 | 238 | 245 | 259 | 273 | 0.3 | 1.1 | 0.6 | 12 | 15 |
| 0.2 | 1.1 | 0.2 | 0.8 | 2.3 | 2.1 | 2.8 | 3.0 | 62 | 62 | 63 | 64 | 64 | 1.1 | 0.2 | 0.8 | 3.1 | 3.5 |
| -1.1 | 2.6 | 0.7 | 1.9 | 0.7 | 0.4 | 0.7 | 0.7 | 12 | 15 | 16 | 17 | 17 | 3.1 | 0.8 | 2.2 | 0.8 | 0.9 |
| 17.3 | 6.9 | 3.4 | 5.6 | 0.0 | 2.6 | 8.7 | 13 | 127 | 184 | 244 | 332 | 428 | 8.3 | 5.8 | 7.3 | 12 | 23 |
| 1.6 | -0.2 | -0.4 | -0.3 | 3.5 | 5.2 | 5.4 | 5.4 | 133 | 134 | 139 | 144 | 148 | 0.6 | 0.6 | 0.6 | 6.9 | 8.0 |
| n.a. | n.a. | -26.0 | n.a. | - | - | -0.0 | -0.0 | -2.9 | -11 | -14 | -11 | 1.1 | n.a. | n.a. | n.a. | -0.7 | 0.1 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.6 | -0.3 | -0.4 | -0.4 | 100 | 100 | 100 | 100 | 1 676 | 1 566 | 1 431 | 1 323 | 1 250 | -1.2 | -1.3 | -1.3 | 100 | 100 |
| -4.2 | -1.0 | -1.1 | -1.0 | 4.1 | 0.8 | 0.7 | 0.7 | 12 | 9.4 | 7.9 | 6.9 | 6.2 | -3.4 | -2.4 | -3.0 | 0.6 | 0.5 |
| 0.3 | -1.2 | -1.6 | -1.4 | 52 | 47 | 40 | 36 | 720 | 621 | 504 | 395 | 305 | -2.8 | -4.9 | -3.6 | 35 | 24 |
| 0.6 | -0.2 | -1.0 | -0.5 | 24 | 24 | 25 | 23 | 408 | 358 | 296 | 235 | 179 | -2.1 | -4.9 | -3.1 | 21 | 14 |
| 1.1 | 1.3 | 1.5 | 1.3 | 18 | 22 | 28 | 34 | 419 | 456 | 488 | 529 | 557 | 1.5 | 1.3 | 1.4 | 34 | 45 |
| 2.4 | -0.3 | -1.0 | -0.6 | 0.2 | 0.3 | 0.3 | 0.3 | 5.6 | 5.2 | 4.7 | 4.1 | 3.6 | -1.5 | -2.4 | -1.9 | 0.3 | 0.3 |
| n.a. | n.a. | 21.2 | n.a. | - | - | 0.0 | 0.2 | 0.1 | 8.2 | 20 | 40 | 84 | n.a. | 15.2 | n.a. | 1.4 | 6.7 |
| 3.7 | -0.7 | -0.8 | -0.8 | 2.3 | 6.2 | 5.8 | 5.6 | 112 | 108 | 109 | 113 | 115 | 0.0 | 0.5 | 0.2 | 7.6 | 9.2 |
| -0.1 | 0.0 | -0.4 | -0.1 | 23 | 18 | 20 | 20 | 316 | 293 | 262 | 234 | 213 | -1.2 | -2.1 | -1.6 | 18 | 17 |
| 0.7 | -1.3 | -1.5 | -1.3 | 37 | 39 | 33 | 30 | 598 | 519 | 440 | 374 | 335 | -2.5 | -2.7 | -2.6 | 31 | 27 |
| 0.7 | 0.2 | 0.1 | 0.2 | 31 | 33 | 36 | 38 | 575 | 562 | 532 | 514 | 498 | -0.4 | -0.7 | -0.5 | 37 | 40 |
| 0.9 | 0.5 | 0.4 | 0.4 | 9.2 | 10 | 12 | 13 | 187 | 192 | 197 | 201 | 204 | 0.5 | 0.4 | 0.4 | 14 | 16 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 1.0 | 1.3 | 1.6 | 1.4 | 100 | 100 | 100 | 100 | 5 582 | 6 269 | 6 911 | 7 875 | 8 756 | 1.8 | 2.4 | 2.0 | 100 | 100 |
| -2.5 | -7.2 | -5.2 | -6.5 | 48 | 15 | 3.4 | 1.7 | 241 | 50 | 11 | 12 | 12 | -22.1 | 0.6 | -14.4 | 0.2 | 0.1 |
| -4.0 | -2.8 | -2.0 | -2.5 | 4.0 | 0.7 | 0.4 | 0.3 | 29 | 25 | 27 | 22 | 16 | -2.0 | -5.0 | -3.1 | 0.4 | 0.2 |
| 5.0 | 0.2 | 0.9 | 0.5 | 11 | 39 | 32 | 30 | 2 118 | 2 267 | 2 150 | 1 988 | 1 653 | 0.5 | -2.6 | -0.6 | 31 | 19 |
| 0.8 | -0.3 | -0.5 | -0.4 | 19 | 18 | 14 | 11 | 906 | 912 | 940 | 995 | 1 047 | 0.3 | 1.1 | 0.6 | 14 | 12 |
| 0.2 | 1.1 | 0.2 | 0.8 | 15 | 12 | 12 | 10 | 716 | 726 | 735 | 743 | 750 | 1.1 | 0.2 | 0.8 | 11 | 8.6 |
| 0.6 | 2.7 | 0.7 | 1.9 | 0.4 | 0.4 | 0.5 | 0.4 | 25 | 31 | 33 | 34 | 36 | 3.1 | 0.8 | 2.3 | 0.5 | 0.4 |
| 40.5 | 10.8 | 4.1 | 8.3 | 0.0 | 4.4 | 20 | 26 | 744 | 1 162 | 1 589 | 2 191 | 2 815 | 12.3 | 5.9 | 9.9 | 23 | 32 |
| 16.4 | 4.3 | 2.6 | 3.7 | 0.1 | 9.2 | 15 | 17 | 685 | 919 | 1 192 | 1 611 | 2 103 | 5.7 | 5.8 | 5.7 | 17 | 24 |
| 4.7 | 0.0 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 3.2 | 3.4 | 3.6 | 3.9 | 4.1 | 0.9 | 1.5 | 1.1 | 0.1 | 0.0 |
| -0.7 | 2.5 | 1.5 | 2.1 | 2.5 | 1.4 | 1.7 | 1.7 | 96 | 113 | 130 | 140 | 150 | 3.5 | 1.4 | 2.7 | 1.9 | 1.7 |
| n.a. | n.a. | 6.0 | n.a. | - | - | 0.9 | 1.4 | 8.2 | 48 | 87 | 123 | 160 | n.a. | 6.3 | n.a. | 1.3 | 1.8 |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.2 | 0.2 | 0.2 | 11 | 11 | 11 | 11 | 11 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.1 | -1.6 | -1.3 | -1.5 | 4 012 | 3 170 | 2 340 | 1 432 | 692 | -4.3 | -11.5 | -7.0 |
| n.a. | n.a. | n.a. | n.a. | - | - | 25 | 132 | 263 | n.a. | 26.5 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.5 | 1.9 | 1.7 | 1.8 | 27 532 | 30 218 | 33 051 | 35 972 | 38 929 | 1.9 | 1.7 | 1.8 |
| 0.9 | 0.5 | 0.3 | 0.4 | 391 | 400 | 408 | 415 | 420 | 0.5 | 0.3 | 0.4 |
| 1.5 | 1.5 | 1.4 | 1.4 | 70 | 76 | 81 | 87 | 93 | 1.5 | 1.4 | 1.4 |
| -0.5 | -1.0 | -0.7 | -0.8 | 5.8 | 5.4 | 5.0 | 4.6 | 4.4 | -1.6 | -1.2 | -1.4 |
| -2.0 | -2.4 | -2.0 | -2.2 | 82 | 71 | 61 | 54 | 48 | -3.0 | -2.5 | -2.8 |
| -2.5 | -3.4 | -2.9 | -3.2 | 146 | 105 | 71 | 40 | 18 | -6.1 | -12.9 | -8.7 |
| -0.5 | -1.1 | -0.9 | -1.0 | 1.8 | 1.5 | 1.2 | 0.7 | 0.4 | -3.2 | -10.7 | -6.1 |

## Table A38 | United States

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 1 914 | 2 273 | 2 216 | 2 143 | 2 046 | 2 012 | 1 965 | 1 925 | 1 900 |
| Coal | 460 | 533 | 501 | 202 | 111 | 84 | 70 | 60 | 49 |
| Oil | 757 | 871 | 807 | 762 | 682 | 641 | 596 | 546 | 497 |
| Natural gas | 438 | 548 | 556 | 765 | 775 | 772 | 755 | 744 | 742 |
| Nuclear | 159 | 208 | 219 | 211 | 214 | 214 | 209 | 204 | 204 |
| Hydro | 23 | 22 | 23 | 21 | 26 | 27 | 27 | 27 | 28 |
| Geothermal | 14 | 13 | 8.4 | 9.7 | 12 | 14 | 15 | 15 | 16 |
| Solar, wind, etc. | 0.3 | 2.1 | 11 | 59 | 113 | 149 | 185 | 222 | 260 |
| Biomass and waste | 62 | 73 | 89 | 112 | 111 | 109 | 108 | 106 | 105 |
| Hydrogen | - | - | - | - | -0.2 | -0.3 | -0.3 | -0.2 | -0.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 294 | 1 546 | 1 513 | 1 561 | 1 533 | 1 514 | 1 482 | 1 449 | 1 421 |
| Coal | 56 | 33 | 27 | 12 | 12 | 11 | 10 | 9.8 | 9.4 |
| Oil | 683 | 793 | 762 | 737 | 676 | 639 | 597 | 552 | 506 |
| Natural gas | 303 | 360 | 322 | 372 | 383 | 378 | 364 | 346 | 330 |
| Electricity | 226 | 301 | 326 | 335 | 362 | 391 | 417 | 450 | 487 |
| Heat | 2.2 | 5.3 | 6.6 | 5.4 | 5.4 | 5.4 | 5.2 | 5.0 | 4.7 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.5 | 1.6 | 3.2 |
| Renewables and waste | 23 | 54 | 70 | 100 | 94 | 90 | 88 | 84 | 81 |
| Industry | 284 | 332 | 270 | 279 | 282 | 282 | 279 | 274 | 270 |
| Transport | 488 | 588 | 596 | 619 | 569 | 535 | 502 | 467 | 434 |
| Buildings, etc. | 403 | 473 | 511 | 507 | 519 | 530 | 530 | 532 | 539 |
| Non-energy use | 119 | 153 | 135 | 157 | 163 | 167 | 171 | 175 | 179 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 3 203 | 4 026 | 4 354 | 4 430 | 4 789 | 5 172 | 5 534 | 5 986 | 6 496 |
| Coal | 1 700 | 2 129 | 1 994 | 742 | 373 | 266 | 212 | 168 | 124 |
| Oil | 131 | 118 | 48 | 33 | 26 | 23 | 20 | 18 | 17 |
| Natural gas | 382 | 634 | 1 018 | 1 865 | 1 872 | 1 903 | 1 892 | 1 951 | 2 037 |
| Nuclear | 612 | 798 | 839 | 808 | 822 | 822 | 802 | 782 | 782 |
| Hydro | 273 | 253 | 262 | 247 | 308 | 312 | 316 | 320 | 324 |
| Geothermal | 16 | 15 | 18 | 20 | 24 | 29 | 30 | 31 | 32 |
| Solar photovoltaics | 0.0 | 0.2 | 3.1 | 214 | 665 | 949 | 1 241 | 1 545 | 1 855 |
| Wind | 3.1 | 5.7 | 95 | 426 | 596 | 734 | 853 | 978 | 1 105 |
| Concentrated solar power and marine | 0.7 | 0.5 | 0.9 | 3.1 | 3.0 | 3.0 | 3.1 | 3.1 | 3.1 |
| Biomass and waste | 86 | 72 | 73 | 61 | 80 | 88 | 97 | 105 | 112 |
| Hydrogen | - | - | - | - | 7.8 | 32 | 57 | 76 | 94 |
| Others | - | - | 3.7 | 11 | 11 | 11 | 11 | 11 | 11 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 4 729 | 5 599 | 5 193 | 4 426 | 3 815 | 3 575 | 3 338 | 3 114 | 2 914 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 9 785 | 13 718 | 16 339 | 22 063 | 25 520 | 28 022 | 30 663 | 33 387 | 36 146 |
| Population (million) | 250 | 282 | 309 | 337 | 349 | 356 | 363 | 369 | 373 |
| GDP per capita ($2015 thousand) | 39 | 49 | 53 | 66 | 73 | 79 | 84 | 91 | 97 |
| Primary energy consumption per capita (toe/person) | 7.7 | 8.1 | 7.2 | 6.4 | 5.9 | 5.6 | 5.4 | 5.2 | 5.1 |
| Primary energy consumption per GDP (toe/$2015 million) | 196 | 166 | 136 | 97 | 80 | 72 | 64 | 58 | 53 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 483 | 408 | 318 | 201 | 150 | 128 | 109 | 93 | 81 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.5 | 2.5 | 2.3 | 2.1 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 0.3 | -0.5 | -0.3 | -0.4 | 100 | 100 | 100 | 100 | 1 991 | 1 889 | 1 766 | 1 685 | 1 624 | -1.1 | -0.8 | -1.0 | 100 | 100 |
| -2.5 | -6.0 | -3.5 | -5.1 | 24 | 9.4 | 3.6 | 2.6 | 79 | 33 | 23 | 22 | 21 | -12.0 | -0.7 | -8.0 | 1.3 | 1.3 |
| 0.0 | -1.4 | -1.8 | -1.6 | 40 | 36 | 30 | 26 | 650 | 551 | 436 | 316 | 221 | -3.2 | -6.6 | -4.5 | 25 | 14 |
| 1.7 | -0.1 | -0.2 | -0.1 | 23 | 36 | 38 | 39 | 772 | 763 | 698 | 632 | 548 | -0.5 | -2.4 | -1.2 | 39 | 34 |
| 0.8 | 0.0 | -0.3 | -0.1 | 8.3 | 9.8 | 11 | 11 | 214 | 214 | 222 | 236 | 250 | 0.3 | 1.2 | 0.6 | 13 | 15 |
| -0.3 | 1.5 | 0.2 | 1.0 | 1.2 | 1.0 | 1.4 | 1.5 | 26 | 27 | 27 | 27 | 28 | 1.5 | 0.2 | 1.0 | 1.5 | 1.7 |
| -1.1 | 2.4 | 0.7 | 1.8 | 0.7 | 0.5 | 0.7 | 0.8 | 12 | 15 | 16 | 16 | 17 | 2.9 | 0.8 | 2.1 | 0.9 | 1.0 |
| 17.1 | 6.9 | 3.5 | 5.6 | 0.0 | 2.8 | 9.4 | 14 | 119 | 172 | 228 | 308 | 395 | 8.3 | 5.6 | 7.3 | 13 | 24 |
| 1.8 | -0.2 | -0.3 | -0.3 | 3.3 | 5.2 | 5.5 | 5.5 | 119 | 121 | 126 | 132 | 137 | 0.7 | 0.8 | 0.7 | 7.2 | 8.4 |
| n.a. | n.a. | -20.7 | n.a. | - | - | -0.0 | -0.0 | -2.3 | -8.4 | -10 | -6.2 | 6.8 | n.a. | n.a. | n.a. | -0.6 | 0.4 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.6 | -0.3 | -0.4 | -0.3 | 100 | 100 | 100 | 100 | 1 493 | 1 398 | 1 278 | 1 183 | 1 120 | -1.2 | -1.3 | -1.2 | 100 | 100 |
| -4.5 | -1.0 | -1.0 | -1.0 | 4.3 | 0.8 | 0.7 | 0.7 | 10 | 8.2 | 6.9 | 6.1 | 5.5 | -3.3 | -2.3 | -2.9 | 0.5 | 0.5 |
| 0.2 | -1.2 | -1.6 | -1.4 | 53 | 47 | 40 | 36 | 648 | 559 | 454 | 353 | 270 | -2.8 | -5.1 | -3.7 | 35 | 24 |
| 0.6 | -0.1 | -1.0 | -0.5 | 23 | 24 | 25 | 23 | 360 | 317 | 263 | 209 | 160 | -2.0 | -4.8 | -3.1 | 21 | 14 |
| 1.2 | 1.3 | 1.6 | 1.4 | 18 | 21 | 28 | 34 | 369 | 402 | 431 | 469 | 496 | 1.5 | 1.4 | 1.5 | 34 | 44 |
| 2.8 | -0.3 | -1.0 | -0.5 | 0.2 | 0.3 | 0.4 | 0.3 | 5.0 | 4.6 | 4.2 | 3.7 | 3.3 | -1.5 | -2.4 | -1.9 | 0.3 | 0.3 |
| n.a. | n.a. | 21.2 | n.a. | - | - | 0.0 | 0.2 | 0.1 | 7.3 | 18 | 36 | 77 | n.a. | 15.4 | n.a. | 1.4 | 6.9 |
| 4.5 | -0.7 | -0.8 | -0.7 | 1.8 | 6.4 | 5.9 | 5.7 | 101 | 99 | 101 | 105 | 108 | 0.1 | 0.7 | 0.3 | 7.9 | 9.7 |
| -0.1 | 0.0 | -0.3 | -0.1 | 22 | 18 | 19 | 19 | 271 | 251 | 224 | 199 | 181 | -1.3 | -2.1 | -1.6 | 18 | 16 |
| 0.7 | -1.2 | -1.4 | -1.3 | 38 | 40 | 34 | 31 | 549 | 479 | 407 | 346 | 310 | -2.4 | -2.7 | -2.5 | 32 | 28 |
| 0.7 | 0.3 | 0.2 | 0.2 | 31 | 32 | 36 | 38 | 511 | 502 | 476 | 462 | 450 | -0.4 | -0.6 | -0.4 | 37 | 40 |
| 0.8 | 0.5 | 0.4 | 0.5 | 9.2 | 10 | 12 | 13 | 163 | 167 | 171 | 175 | 179 | 0.5 | 0.4 | 0.5 | 13 | 16 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 1.0 | 1.3 | 1.6 | 1.4 | 100 | 100 | 100 | 100 | 4 888 | 5 490 | 6 045 | 6 887 | 7 646 | 1.8 | 2.4 | 2.0 | 100 | 100 |
| -2.5 | -7.1 | -5.2 | -6.4 | 53 | 17 | 3.8 | 1.9 | 239 | 48 | 8.4 | 9.1 | 9.2 | -23.2 | 1.0 | -15.0 | 0.1 | 0.1 |
| -4.1 | -2.9 | -1.8 | -2.5 | 4.1 | 0.7 | 0.4 | 0.3 | 26 | 22 | 24 | 20 | 14 | -1.8 | -5.0 | -3.0 | 0.4 | 0.2 |
| 4.9 | 0.1 | 0.7 | 0.3 | 12 | 42 | 34 | 31 | 2 030 | 2 153 | 2 009 | 1 822 | 1 476 | 0.4 | -3.0 | -0.9 | 33 | 19 |
| 0.8 | 0.0 | -0.3 | -0.1 | 19 | 18 | 14 | 12 | 822 | 822 | 851 | 905 | 958 | 0.3 | 1.2 | 0.6 | 14 | 13 |
| -0.3 | 1.5 | 0.2 | 1.0 | 8.5 | 5.6 | 5.7 | 5.0 | 308 | 312 | 316 | 320 | 324 | 1.5 | 0.2 | 1.0 | 5.2 | 4.2 |
| 0.6 | 2.5 | 0.7 | 1.9 | 0.5 | 0.4 | 0.5 | 0.5 | 24 | 31 | 32 | 34 | 35 | 3.0 | 0.9 | 2.2 | 0.5 | 0.5 |
| 40.3 | 10.9 | 4.1 | 8.3 | 0.0 | 4.8 | 22 | 29 | 724 | 1 132 | 1 549 | 2 136 | 2 744 | 12.3 | 5.9 | 9.9 | 26 | 36 |
| 16.1 | 4.2 | 2.6 | 3.6 | 0.1 | 9.6 | 15 | 17 | 608 | 812 | 1 046 | 1 388 | 1 789 | 5.4 | 5.5 | 5.5 | 17 | 23 |
| 4.8 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.1 | 0.8 | 1.5 | 1.1 | 0.1 | 0.1 |
| -1.0 | 2.7 | 1.5 | 2.3 | 2.7 | 1.4 | 1.7 | 1.7 | 83 | 99 | 115 | 124 | 133 | 3.8 | 1.5 | 2.9 | 1.9 | 1.7 |
| n.a. | n.a. | 5.1 | n.a. | - | - | 1.0 | 1.4 | 8.2 | 44 | 80 | 114 | 148 | n.a. | 6.3 | n.a. | 1.3 | 1.9 |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.2 | 0.2 | 0.2 | 11 | 11 | 11 | 11 | 11 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.2 | -1.6 | -1.3 | -1.5 | 3 578 | 2 800 | 2 042 | 1 208 | 533 | -4.4 | -12.6 | -7.5 |
| n.a. | n.a. | n.a. | n.a. | - | - | 23 | 127 | 256 | n.a. | 27.4 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.5 | 2.0 | 1.7 | 1.8 | 25 520 | 28 022 | 30 663 | 33 387 | 36 146 | 2.0 | 1.7 | 1.8 |
| 0.9 | 0.4 | 0.3 | 0.4 | 349 | 356 | 363 | 369 | 373 | 0.4 | 0.3 | 0.4 |
| 1.6 | 1.5 | 1.4 | 1.5 | 73 | 79 | 84 | 91 | 97 | 1.5 | 1.4 | 1.5 |
| -0.6 | -0.9 | -0.6 | -0.8 | 5.7 | 5.3 | 4.9 | 4.6 | 4.3 | -1.6 | -1.1 | -1.4 |
| -2.1 | -2.4 | -2.0 | -2.2 | 78 | 67 | 58 | 50 | 45 | -3.0 | -2.5 | -2.8 |
| -2.6 | -3.5 | -3.0 | -3.3 | 140 | 100 | 67 | 36 | 15 | -6.3 | -14.0 | -9.2 |
| -0.5 | -1.1 | -1.0 | -1.1 | 1.8 | 1.5 | 1.2 | 0.7 | 0.3 | -3.4 | -11.8 | -6.6 |

## Table A39 | Latin America

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 467 | 611 | 791 | 867 | 925 | 976 | 1 023 | 1 068 | 1 112 |
| Coal | 21 | 28 | 40 | 37 | 32 | 32 | 32 | 33 | 35 |
| Oil | 241 | 314 | 367 | 356 | 360 | 370 | 379 | 382 | 380 |
| Natural gas | 71 | 118 | 178 | 207 | 215 | 232 | 254 | 283 | 314 |
| Nuclear | 3.2 | 5.3 | 7.2 | 9.5 | 9.9 | 17 | 18 | 15 | 15 |
| Hydro | 34 | 51 | 64 | 66 | 73 | 76 | 79 | 82 | 85 |
| Geothermal | 5.1 | 6.5 | 6.4 | 6.3 | 11 | 14 | 15 | 17 | 18 |
| Solar, wind, etc. | 0.0 | 0.2 | 0.9 | 24 | 45 | 56 | 69 | 81 | 93 |
| Biomass and waste | 91 | 89 | 128 | 160 | 178 | 180 | 180 | 180 | 179 |
| Hydrogen | - | - | - | - | -0.1 | -0.9 | -2.9 | -4.7 | -6.9 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 343 | 442 | 571 | 630 | 673 | 704 | 733 | 760 | 784 |
| Coal | 8.3 | 11 | 15 | 12 | 13 | 13 | 13 | 14 | 14 |
| Oil | 179 | 236 | 286 | 306 | 314 | 323 | 332 | 338 | 339 |
| Natural gas | 38 | 54 | 74 | 67 | 71 | 74 | 77 | 80 | 84 |
| Electricity | 44 | 68 | 97 | 125 | 145 | 163 | 181 | 200 | 220 |
| Heat | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrogen | - | - | - | - | - | - | 0.1 | 0.6 | 1.3 |
| Renewables and waste | 74 | 73 | 99 | 119 | 129 | 131 | 129 | 128 | 126 |
| Industry | 114 | 143 | 180 | 181 | 201 | 218 | 234 | 247 | 259 |
| Transport | 104 | 141 | 199 | 237 | 246 | 253 | 260 | 266 | 270 |
| Buildings, etc. | 99 | 121 | 147 | 176 | 187 | 192 | 196 | 201 | 207 |
| Non-energy use | 26 | 38 | 45 | 36 | 38 | 41 | 43 | 46 | 48 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 624 | 1 008 | 1 405 | 1 796 | 2 071 | 2 318 | 2 594 | 2 872 | 3 168 |
| Coal | 24 | 44 | 75 | 83 | 55 | 53 | 52 | 51 | 55 |
| Oil | 130 | 196 | 188 | 110 | 84 | 78 | 71 | 60 | 42 |
| Natural gas | 54 | 134 | 317 | 439 | 424 | 487 | 578 | 705 | 837 |
| Nuclear | 12 | 20 | 28 | 36 | 38 | 66 | 69 | 57 | 57 |
| Hydro | 391 | 591 | 739 | 772 | 850 | 883 | 917 | 951 | 985 |
| Geothermal | 5.9 | 8.0 | 9.9 | 9.2 | 14 | 16 | 18 | 20 | 21 |
| Solar photovoltaics | 0.0 | 0.0 | 0.1 | 104 | 261 | 319 | 391 | 454 | 517 |
| Wind | 0.0 | 0.3 | 4.7 | 155 | 239 | 304 | 383 | 457 | 531 |
| Concentrated solar power and marine | - | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Biomass and waste | 7.4 | 13 | 44 | 83 | 102 | 106 | 110 | 113 | 116 |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Others | - | 0.4 | 0.5 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 829 | 1 148 | 1 471 | 1 478 | 1 472 | 1 532 | 1 602 | 1 679 | 1 749 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 2 636 | 3 592 | 4 885 | 5 757 | 6 834 | 7 874 | 9 029 | 10 261 | 11 544 |
| Population (million) | 438 | 517 | 585 | 655 | 684 | 701 | 714 | 722 | 727 |
| GDP per capita ($2015 thousand) | 6.0 | 6.9 | 8.4 | 8.8 | 10.0 | 11 | 13 | 14 | 16 |
| Primary energy consumption per capita (toe/person) | 1.1 | 1.2 | 1.4 | 1.3 | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 177 | 170 | 162 | 151 | 135 | 124 | 113 | 104 | 96 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 315 | 320 | 301 | 257 | 215 | 195 | 177 | 164 | 152 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.8 | 1.9 | 1.9 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 1.9 | 1.0 | 0.8 | 0.9 | 100 | 100 | 100 | 100 | 901 | 916 | 919 | 923 | 935 | 0.3 | 0.2 | 0.3 | 100 | 100 |
| 1.7 | -0.8 | 1.0 | -0.2 | 4.6 | 4.2 | 3.1 | 3.2 | 29 | 26 | 24 | 25 | 27 | -2.5 | 1.2 | -1.1 | 2.6 | 2.9 |
| 1.2 | 0.4 | 0.0 | 0.2 | 52 | 41 | 37 | 34 | 340 | 320 | 289 | 252 | 216 | -1.2 | -2.9 | -1.8 | 31 | 23 |
| 3.3 | 1.2 | 2.2 | 1.6 | 15 | 24 | 25 | 28 | 214 | 227 | 242 | 255 | 267 | 0.9 | 1.0 | 0.9 | 26 | 29 |
| 3.3 | 3.9 | -2.0 | 1.7 | 0.7 | 1.1 | 1.8 | 1.3 | 9.9 | 18 | 26 | 34 | 41 | 6.2 | 4.5 | 5.5 | 2.9 | 4.4 |
| 2.1 | 1.0 | 0.7 | 0.9 | 7.2 | 7.7 | 7.7 | 7.6 | 73 | 77 | 80 | 84 | 88 | 1.1 | 0.9 | 1.0 | 8.7 | 9.4 |
| 0.6 | 5.4 | 1.6 | 4.0 | 1.1 | 0.7 | 1.5 | 1.6 | 11 | 16 | 18 | 19 | 20 | 6.3 | 1.1 | 4.3 | 1.9 | 2.1 |
| 22.1 | 6.3 | 3.0 | 5.1 | 0.0 | 2.8 | 6.8 | 8.4 | 49 | 70 | 96 | 136 | 187 | 8.4 | 6.9 | 7.8 | 10 | 20 |
| 1.7 | 0.7 | -0.1 | 0.4 | 20 | 18 | 18 | 16 | 174 | 166 | 156 | 147 | 140 | -0.2 | -1.1 | -0.5 | 17 | 15 |
| n.a. | n.a. | 9.0 | n.a. | - | - | -0.3 | -0.6 | -0.2 | -4.4 | -13 | -29 | -51 | n.a. | 15.0 | n.a. | -1.4 | -5.5 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 1.9 | 0.9 | 0.7 | 0.8 | 100 | 100 | 100 | 100 | 653 | 648 | 634 | 618 | 610 | 0.0 | -0.4 | -0.1 | 100 | 100 |
| 1.2 | 0.5 | 0.4 | 0.5 | 2.4 | 1.9 | 1.8 | 1.8 | 12 | 9.8 | 8.7 | 7.9 | 7.3 | -2.0 | -1.7 | -1.9 | 1.4 | 1.2 |
| 1.6 | 0.5 | 0.2 | 0.4 | 52 | 49 | 45 | 43 | 298 | 284 | 261 | 233 | 208 | -0.9 | -2.3 | -1.4 | 41 | 34 |
| 1.7 | 0.8 | 0.8 | 0.8 | 11 | 11 | 10 | 11 | 68 | 65 | 61 | 56 | 51 | -0.6 | -1.8 | -1.0 | 9.5 | 8.3 |
| 3.2 | 2.2 | 2.0 | 2.1 | 13 | 20 | 25 | 28 | 149 | 170 | 192 | 214 | 236 | 2.5 | 2.1 | 2.4 | 30 | 39 |
| n.a. | 1.6 | 0.0 | 1.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.7 | 1.3 | 0.0 | 0.0 |
| n.a. | n.a. | 24.1 | n.a. | - | - | 0.0 | 0.2 | 0.0 | 0.9 | 2.6 | 6.2 | 13 | n.a. | 17.7 | n.a. | 0.4 | 2.2 |
| 1.5 | 0.5 | -0.2 | 0.2 | 21 | 19 | 18 | 16 | 126 | 119 | 110 | 101 | 95 | -0.5 | -1.5 | -0.8 | 17 | 16 |
| 1.4 | 1.5 | 1.0 | 1.3 | 33 | 29 | 32 | 33 | 194 | 197 | 194 | 190 | 189 | 0.4 | -0.3 | 0.1 | 31 | 31 |
| 2.5 | 0.5 | 0.4 | 0.5 | 30 | 38 | 35 | 34 | 237 | 228 | 216 | 205 | 197 | -0.5 | -0.9 | -0.7 | 34 | 32 |
| 1.8 | 0.7 | 0.5 | 0.6 | 29 | 28 | 27 | 26 | 184 | 183 | 181 | 178 | 177 | 0.2 | -0.2 | 0.0 | 28 | 29 |
| 0.9 | 1.1 | 1.1 | 1.1 | 7.6 | 5.6 | 5.9 | 6.1 | 38 | 41 | 43 | 46 | 48 | 1.1 | 1.1 | 1.1 | 6.8 | 7.9 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.3 | 2.2 | 2.0 | 2.1 | 100 | 100 | 100 | 100 | 2 137 | 2 547 | 3 065 | 3 775 | 4 610 | 3.2 | 4.2 | 3.6 | 100 | 100 |
| 3.9 | -2.7 | 0.6 | -1.5 | 3.8 | 4.6 | 2.0 | 1.7 | 49 | 46 | 41 | 47 | 53 | -4.1 | 2.6 | -1.7 | 1.3 | 1.1 |
| -0.5 | -2.6 | -5.1 | -3.5 | 21 | 6.1 | 2.7 | 1.3 | 77 | 65 | 52 | 38 | 24 | -4.3 | -7.5 | -5.5 | 1.7 | 0.5 |
| 6.6 | 1.6 | 3.8 | 2.4 | 8.6 | 24 | 22 | 26 | 449 | 562 | 714 | 885 | 1 060 | 2.9 | 4.0 | 3.3 | 23 | 23 |
| 3.3 | 3.9 | -2.0 | 1.7 | 2.0 | 2.0 | 2.7 | 1.8 | 38 | 69 | 101 | 132 | 156 | 6.2 | 4.5 | 5.5 | 3.3 | 3.4 |
| 2.1 | 1.0 | 0.7 | 0.9 | 63 | 43 | 35 | 31 | 854 | 892 | 932 | 975 | 1 022 | 1.1 | 0.9 | 1.0 | 30 | 22 |
| 1.3 | 4.1 | 1.6 | 3.2 | 1.0 | 0.5 | 0.7 | 0.7 | 14 | 19 | 21 | 22 | 23 | 9.0 | 1.2 | 6.0 | 0.7 | 0.5 |
| 41.9 | 8.1 | 2.8 | 6.1 | 0.0 | 5.8 | 15 | 16 | 294 | 411 | 555 | 754 | 999 | 10.3 | 6.1 | 8.7 | 18 | 22 |
| 43.6 | 5.5 | 3.3 | 4.7 | 0.0 | 8.6 | 15 | 17 | 249 | 363 | 525 | 792 | 1 138 | 7.5 | 8.0 | 7.7 | 17 | 25 |
| n.a. | 1.6 | 1.3 | 1.5 | - | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.3 | 0.5 | 0.6 | 5.0 | 7.5 | 5.9 | 0.0 | 0.0 |
| 7.6 | 1.7 | 0.6 | 1.2 | 1.2 | 4.6 | 4.2 | 3.7 | 108 | 113 | 119 | 124 | 128 | 2.1 | 0.8 | 1.6 | 3.9 | 2.8 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.3 | 0.2 | 0.2 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.8 | 0.5 | 0.9 | 0.6 | 1 399 | 1 316 | 1 195 | 1 047 | 894 | -1.2 | -2.9 | -1.8 |
| n.a. | n.a. | n.a. | n.a. | - | - | 7.3 | 15 | 22 | n.a. | 11.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.4 | 2.7 | 2.5 | 2.6 | 6 834 | 7 874 | 9 029 | 10 261 | 11 544 | 2.7 | 2.5 | 2.6 |
| 1.2 | 0.5 | 0.2 | 0.4 | 684 | 701 | 714 | 722 | 727 | 0.5 | 0.2 | 0.4 |
| 1.2 | 2.2 | 2.3 | 2.2 | 10.0 | 11 | 13 | 14 | 16 | 2.2 | 2.3 | 2.2 |
| 0.7 | 0.5 | 0.6 | 0.5 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | -0.2 | 0.0 | -0.1 |
| -0.5 | -1.7 | -1.6 | -1.6 | 132 | 116 | 102 | 90 | 81 | -2.3 | -2.3 | -2.3 |
| -0.6 | -2.1 | -1.6 | -1.9 | 205 | 167 | 132 | 102 | 77 | -3.8 | -5.2 | -4.3 |
| -0.1 | -0.5 | 0.0 | -0.3 | 1.6 | 1.4 | 1.3 | 1.1 | 1.0 | -1.6 | -3.0 | -2.1 |

## Table A40 | Advanced Europe

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 1 644 | 1 759 | 1 834 | 1 548 | 1 456 | 1 409 | 1 353 | 1 287 | 1 229 |
| Coal | 450 | 331 | 301 | 168 | 118 | 102 | 85 | 76 | 67 |
| Oil | 617 | 654 | 605 | 519 | 461 | 423 | 387 | 350 | 314 |
| Natural gas | 267 | 396 | 473 | 362 | 316 | 298 | 273 | 245 | 213 |
| Nuclear | 210 | 247 | 239 | 171 | 181 | 190 | 198 | 184 | 177 |
| Hydro | 39 | 47 | 48 | 48 | 51 | 51 | 52 | 52 | 53 |
| Geothermal | 4.9 | 7.1 | 11 | 23 | 28 | 36 | 37 | 37 | 37 |
| Solar, wind, etc. | 0.4 | 2.9 | 18 | 82 | 114 | 126 | 145 | 174 | 205 |
| Biomass and waste | 56 | 72 | 137 | 173 | 193 | 190 | 184 | 176 | 170 |
| Hydrogen | - | - | - | - | -0.0 | -0.4 | -2.0 | -3.2 | -4.5 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 142 | 1 235 | 1 289 | 1 154 | 1 093 | 1 044 | 994 | 946 | 903 |
| Coal | 124 | 61 | 55 | 36 | 34 | 30 | 26 | 23 | 21 |
| Oil | 528 | 573 | 538 | 475 | 427 | 392 | 358 | 324 | 290 |
| Natural gas | 205 | 269 | 285 | 238 | 223 | 212 | 200 | 186 | 174 |
| Electricity | 193 | 234 | 267 | 256 | 262 | 269 | 278 | 290 | 303 |
| Heat | 45 | 42 | 53 | 43 | 42 | 40 | 38 | 36 | 34 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.3 | 1.1 | 2.1 |
| Renewables and waste | 48 | 56 | 92 | 106 | 105 | 101 | 93 | 86 | 79 |
| Industry | 330 | 325 | 296 | 271 | 266 | 260 | 252 | 243 | 234 |
| Transport | 269 | 318 | 335 | 347 | 312 | 285 | 260 | 236 | 215 |
| Buildings, etc. | 442 | 477 | 545 | 452 | 430 | 414 | 398 | 385 | 374 |
| Non-energy use | 101 | 114 | 113 | 84 | 85 | 85 | 84 | 83 | 81 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2 695 | 3 236 | 3 623 | 3 462 | 3 632 | 3 741 | 3 894 | 4 084 | 4 292 |
| Coal | 1 030 | 968 | 873 | 449 | 250 | 194 | 134 | 98 | 62 |
| Oil | 209 | 180 | 81 | 46 | 14 | 11 | 7.9 | 5.9 | 3.2 |
| Natural gas | 176 | 514 | 857 | 615 | 479 | 444 | 379 | 299 | 186 |
| Nuclear | 804 | 948 | 916 | 657 | 695 | 729 | 759 | 707 | 680 |
| Hydro | 450 | 547 | 559 | 558 | 588 | 595 | 602 | 609 | 616 |
| Geothermal | 3.6 | 6.2 | 11 | 23 | 29 | 40 | 41 | 41 | 42 |
| Solar photovoltaics | 0.0 | 0.1 | 23 | 281 | 577 | 664 | 803 | 980 | 1 162 |
| Wind | 0.8 | 22 | 153 | 598 | 675 | 721 | 808 | 966 | 1 147 |
| Concentrated solar power and marine | 0.5 | 0.5 | 1.2 | 5.6 | 4.7 | 5.1 | 5.4 | 6.3 | 7.0 |
| Biomass and waste | 21 | 48 | 146 | 220 | 311 | 323 | 335 | 341 | 348 |
| Hydrogen | - | - | - | - | 1.1 | 6.7 | 12 | 21 | 30 |
| Others | 0.3 | 1.5 | 4.6 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 3 948 | 3 916 | 3 823 | 2 924 | 2 429 | 2 207 | 1 976 | 1 757 | 1 536 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 11 667 | 14 676 | 16 969 | 20 871 | 23 040 | 24 837 | 26 651 | 28 479 | 30 246 |
| Population (million) | 507 | 529 | 558 | 587 | 587 | 586 | 583 | 580 | 574 |
| GDP per capita ($2015 thousand) | 23 | 28 | 30 | 36 | 39 | 42 | 46 | 49 | 53 |
| Primary energy consumption per capita (toe/person) | 3.2 | 3.3 | 3.3 | 2.6 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 |
| Primary energy consumption per GDP (toe/$2015 million) | 141 | 120 | 108 | 74 | 63 | 57 | 51 | 45 | 41 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 338 | 267 | 225 | 140 | 105 | 89 | 74 | 62 | 51 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.2 | 2.1 | 1.9 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| -0.2 | -0.8 | -1.0 | -0.9 | 100 | 100 | 100 | 100 | 1 416 | 1 328 | 1 225 | 1 165 | 1 149 | -1.4 | -0.6 | -1.1 | 100 | 100 |
| -2.9 | -3.9 | -2.4 | -3.3 | 27 | 11 | 6.3 | 5.5 | 106 | 82 | 63 | 55 | 53 | -5.6 | -1.6 | -4.2 | 5.1 | 4.6 |
| -0.5 | -1.7 | -2.1 | -1.8 | 38 | 34 | 29 | 26 | 417 | 326 | 246 | 174 | 121 | -4.3 | -6.9 | -5.3 | 20 | 11 |
| 0.9 | -1.6 | -2.4 | -1.9 | 16 | 23 | 20 | 17 | 296 | 249 | 181 | 128 | 92 | -4.0 | -6.5 | -4.9 | 15 | 8.0 |
| -0.6 | 0.8 | -1.1 | 0.1 | 13 | 11 | 15 | 14 | 189 | 218 | 241 | 248 | 277 | 2.0 | 1.4 | 1.8 | 20 | 24 |
| 0.7 | 0.4 | 0.2 | 0.4 | 2.4 | 3.1 | 3.8 | 4.3 | 51 | 51 | 52 | 52 | 53 | 0.4 | 0.2 | 0.4 | 4.2 | 4.6 |
| 4.8 | 2.8 | 0.0 | 1.8 | 0.3 | 1.5 | 2.7 | 3.0 | 28 | 38 | 39 | 39 | 39 | 3.1 | 0.0 | 1.9 | 3.2 | 3.4 |
| 17.9 | 3.4 | 3.5 | 3.4 | 0.0 | 5.3 | 11 | 17 | 131 | 168 | 216 | 285 | 340 | 5.8 | 4.7 | 5.4 | 18 | 30 |
| 3.5 | 0.4 | -0.8 | -0.1 | 3.4 | 11 | 14 | 14 | 201 | 191 | 179 | 167 | 157 | 0.2 | -1.3 | -0.4 | 15 | 14 |
| n.a. | n.a. | 8.4 | n.a. | - | - | -0.1 | -0.4 | 2.5 | 9.8 | 14 | 21 | 21 | n.a. | 3.7 | n.a. | 1.2 | 1.8 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.0 | -0.9 | -0.9 | -0.9 | 100 | 100 | 100 | 100 | 1 054 | 948 | 846 | 769 | 714 | -1.8 | -1.7 | -1.8 | 100 | 100 |
| -3.7 | -1.9 | -2.1 | -2.0 | 11 | 3.1 | 2.6 | 2.3 | 29 | 21 | 17 | 13 | 11 | -4.4 | -3.8 | -4.2 | 2.0 | 1.6 |
| -0.3 | -1.6 | -2.1 | -1.8 | 46 | 41 | 36 | 32 | 390 | 311 | 243 | 192 | 153 | -3.9 | -4.5 | -4.1 | 29 | 21 |
| 0.4 | -1.0 | -1.4 | -1.2 | 18 | 21 | 20 | 19 | 213 | 183 | 149 | 115 | 85 | -2.7 | -5.5 | -3.7 | 18 | 12 |
| 0.9 | 0.5 | 0.9 | 0.6 | 17 | 22 | 28 | 34 | 274 | 292 | 307 | 323 | 332 | 1.1 | 0.8 | 1.0 | 36 | 47 |
| -0.2 | -0.6 | -1.3 | -0.9 | 3.9 | 3.7 | 3.9 | 3.7 | 41 | 38 | 35 | 31 | 28 | -1.2 | -2.2 | -1.6 | 4.1 | 3.9 |
| n.a. | n.a. | 20.8 | n.a. | - | - | 0.0 | 0.2 | 0.1 | 4.9 | 12 | 23 | 42 | n.a. | 13.5 | n.a. | 1.4 | 5.9 |
| 2.5 | -0.8 | -1.6 | -1.1 | 4.2 | 9.2 | 9.4 | 8.8 | 107 | 97 | 84 | 72 | 63 | -1.4 | -2.9 | -1.9 | 9.9 | 8.8 |
| -0.6 | -0.4 | -0.7 | -0.5 | 29 | 23 | 25 | 26 | 257 | 238 | 214 | 194 | 179 | -1.4 | -1.8 | -1.5 | 25 | 25 |
| 0.8 | -1.7 | -1.9 | -1.8 | 24 | 30 | 26 | 24 | 290 | 234 | 189 | 158 | 142 | -3.5 | -2.8 | -3.3 | 22 | 20 |
| 0.1 | -0.8 | -0.6 | -0.7 | 39 | 39 | 40 | 41 | 422 | 392 | 359 | 334 | 312 | -1.3 | -1.4 | -1.4 | 42 | 44 |
| -0.6 | 0.0 | -0.3 | -0.1 | 8.9 | 7.2 | 8.5 | 9.0 | 85 | 85 | 84 | 83 | 81 | 0.0 | -0.3 | -0.1 | 9.9 | 11 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.8 | 0.7 | 1.0 | 0.8 | 100 | 100 | 100 | 100 | 3 817 | 4 251 | 4 674 | 5 434 | 6 207 | 1.8 | 2.9 | 2.2 | 100 | 100 |
| -2.5 | -6.9 | -7.4 | -7.1 | 38 | 13 | 3.4 | 1.4 | 214 | 141 | 72 | 49 | 47 | -10.2 | -4.2 | -8.0 | 1.5 | 0.8 |
| -4.5 | -9.9 | -8.7 | -9.4 | 7.8 | 1.3 | 0.2 | 0.1 | 11 | 7.5 | 3.2 | 1.3 | 0.6 | -14.5 | -15.3 | -14.8 | 0.1 | 0.0 |
| 3.9 | -2.8 | -6.9 | -4.3 | 6.5 | 18 | 9.7 | 4.3 | 444 | 371 | 183 | 100 | 82 | -6.9 | -7.7 | -7.2 | 3.9 | 1.3 |
| -0.6 | 0.8 | -1.1 | 0.1 | 30 | 19 | 19 | 16 | 726 | 837 | 927 | 953 | 1 063 | 2.0 | 1.4 | 1.8 | 20 | 17 |
| 0.7 | 0.4 | 0.2 | 0.4 | 17 | 16 | 15 | 14 | 588 | 595 | 602 | 609 | 616 | 0.4 | 0.2 | 0.4 | 13 | 9.9 |
| 5.8 | 3.4 | 0.1 | 2.2 | 0.1 | 0.7 | 1.1 | 1.0 | 29 | 43 | 44 | 44 | 45 | 3.8 | 0.2 | 2.4 | 0.9 | 0.7 |
| 34.5 | 6.4 | 3.8 | 5.4 | 0.0 | 8.1 | 21 | 27 | 731 | 954 | 1 250 | 1 550 | 1 753 | 9.2 | 3.4 | 7.0 | 27 | 28 |
| 22.3 | 1.8 | 3.6 | 2.4 | 0.0 | 17 | 21 | 27 | 722 | 921 | 1 180 | 1 676 | 2 113 | 4.1 | 6.0 | 4.8 | 25 | 34 |
| 7.6 | -0.3 | 2.8 | 0.8 | 0.0 | 0.2 | 0.1 | 0.2 | 5.1 | 6.0 | 7.9 | 12 | 15 | 2.0 | 6.7 | 3.7 | 0.2 | 0.2 |
| 7.4 | 2.5 | 0.4 | 1.7 | 0.8 | 6.4 | 8.6 | 8.1 | 337 | 348 | 361 | 369 | 377 | 2.9 | 0.4 | 2.0 | 7.7 | 6.1 |
| n.a. | n.a. | 9.3 | n.a. | - | - | 0.3 | 0.7 | 2.2 | 19 | 35 | 61 | 87 | n.a. | 9.4 | n.a. | 0.8 | 1.4 |
| 10.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.2 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.9 | -2.3 | -2.5 | -2.4 | 2 191 | 1 691 | 1 163 | 662 | 287 | -5.3 | -13.1 | -8.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | 44 | 127 | 209 | n.a. | 16.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.8 | 1.4 | 1.3 | 1.4 | 23 040 | 24 837 | 26 651 | 28 479 | 30 246 | 1.4 | 1.3 | 1.4 |
| 0.4 | 0.0 | -0.2 | -0.1 | 587 | 586 | 583 | 580 | 574 | 0.0 | -0.2 | -0.1 |
| 1.3 | 1.5 | 1.4 | 1.5 | 39 | 42 | 46 | 49 | 53 | 1.5 | 1.4 | 1.5 |
| -0.6 | -0.8 | -0.8 | -0.8 | 2.4 | 2.3 | 2.1 | 2.0 | 2.0 | -1.3 | -0.5 | -1.0 |
| -1.9 | -2.2 | -2.2 | -2.2 | 61 | 53 | 46 | 41 | 38 | -2.8 | -1.9 | -2.4 |
| -2.6 | -3.7 | -3.7 | -3.7 | 95 | 68 | 44 | 23 | 9.5 | -6.6 | -14.2 | -9.5 |
| -0.7 | -1.5 | -1.5 | -1.5 | 1.5 | 1.3 | 0.9 | 0.6 | 0.3 | -4.0 | -12.5 | -7.2 |

## Table A41 | Other Europe/Eurasia

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 1 514 | 988 | 1 113 | 1 160 | 1 161 | 1 167 | 1 167 | 1 175 | 1 183 |
| Coal | 365 | 209 | 211 | 218 | 191 | 183 | 180 | 181 | 186 |
| Oil | 459 | 199 | 216 | 237 | 237 | 232 | 227 | 221 | 215 |
| Natural gas | 596 | 481 | 566 | 565 | 530 | 521 | 512 | 514 | 527 |
| Nuclear | 55 | 61 | 76 | 81 | 103 | 126 | 140 | 148 | 142 |
| Hydro | 22 | 23 | 26 | 29 | 31 | 32 | 33 | 34 | 34 |
| Geothermal | 0.0 | 0.1 | 0.6 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Solar, wind, etc. | - | 0.0 | 0.2 | 3.9 | 8.3 | 10 | 12 | 14 | 16 |
| Biomass and waste | 17 | 15 | 19 | 28 | 57 | 58 | 59 | 61 | 63 |
| Hydrogen | - | - | - | - | -0.0 | -0.1 | -0.4 | -0.8 | -1.1 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 057 | 647 | 709 | 769 | 769 | 763 | 753 | 745 | 739 |
| Coal | 113 | 36 | 39 | 47 | 49 | 47 | 45 | 43 | 41 |
| Oil | 275 | 144 | 174 | 213 | 209 | 205 | 201 | 196 | 189 |
| Natural gas | 258 | 200 | 233 | 242 | 233 | 228 | 221 | 216 | 211 |
| Electricity | 125 | 86 | 103 | 114 | 127 | 138 | 147 | 158 | 169 |
| Heat | 274 | 170 | 147 | 132 | 129 | 125 | 120 | 115 | 112 |
| Hydrogen | - | - | - | - | - | - | - | 0.0 | 0.0 |
| Renewables and waste | 13 | 11 | 14 | 20 | 22 | 21 | 19 | 18 | 17 |
| Industry | 391 | 205 | 205 | 207 | 218 | 221 | 222 | 223 | 223 |
| Transport | 170 | 110 | 145 | 161 | 156 | 152 | 149 | 146 | 143 |
| Buildings, etc. | 431 | 285 | 279 | 315 | 308 | 303 | 295 | 290 | 287 |
| Non-energy use | 65 | 47 | 80 | 86 | 87 | 87 | 87 | 86 | 86 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 1 856 | 1 415 | 1 689 | 1 826 | 1 889 | 2 024 | 2 149 | 2 284 | 2 425 |
| Coal | 429 | 338 | 396 | 375 | 329 | 331 | 344 | 372 | 419 |
| Oil | 252 | 69 | 22 | 20 | 16 | 15 | 15 | 15 | 16 |
| Natural gas | 707 | 504 | 671 | 731 | 646 | 649 | 668 | 709 | 790 |
| Nuclear | 209 | 234 | 289 | 311 | 393 | 484 | 536 | 568 | 544 |
| Hydro | 259 | 267 | 306 | 335 | 358 | 371 | 382 | 391 | 398 |
| Geothermal | 0.0 | 0.1 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Solar photovoltaics | - | - | 0.0 | 19 | 59 | 73 | 89 | 100 | 111 |
| Wind | - | 0.0 | 1.2 | 24 | 35 | 43 | 51 | 60 | 69 |
| Concentrated solar power and marine | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| Biomass and waste | 0.0 | 2.6 | 3.3 | 9.1 | 52 | 58 | 63 | 69 | 75 |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Others | - | - | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 3 859 | 2 324 | 2 494 | 2 510 | 2 357 | 2 298 | 2 257 | 2 251 | 2 282 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 1 797 | 1 233 | 2 050 | 2 706 | 3 211 | 3 558 | 3 936 | 4 353 | 4 800 |
| Population (million) | 338 | 336 | 333 | 339 | 343 | 343 | 344 | 345 | 346 |
| GDP per capita ($2015 thousand) | 5.3 | 3.7 | 6.2 | 8.0 | 9.4 | 10 | 11 | 13 | 14 |
| Primary energy consumption per capita (toe/person) | 4.5 | 2.9 | 3.3 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| Primary energy consumption per GDP (toe/$2015 million) | 842 | 802 | 543 | 429 | 362 | 328 | 297 | 270 | 246 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 2 147 | 1 885 | 1 217 | 928 | 734 | 646 | 573 | 517 | 475 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.5 | 2.4 | 2.2 | 2.2 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| -0.8 | 0.0 | 0.1 | 0.1 | 100 | 100 | 100 | 100 | 1 154 | 1 127 | 1 085 | 1 051 | 1 022 | -0.4 | -0.6 | -0.5 | 100 | 100 |
| -1.5 | -1.1 | 0.3 | -0.6 | 24 | 19 | 15 | 16 | 181 | 161 | 150 | 139 | 131 | -2.2 | -1.3 | -1.9 | 14 | 13 |
| -2.0 | -0.3 | -0.6 | -0.4 | 30 | 20 | 19 | 18 | 228 | 205 | 178 | 150 | 126 | -1.7 | -3.4 | -2.3 | 16 | 12 |
| -0.2 | -0.6 | 0.3 | -0.3 | 39 | 49 | 44 | 45 | 529 | 505 | 487 | 465 | 447 | -0.9 | -0.8 | -0.9 | 45 | 44 |
| 1.2 | 3.2 | 0.2 | 2.1 | 3.6 | 7.0 | 12 | 12 | 107 | 142 | 153 | 174 | 189 | 3.8 | 2.1 | 3.2 | 14 | 18 |
| 0.8 | 0.8 | 0.4 | 0.6 | 1.5 | 2.5 | 2.8 | 2.9 | 31 | 32 | 33 | 34 | 34 | 0.8 | 0.4 | 0.6 | 3.0 | 3.3 |
| 6.8 | 2.1 | 0.2 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 1.9 | 0.0 | 1.2 | 0.0 | 0.0 |
| n.a. | 7.0 | 2.5 | 5.3 | - | 0.3 | 1.1 | 1.3 | 9.4 | 13 | 18 | 24 | 32 | 9.2 | 6.0 | 8.0 | 1.6 | 3.1 |
| 1.6 | 4.5 | 0.6 | 3.0 | 1.1 | 2.4 | 5.1 | 5.3 | 64 | 64 | 64 | 65 | 66 | 4.9 | 0.4 | 3.2 | 5.9 | 6.5 |
| n.a. | n.a. | 10.3 | n.a. | - | - | -0.0 | -0.1 | 0.3 | -0.1 | -1.3 | -3.2 | -6.1 | n.a. | 17.1 | n.a. | -0.1 | -0.6 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| -1.0 | -0.1 | -0.2 | -0.1 | 100 | 100 | 100 | 100 | 747 | 704 | 653 | 605 | 567 | -1.0 | -1.4 | -1.1 | 100 | 100 |
| -2.6 | -0.3 | -0.8 | -0.5 | 11 | 6.1 | 5.9 | 5.6 | 45 | 38 | 31 | 27 | 23 | -2.4 | -3.1 | -2.6 | 4.8 | 4.0 |
| -0.8 | -0.4 | -0.6 | -0.4 | 26 | 28 | 27 | 26 | 202 | 184 | 161 | 137 | 117 | -1.7 | -3.1 | -2.2 | 25 | 21 |
| -0.2 | -0.5 | -0.5 | -0.5 | 24 | 32 | 29 | 29 | 223 | 203 | 179 | 159 | 141 | -1.8 | -2.4 | -2.0 | 27 | 25 |
| -0.3 | 1.5 | 1.4 | 1.5 | 12 | 15 | 20 | 23 | 131 | 144 | 156 | 168 | 179 | 1.8 | 1.4 | 1.7 | 24 | 32 |
| -2.2 | -0.6 | -0.7 | -0.6 | 26 | 17 | 16 | 15 | 125 | 117 | 108 | 99 | 92 | -1.2 | -1.6 | -1.3 | 17 | 16 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | n.a. | 0.0 | n.a. | 0.0 | 0.0 |
| 1.3 | 0.0 | -1.4 | -0.6 | 1.2 | 2.6 | 2.6 | 2.3 | 20 | 19 | 17 | 16 | 15 | -0.9 | -1.1 | -1.0 | 2.6 | 2.7 |
| -1.9 | 0.4 | 0.0 | 0.3 | 37 | 27 | 30 | 30 | 209 | 197 | 182 | 168 | 158 | -0.7 | -1.4 | -1.0 | 28 | 28 |
| -0.2 | -0.5 | -0.4 | -0.5 | 16 | 21 | 20 | 19 | 150 | 135 | 120 | 106 | 94 | -1.7 | -2.4 | -2.0 | 18 | 17 |
| -0.9 | -0.4 | -0.3 | -0.3 | 41 | 41 | 39 | 39 | 301 | 284 | 264 | 246 | 229 | -1.0 | -1.4 | -1.2 | 40 | 40 |
| 0.9 | 0.0 | 0.0 | 0.0 | 6.2 | 11 | 11 | 12 | 87 | 87 | 87 | 86 | 86 | 0.0 | 0.0 | 0.0 | 13 | 15 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| -0.1 | 1.0 | 1.2 | 1.1 | 100 | 100 | 100 | 100 | 1 957 | 2 155 | 2 331 | 2 526 | 2 729 | 1.4 | 1.6 | 1.5 | 100 | 100 |
| -0.4 | -0.5 | 2.0 | 0.4 | 23 | 21 | 16 | 17 | 309 | 282 | 279 | 269 | 261 | -1.7 | -0.7 | -1.3 | 12 | 9.6 |
| -7.4 | -1.8 | 0.9 | -0.8 | 14 | 1.1 | 0.7 | 0.7 | 15 | 13 | 13 | 13 | 13 | -2.4 | -0.2 | -1.6 | 0.6 | 0.5 |
| 0.1 | -0.5 | 1.7 | 0.3 | 38 | 40 | 31 | 33 | 689 | 724 | 790 | 827 | 879 | 0.5 | 1.1 | 0.7 | 34 | 32 |
| 1.2 | 3.3 | 0.2 | 2.1 | 11 | 17 | 25 | 22 | 412 | 544 | 588 | 667 | 724 | 3.8 | 2.1 | 3.2 | 25 | 27 |
| 0.8 | 0.8 | 0.4 | 0.6 | 14 | 18 | 18 | 16 | 358 | 371 | 382 | 391 | 398 | 0.8 | 0.4 | 0.6 | 16 | 15 |
| 9.0 | 1.2 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 1.2 | 0.0 | 0.8 | 0.0 | 0.0 |
| n.a. | 9.4 | 2.3 | 6.7 | - | 1.1 | 4.1 | 4.6 | 71 | 102 | 141 | 195 | 259 | 12.4 | 6.3 | 10.1 | 6.1 | 9.5 |
| n.a. | 4.5 | 3.0 | 3.9 | - | 1.3 | 2.4 | 2.8 | 35 | 46 | 60 | 81 | 105 | 5.5 | 5.8 | 5.6 | 2.6 | 3.9 |
| n.a. | n.a. | 10.9 | n.a. | - | - | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.5 | 0.6 | n.a. | 7.7 | n.a. | 0.0 | 0.0 |
| 17.2 | 12.0 | 1.9 | 8.2 | 0.0 | 0.5 | 2.9 | 3.1 | 66 | 71 | 76 | 82 | 88 | 13.3 | 1.5 | 8.8 | 3.3 | 3.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -1.3 | -0.6 | 0.1 | -0.4 | 2 296 | 2 043 | 1 820 | 1 594 | 1 400 | -1.9 | -2.6 | -2.1 |
| n.a. | n.a. | n.a. | n.a. | - | - | 13 | 28 | 44 | n.a. | 12.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.2 | 2.2 | 2.0 | 2.1 | 3 211 | 3 558 | 3 936 | 4 353 | 4 800 | 2.2 | 2.0 | 2.1 |
| 0.0 | 0.1 | 0.1 | 0.1 | 343 | 343 | 344 | 345 | 346 | 0.1 | 0.1 | 0.1 |
| 1.2 | 2.1 | 1.9 | 2.1 | 9.4 | 10 | 11 | 13 | 14 | 2.1 | 1.9 | 2.1 |
| -0.8 | -0.1 | 0.1 | 0.0 | 3.4 | 3.3 | 3.2 | 3.0 | 2.9 | -0.5 | -0.7 | -0.6 |
| -2.0 | -2.1 | -1.8 | -2.0 | 360 | 317 | 276 | 242 | 213 | -2.6 | -2.6 | -2.6 |
| -2.5 | -2.8 | -1.9 | -2.4 | 715 | 574 | 462 | 366 | 292 | -4.0 | -4.5 | -4.2 |
| -0.5 | -0.7 | 0.0 | -0.4 | 2.0 | 1.8 | 1.7 | 1.5 | 1.4 | -1.5 | -2.0 | -1.7 |

## Table A42 | European Union

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 1 441 | 1 471 | 1 528 | 1 248 | 1 182 | 1 139 | 1 091 | 1 036 | 987 |
| Coal | 393 | 285 | 252 | 129 | 90 | 77 | 66 | 60 | 55 |
| Oil | 531 | 550 | 506 | 426 | 379 | 348 | 318 | 287 | 257 |
| Natural gas | 250 | 309 | 363 | 272 | 238 | 224 | 206 | 186 | 163 |
| Nuclear | 190 | 224 | 223 | 162 | 175 | 183 | 182 | 161 | 155 |
| Hydro | 24 | 30 | 32 | 28 | 30 | 30 | 31 | 31 | 31 |
| Geothermal | 3.2 | 4.6 | 5.5 | 6.6 | 7.6 | 7.9 | 7.9 | 7.9 | 7.8 |
| Solar, wind, etc. | 0.3 | 2.5 | 16 | 68 | 93 | 102 | 121 | 146 | 171 |
| Biomass and waste | 47 | 65 | 129 | 155 | 174 | 171 | 164 | 157 | 151 |
| Hydrogen | - | - | - | - | -0.0 | -0.3 | -1.5 | -2.3 | -3.2 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 995 | 1 027 | 1 071 | 931 | 881 | 841 | 799 | 759 | 722 |
| Coal | 109 | 47 | 37 | 23 | 22 | 19 | 17 | 15 | 14 |
| Oil | 445 | 479 | 448 | 388 | 349 | 320 | 293 | 264 | 236 |
| Natural gas | 185 | 220 | 231 | 182 | 171 | 162 | 152 | 142 | 132 |
| Electricity | 162 | 189 | 216 | 200 | 204 | 210 | 217 | 227 | 237 |
| Heat | 55 | 43 | 52 | 40 | 39 | 38 | 36 | 33 | 31 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.2 | 0.8 | 1.6 |
| Renewables and waste | 39 | 50 | 87 | 97 | 96 | 91 | 84 | 77 | 71 |
| Industry | 313 | 274 | 247 | 217 | 214 | 210 | 204 | 197 | 190 |
| Transport | 220 | 262 | 279 | 280 | 252 | 230 | 209 | 190 | 171 |
| Buildings, etc. | 374 | 391 | 447 | 362 | 342 | 328 | 314 | 301 | 291 |
| Non-energy use | 88 | 100 | 98 | 72 | 73 | 73 | 72 | 71 | 69 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2 256 | 2 630 | 2 955 | 2 718 | 3 387 | 3 592 | 3 741 | 3 729 | 3 747 |
| Coal | 844 | 846 | 755 | 346 | 188 | 145 | 101 | 82 | 63 |
| Oil | 189 | 173 | 82 | 48 | - | - | - | - | - |
| Natural gas | 188 | 331 | 589 | 459 | 363 | 337 | 292 | 237 | 158 |
| Nuclear | 729 | 860 | 854 | 620 | 672 | 701 | 699 | 618 | 593 |
| Hydro | 284 | 350 | 372 | 330 | 348 | 352 | 357 | 361 | 366 |
| Geothermal | 3.2 | 4.8 | 5.6 | 6.3 | 9.7 | 13 | 14 | 14 | 14 |
| Solar photovoltaics | 0.0 | 0.1 | 22 | 247 | 733 | 866 | 999 | 1 058 | 1 117 |
| Wind | 0.8 | 21 | 140 | 479 | 805 | 893 | 982 | 1 049 | 1 115 |
| Concentrated solar power and marine | 0.5 | 0.5 | 1.2 | 5.6 | 6.1 | 6.6 | 6.6 | 6.7 | 6.8 |
| Biomass and waste | 19 | 42 | 129 | 172 | 257 | 266 | 276 | 281 | 285 |
| Hydrogen | - | - | - | - | 0.9 | 5.3 | 9.6 | 17 | 24 |
| Others | 0.2 | 1.4 | 4.4 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 3 970 | 3 671 | 3 512 | 2 517 | 2 117 | 1 918 | 1 717 | 1 536 | 1 356 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 9 094 | 11 284 | 12 931 | 15 477 | 17 038 | 18 344 | 19 670 | 21 003 | 22 287 |
| Population (million) | 421 | 429 | 442 | 449 | 446 | 442 | 438 | 433 | 427 |
| GDP per capita ($2015 thousand) | 22 | 26 | 29 | 34 | 38 | 41 | 45 | 48 | 52 |
| Primary energy consumption per capita (toe/person) | 3.4 | 3.4 | 3.5 | 2.8 | 2.7 | 2.6 | 2.5 | 2.4 | 2.3 |
| Primary energy consumption per GDP (toe/$2015 million) | 158 | 130 | 118 | 81 | 69 | 62 | 55 | 49 | 44 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 437 | 325 | 272 | 163 | 124 | 105 | 87 | 73 | 61 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.8 | 2.5 | 2.3 | 2.0 | 1.8 | 1.7 | 1.6 | 1.5 | 1.4 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| -0.4 | -0.8 | -1.0 | -0.9 | 100 | 100 | 100 | 100 | 1 155 | 1 083 | 998 | 949 | 930 | -1.3 | -0.7 | -1.1 | 100 | 100 |
| -3.3 | -3.9 | -1.7 | -3.1 | 27 | 10 | 6.0 | 5.6 | 80 | 61 | 49 | 44 | 42 | -5.6 | -1.3 | -4.0 | 4.9 | 4.6 |
| -0.7 | -1.7 | -2.1 | -1.9 | 37 | 34 | 29 | 26 | 343 | 269 | 204 | 145 | 103 | -4.3 | -6.6 | -5.1 | 20 | 11 |
| 0.3 | -1.6 | -2.3 | -1.9 | 17 | 22 | 19 | 17 | 224 | 188 | 136 | 98 | 70 | -4.0 | -6.4 | -4.9 | 14 | 7.6 |
| -0.5 | 0.7 | -1.6 | -0.2 | 13 | 13 | 17 | 16 | 185 | 215 | 226 | 223 | 241 | 2.0 | 0.7 | 1.5 | 23 | 26 |
| 0.5 | 0.5 | 0.2 | 0.4 | 1.7 | 2.3 | 2.8 | 3.2 | 30 | 30 | 31 | 31 | 31 | 0.5 | 0.2 | 0.4 | 3.1 | 3.4 |
| 2.2 | 1.0 | -0.1 | 0.6 | 0.2 | 0.5 | 0.7 | 0.8 | 7.6 | 8.0 | 8.0 | 7.9 | 7.9 | 1.1 | -0.1 | 0.6 | 0.8 | 0.8 |
| 17.7 | 3.5 | 3.6 | 3.5 | 0.0 | 5.4 | 11 | 17 | 107 | 137 | 179 | 235 | 282 | 5.9 | 4.7 | 5.4 | 18 | 30 |
| 3.7 | 0.4 | -0.9 | -0.1 | 3.3 | 12 | 15 | 15 | 181 | 172 | 160 | 148 | 139 | 0.2 | -1.4 | -0.4 | 16 | 15 |
| n.a. | n.a. | 8.0 | n.a. | - | - | -0.1 | -0.3 | 1.8 | 6.8 | 9.6 | 13 | 11 | n.a. | 1.8 | n.a. | 1.0 | 1.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| -0.2 | -0.9 | -1.0 | -0.9 | 100 | 100 | 100 | 100 | 850 | 764 | 680 | 616 | 569 | -1.8 | -1.8 | -1.8 | 100 | 100 |
| -4.6 | -1.8 | -2.1 | -1.9 | 11 | 2.5 | 2.1 | 1.9 | 19 | 14 | 11 | 8.9 | 7.4 | -4.3 | -3.8 | -4.1 | 1.6 | 1.3 |
| -0.4 | -1.6 | -2.1 | -1.8 | 45 | 42 | 37 | 33 | 318 | 254 | 199 | 157 | 125 | -3.8 | -4.5 | -4.1 | 29 | 22 |
| -0.1 | -1.0 | -1.4 | -1.2 | 19 | 20 | 19 | 18 | 163 | 140 | 114 | 88 | 65 | -2.7 | -5.4 | -3.7 | 17 | 11 |
| 0.6 | 0.5 | 0.9 | 0.6 | 16 | 22 | 27 | 33 | 214 | 228 | 240 | 252 | 261 | 1.1 | 0.8 | 1.0 | 35 | 46 |
| -1.0 | -0.7 | -1.4 | -0.9 | 5.5 | 4.3 | 4.5 | 4.3 | 38 | 36 | 32 | 29 | 26 | -1.3 | -2.3 | -1.7 | 4.8 | 4.5 |
| n.a. | n.a. | 20.8 | n.a. | - | - | 0.0 | 0.2 | 0.1 | 3.6 | 8.7 | 17 | 31 | n.a. | 13.4 | n.a. | 1.3 | 5.4 |
| 2.8 | -0.9 | -1.7 | -1.2 | 4.0 | 10 | 10 | 9.8 | 98 | 87 | 75 | 64 | 54 | -1.5 | -3.2 | -2.1 | 11 | 9.5 |
| -1.1 | -0.4 | -0.7 | -0.5 | 31 | 23 | 26 | 26 | 206 | 191 | 172 | 155 | 142 | -1.4 | -1.9 | -1.6 | 25 | 25 |
| 0.7 | -1.7 | -2.0 | -1.8 | 22 | 30 | 26 | 24 | 234 | 189 | 152 | 126 | 112 | -3.5 | -3.0 | -3.3 | 22 | 20 |
| -0.1 | -0.8 | -0.7 | -0.8 | 38 | 39 | 39 | 40 | 336 | 311 | 284 | 264 | 246 | -1.4 | -1.4 | -1.4 | 42 | 43 |
| -0.6 | 0.0 | -0.4 | -0.2 | 8.9 | 7.8 | 9.0 | 9.6 | 73 | 73 | 72 | 71 | 69 | 0.0 | -0.4 | -0.2 | 11 | 12 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.6 | 1.9 | 0.0 | 1.2 | 100 | 100 | 100 | 100 | 3 627 | 4 016 | 4 256 | 4 401 | 4 673 | 2.7 | 0.9 | 2.0 | 100 | 100 |
| -2.7 | -7.0 | -4.6 | -6.1 | 37 | 13 | 2.7 | 1.7 | 156 | 98 | 54 | 41 | 41 | -10.4 | -2.8 | -7.6 | 1.3 | 0.9 |
| -4.0 | -100 | n.a. | -100 | 8.4 | 1.8 | - | - | - | - | - | - | - | -100 | n.a. | -100 | - | - |
| 2.7 | -2.6 | -6.0 | -3.9 | 8.3 | 17 | 7.8 | 4.2 | 334 | 274 | 129 | 80 | 66 | -7.2 | -6.5 | -6.9 | 3.0 | 1.4 |
| -0.5 | 0.7 | -1.6 | -0.2 | 32 | 23 | 19 | 16 | 710 | 825 | 866 | 855 | 924 | 2.0 | 0.7 | 1.5 | 20 | 20 |
| 0.5 | 0.5 | 0.2 | 0.4 | 13 | 12 | 9.5 | 9.8 | 348 | 352 | 357 | 361 | 366 | 0.5 | 0.2 | 0.4 | 8.4 | 7.8 |
| 2.0 | 4.7 | 0.1 | 3.0 | 0.1 | 0.2 | 0.4 | 0.4 | 9.7 | 14 | 15 | 15 | 15 | 5.1 | 0.2 | 3.3 | 0.3 | 0.3 |
| 34.2 | 8.6 | 1.1 | 5.7 | 0.0 | 9.1 | 27 | 30 | 879 | 1 082 | 1 285 | 1 351 | 1 417 | 10.2 | 1.0 | 6.7 | 30 | 30 |
| 21.5 | 4.3 | 1.3 | 3.2 | 0.0 | 18 | 26 | 30 | 895 | 1 054 | 1 213 | 1 333 | 1 454 | 5.6 | 1.8 | 4.2 | 29 | 31 |
| 7.6 | 1.0 | 0.2 | 0.7 | 0.0 | 0.2 | 0.2 | 0.2 | 6.7 | 7.0 | 7.2 | 7.4 | 7.6 | 1.4 | 0.6 | 1.1 | 0.2 | 0.2 |
| 6.9 | 2.8 | 0.3 | 1.9 | 0.8 | 6.3 | 7.4 | 7.6 | 281 | 290 | 299 | 305 | 311 | 3.3 | 0.4 | 2.2 | 7.0 | 6.7 |
| n.a. | n.a. | 9.6 | n.a. | - | - | 0.3 | 0.6 | 1.7 | 13 | 25 | 46 | 67 | n.a. | 10.3 | n.a. | 0.6 | 1.4 |
| 10.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.2 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -1.4 | -2.2 | -2.3 | -2.3 | 1 900 | 1 449 | 1 002 | 594 | 289 | -5.3 | -11.7 | -7.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | 34 | 99 | 165 | n.a. | 17.1 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.6 | 1.4 | 1.3 | 1.4 | 17 038 | 18 344 | 19 670 | 21 003 | 22 287 | 1.4 | 1.3 | 1.4 |
| 0.2 | -0.1 | -0.3 | -0.2 | 446 | 442 | 438 | 433 | 427 | -0.1 | -0.3 | -0.2 |
| 1.4 | 1.6 | 1.5 | 1.6 | 38 | 41 | 45 | 48 | 52 | 1.6 | 1.5 | 1.6 |
| -0.6 | -0.6 | -0.7 | -0.7 | 2.6 | 2.4 | 2.3 | 2.2 | 2.2 | -1.2 | -0.4 | -0.9 |
| -2.0 | -2.2 | -2.2 | -2.2 | 68 | 59 | 51 | 45 | 42 | -2.7 | -1.9 | -2.4 |
| -2.9 | -3.6 | -3.5 | -3.6 | 112 | 79 | 51 | 28 | 13 | -6.6 | -12.8 | -8.9 |
| -0.9 | -1.4 | -1.4 | -1.4 | 1.6 | 1.3 | 1.0 | 0.6 | 0.3 | -4.0 | -11.1 | -6.7 |

## Table A43 | Africa

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 354 | 437 | 610 | 813 | 898 | 985 | 1 047 | 1 115 | 1 196 |
| Coal | 74 | 90 | 109 | 103 | 99 | 104 | 111 | 122 | 131 |
| Oil | 85 | 100 | 161 | 215 | 235 | 256 | 283 | 311 | 338 |
| Natural gas | 30 | 47 | 89 | 143 | 167 | 214 | 262 | 319 | 381 |
| Nuclear | 2.2 | 3.4 | 3.2 | 2.2 | 5.6 | 7.8 | 10.0 | 8.8 | 8.8 |
| Hydro | 4.8 | 6.4 | 9.4 | 14 | 18 | 22 | 26 | 32 | 39 |
| Geothermal | 0.3 | 0.4 | 0.9 | 5.2 | 13 | 22 | 27 | 32 | 37 |
| Solar, wind, etc. | 0.0 | 0.0 | 0.3 | 5.0 | 19 | 27 | 35 | 43 | 51 |
| Biomass and waste | 158 | 187 | 237 | 324 | 342 | 333 | 293 | 247 | 210 |
| Hydrogen | - | - | - | - | -0.1 | -0.3 | -0.7 | -0.9 | -1.1 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 247 | 307 | 421 | 564 | 629 | 676 | 698 | 716 | 747 |
| Coal | 20 | 19 | 18 | 21 | 22 | 22 | 23 | 24 | 25 |
| Oil | 70 | 89 | 136 | 188 | 208 | 233 | 260 | 287 | 311 |
| Natural gas | 9.3 | 15 | 28 | 48 | 58 | 66 | 72 | 79 | 85 |
| Electricity | 22 | 31 | 47 | 64 | 82 | 103 | 130 | 161 | 197 |
| Heat | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 |
| Hydrogen | - | - | - | - | - | - | 0.1 | 0.3 | 0.6 |
| Renewables and waste | 126 | 153 | 192 | 243 | 260 | 251 | 212 | 165 | 128 |
| Industry | 55 | 59 | 85 | 98 | 114 | 129 | 145 | 162 | 178 |
| Transport | 38 | 54 | 87 | 131 | 142 | 158 | 176 | 194 | 212 |
| Buildings, etc. | 144 | 179 | 230 | 309 | 345 | 357 | 342 | 322 | 315 |
| Non-energy use | 11 | 15 | 19 | 25 | 28 | 31 | 35 | 38 | 42 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 315 | 442 | 687 | 912 | 1 169 | 1 466 | 1 842 | 2 272 | 2 747 |
| Coal | 164 | 208 | 259 | 226 | 206 | 227 | 255 | 300 | 337 |
| Oil | 40 | 37 | 65 | 73 | 58 | 50 | 42 | 42 | 42 |
| Natural gas | 45 | 107 | 235 | 382 | 440 | 571 | 764 | 989 | 1 245 |
| Nuclear | 8.4 | 13 | 12 | 8.5 | 21 | 30 | 38 | 34 | 34 |
| Hydro | 56 | 75 | 110 | 164 | 209 | 252 | 306 | 372 | 453 |
| Geothermal | 0.3 | 0.4 | 1.1 | 6.0 | 15 | 25 | 31 | 37 | 44 |
| Solar photovoltaics | - | 0.0 | 0.3 | 17 | 141 | 213 | 288 | 360 | 434 |
| Wind | - | 0.2 | 2.4 | 29 | 70 | 88 | 108 | 127 | 147 |
| Concentrated solar power and marine | - | - | - | 3.0 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 |
| Biomass and waste | 0.5 | 1.5 | 2.4 | 2.4 | 3.9 | 4.4 | 4.8 | 5.3 | 5.8 |
| Hydrogen | - | - | - | - | - | - | - | - | - |
| Others | - | 0.1 | 0.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 542 | 672 | 1 039 | 1 270 | 1 366 | 1 547 | 1 756 | 2 007 | 2 254 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 967 | 1 233 | 2 040 | 2 865 | 3 742 | 4 682 | 5 843 | 7 227 | 8 845 |
| Population (million) | 625 | 805 | 1 038 | 1 430 | 1 667 | 1 843 | 2 022 | 2 201 | 2 378 |
| GDP per capita ($2015 thousand) | 1.5 | 1.5 | 2.0 | 2.0 | 2.2 | 2.5 | 2.9 | 3.3 | 3.7 |
| Primary energy consumption per capita (toe/person) | 0.6 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 366 | 354 | 299 | 284 | 240 | 210 | 179 | 154 | 135 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 560 | 544 | 509 | 443 | 365 | 331 | 301 | 278 | 255 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 1.5 | 1.5 | 1.7 | 1.6 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 2.6 | 1.5 | 1.3 | 1.4 | 100 | 100 | 100 | 100 | 853 | 882 | 898 | 921 | 950 | 0.6 | 0.6 | 0.6 | 100 | 100 |
| 1.0 | 0.4 | 1.7 | 0.9 | 21 | 13 | 11 | 11 | 92 | 85 | 79 | 75 | 68 | -1.5 | -1.5 | -1.5 | 8.8 | 7.2 |
| 2.9 | 1.6 | 1.8 | 1.7 | 24 | 26 | 27 | 28 | 223 | 225 | 230 | 227 | 220 | 0.4 | -0.4 | 0.1 | 26 | 23 |
| 4.9 | 3.6 | 3.8 | 3.7 | 8.4 | 18 | 25 | 32 | 166 | 209 | 241 | 270 | 295 | 3.1 | 2.0 | 2.7 | 27 | 31 |
| 0.0 | 9.2 | -1.3 | 5.2 | 0.6 | 0.3 | 1.0 | 0.7 | 5.6 | 14 | 22 | 32 | 45 | 14.4 | 7.4 | 11.7 | 2.4 | 4.7 |
| 3.3 | 3.7 | 4.0 | 3.8 | 1.4 | 1.7 | 2.5 | 3.3 | 18 | 22 | 26 | 32 | 39 | 3.7 | 4.0 | 3.8 | 2.9 | 4.1 |
| 9.2 | 10.1 | 3.5 | 7.6 | 0.1 | 0.6 | 2.5 | 3.1 | 13 | 26 | 31 | 37 | 44 | 11.1 | 3.4 | 8.2 | 3.5 | 4.6 |
| 29.4 | 12.2 | 3.8 | 9.0 | 0.0 | 0.6 | 3.4 | 4.3 | 27 | 41 | 57 | 75 | 94 | 15.4 | 5.0 | 11.5 | 6.4 | 9.8 |
| 2.2 | -0.6 | -3.3 | -1.6 | 45 | 40 | 28 | 18 | 310 | 265 | 219 | 185 | 158 | -2.3 | -3.2 | -2.6 | 24 | 17 |
| n.a. | n.a. | 4.8 | n.a. | - | - | -0.1 | -0.1 | -1.0 | -4.9 | -8.8 | -12 | -13 | n.a. | 3.9 | n.a. | -1.0 | -1.4 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.5 | 1.3 | 0.7 | 1.0 | 100 | 100 | 100 | 100 | 590 | 583 | 572 | 570 | 574 | 0.1 | 0.0 | 0.1 | 100 | 100 |
| 0.2 | 0.6 | 0.7 | 0.6 | 8.1 | 3.7 | 3.3 | 3.3 | 20 | 18 | 17 | 16 | 15 | -1.2 | -1.0 | -1.1 | 3.0 | 2.7 |
| 3.0 | 1.9 | 1.8 | 1.9 | 28 | 33 | 37 | 42 | 202 | 213 | 220 | 222 | 220 | 0.9 | 0.0 | 0.6 | 38 | 38 |
| 5.1 | 2.4 | 1.6 | 2.1 | 3.8 | 8.6 | 10 | 11 | 55 | 58 | 59 | 58 | 57 | 1.1 | -0.3 | 0.6 | 10 | 9.9 |
| 3.3 | 4.3 | 4.2 | 4.3 | 8.9 | 11 | 19 | 26 | 85 | 111 | 138 | 167 | 198 | 4.7 | 3.7 | 4.3 | 24 | 35 |
| n.a. | n.a. | 0.0 | n.a. | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | n.a. | 11.6 | n.a. | 0.0 | 0.0 |
| n.a. | n.a. | 24.0 | n.a. | - | - | 0.0 | 0.1 | 0.0 | 0.4 | 1.3 | 3.3 | 7.4 | n.a. | 18.7 | n.a. | 0.2 | 1.3 |
| 2.0 | -0.8 | -4.9 | -2.3 | 51 | 43 | 30 | 17 | 228 | 183 | 137 | 103 | 76 | -3.3 | -5.8 | -4.2 | 24 | 13 |
| 1.8 | 2.3 | 2.1 | 2.2 | 22 | 17 | 21 | 24 | 108 | 114 | 118 | 121 | 126 | 1.1 | 0.7 | 0.9 | 21 | 22 |
| 3.8 | 1.8 | 1.9 | 1.8 | 15 | 23 | 25 | 28 | 138 | 146 | 152 | 157 | 163 | 0.9 | 0.7 | 0.8 | 27 | 28 |
| 2.4 | 0.6 | -0.8 | 0.1 | 58 | 55 | 49 | 42 | 316 | 293 | 268 | 253 | 244 | -0.8 | -0.9 | -0.9 | 47 | 42 |
| 2.6 | 1.9 | 1.9 | 1.9 | 4.4 | 4.5 | 5.0 | 5.6 | 28 | 31 | 35 | 38 | 42 | 1.9 | 1.9 | 1.9 | 6.1 | 7.3 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 3.3 | 4.2 | 4.1 | 4.2 | 100 | 100 | 100 | 100 | 1 225 | 1 606 | 2 031 | 2 509 | 3 029 | 4.8 | 4.1 | 4.5 | 100 | 100 |
| 1.0 | 0.7 | 2.8 | 1.5 | 52 | 25 | 14 | 12 | 189 | 175 | 165 | 153 | 133 | -1.8 | -2.2 | -2.0 | 8.1 | 4.4 |
| 1.8 | -3.2 | 0.2 | -2.0 | 13 | 8.0 | 2.3 | 1.5 | 40 | 25 | 21 | 15 | 5.2 | -7.0 | -13.2 | -9.3 | 1.0 | 0.2 |
| 6.7 | 4.2 | 5.0 | 4.5 | 14 | 42 | 41 | 45 | 446 | 596 | 759 | 946 | 1 139 | 4.1 | 4.1 | 4.1 | 37 | 38 |
| 0.0 | 9.2 | -1.3 | 5.2 | 2.7 | 0.9 | 2.1 | 1.2 | 21 | 55 | 84 | 121 | 171 | 14.4 | 7.4 | 11.7 | 4.1 | 5.7 |
| 3.3 | 3.7 | 4.0 | 3.8 | 18 | 18 | 17 | 17 | 209 | 252 | 306 | 372 | 453 | 3.7 | 4.0 | 3.8 | 15 | 15 |
| 9.2 | 10.1 | 3.5 | 7.6 | 0.1 | 0.7 | 1.7 | 1.6 | 15 | 30 | 36 | 43 | 51 | 11.1 | 3.4 | 8.2 | 1.8 | 1.7 |
| n.a. | 18.2 | 4.2 | 12.8 | - | 1.8 | 16 | 16 | 225 | 369 | 527 | 689 | 867 | 22.5 | 5.1 | 15.7 | 26 | 29 |
| n.a. | 8.1 | 3.1 | 6.2 | - | 3.2 | 5.8 | 5.3 | 71 | 94 | 120 | 155 | 195 | 8.8 | 5.0 | 7.4 | 5.9 | 6.4 |
| n.a. | 0.6 | 0.6 | 0.6 | - | 0.3 | 0.2 | 0.1 | 3.8 | 4.1 | 4.6 | 5.3 | 6.2 | 2.4 | 3.0 | 2.6 | 0.2 | 0.2 |
| 5.0 | 4.1 | 1.8 | 3.2 | 0.2 | 0.3 | 0.3 | 0.2 | 4.4 | 5.1 | 5.8 | 6.5 | 7.1 | 5.3 | 2.0 | 4.0 | 0.3 | 0.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.2 | 0.1 | 0.1 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.6 | 1.9 | 2.5 | 2.1 | 1 297 | 1 323 | 1 334 | 1 317 | 1 277 | 0.3 | -0.4 | 0.0 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 3.3 | 4.3 | 4.2 | 4.3 | 3 742 | 4 682 | 5 843 | 7 227 | 8 845 | 4.3 | 4.2 | 4.3 |
| 2.5 | 2.1 | 1.6 | 1.9 | 1 667 | 1 843 | 2 022 | 2 201 | 2 378 | 2.1 | 1.6 | 1.9 |
| 0.8 | 2.2 | 2.6 | 2.3 | 2.2 | 2.5 | 2.9 | 3.3 | 3.7 | 2.2 | 2.6 | 2.3 |
| 0.0 | -0.5 | -0.3 | -0.4 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | -1.4 | -1.1 | -1.3 |
| -0.8 | -2.7 | -2.8 | -2.7 | 228 | 188 | 154 | 127 | 107 | -3.5 | -3.5 | -3.5 |
| -0.7 | -2.3 | -1.6 | -2.0 | 346 | 283 | 228 | 182 | 144 | -3.8 | -4.5 | -4.1 |
| 0.1 | 0.4 | 1.2 | 0.7 | 1.5 | 1.5 | 1.5 | 1.4 | 1.3 | -0.3 | -1.0 | -0.6 |

## Table A44 | Middle East

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 223 | 380 | 647 | 899 | 978 | 1 036 | 1 088 | 1 148 | 1 206 |
| Coal | 3.0 | 8.1 | 9.2 | 7.8 | 6.8 | 6.0 | 5.0 | 4.8 | 4.9 |
| Oil | 146 | 224 | 323 | 372 | 377 | 391 | 399 | 405 | 406 |
| Natural gas | 72 | 145 | 311 | 501 | 563 | 604 | 644 | 694 | 748 |
| Nuclear | - | - | - | 10 | 13 | 13 | 13 | 13 | 13 |
| Hydro | 1.0 | 0.7 | 1.5 | 1.7 | 2.4 | 2.6 | 2.6 | 2.7 | 2.8 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar, wind, etc. | 0.4 | 0.7 | 1.3 | 4.5 | 14 | 18 | 23 | 27 | 30 |
| Biomass and waste | 0.5 | 0.5 | 1.0 | 1.4 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 |
| Hydrogen | - | - | - | - | -0.3 | -0.6 | -0.9 | -1.0 | -1.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 158 | 260 | 451 | 610 | 672 | 713 | 748 | 782 | 813 |
| Coal | 0.2 | 0.5 | 0.6 | 2.8 | 3.1 | 3.0 | 3.0 | 2.9 | 2.8 |
| Oil | 108 | 160 | 238 | 272 | 298 | 317 | 333 | 348 | 359 |
| Natural gas | 32 | 66 | 149 | 231 | 250 | 258 | 261 | 262 | 261 |
| Electricity | 17 | 32 | 62 | 101 | 119 | 133 | 149 | 166 | 185 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.3 | 1.0 | 2.1 |
| Renewables and waste | 0.8 | 1.0 | 2.2 | 2.0 | 2.1 | 2.1 | 2.2 | 2.2 | 2.3 |
| Industry | 42 | 64 | 119 | 160 | 183 | 194 | 200 | 205 | 209 |
| Transport | 51 | 75 | 122 | 156 | 165 | 173 | 180 | 186 | 191 |
| Buildings, etc. | 47 | 82 | 136 | 198 | 215 | 226 | 237 | 247 | 257 |
| Non-energy use | 19 | 38 | 75 | 96 | 110 | 120 | 131 | 143 | 155 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 244 | 472 | 888 | 1 502 | 1 713 | 1 898 | 2 103 | 2 344 | 2 600 |
| Coal | 11 | 30 | 35 | 17 | 11 | 6.9 | 2.6 | 1.7 | 2.0 |
| Oil | 108 | 189 | 290 | 362 | 296 | 262 | 224 | 180 | 128 |
| Natural gas | 114 | 246 | 545 | 1 026 | 1 178 | 1 351 | 1 543 | 1 775 | 2 031 |
| Nuclear | - | - | - | 39 | 51 | 51 | 52 | 51 | 51 |
| Hydro | 12 | 8.0 | 18 | 20 | 28 | 30 | 31 | 32 | 33 |
| Geothermal | - | - | - | - | - | - | - | - | - |
| Solar photovoltaics | - | - | 0.1 | 32 | 133 | 176 | 224 | 263 | 297 |
| Wind | 0.0 | 0.0 | 0.2 | 4.7 | 10 | 15 | 20 | 27 | 35 |
| Concentrated solar power and marine | - | - | - | 2.0 | 2.8 | 2.8 | 3.0 | 3.2 | 3.2 |
| Biomass and waste | - | 0.0 | 0.1 | 0.0 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 |
| Hydrogen | - | - | - | - | - | 1.1 | 2.3 | 10 | 18 |
| Others | - | - | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 551 | 922 | 1 524 | 2 054 | 2 157 | 2 259 | 2 341 | 2 442 | 2 533 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 911 | 1 378 | 2 092 | 3 000 | 3 661 | 4 200 | 4 791 | 5 446 | 6 167 |
| Population (million) | 131 | 168 | 217 | 284 | 320 | 342 | 364 | 384 | 404 |
| GDP per capita ($2015 thousand) | 6.9 | 8.2 | 9.6 | 11 | 11 | 12 | 13 | 14 | 15 |
| Primary energy consumption per capita (toe/person) | 1.7 | 2.3 | 3.0 | 3.2 | 3.1 | 3.0 | 3.0 | 3.0 | 3.0 |
| Primary energy consumption per GDP (toe/$2015 million) | 244 | 276 | 309 | 300 | 267 | 247 | 227 | 211 | 195 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 605 | 669 | 728 | 685 | 589 | 538 | 489 | 448 | 411 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.5 | 2.4 | 2.4 | 2.3 | 2.2 | 2.2 | 2.2 | 2.1 | 2.1 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 4.3 | 1.1 | 1.0 | 1.1 | 100 | 100 | 100 | 100 | 950 | 972 | 983 | 1 011 | 1 040 | 0.5 | 0.6 | 0.5 | 100 | 100 |
| 3.0 | -2.6 | -0.1 | -1.7 | 1.3 | 0.9 | 0.5 | 0.4 | 4.9 | 3.6 | 3.2 | 3.4 | 3.5 | -5.1 | 0.8 | -2.9 | 0.3 | 0.3 |
| 2.9 | 0.4 | 0.2 | 0.3 | 66 | 41 | 37 | 34 | 351 | 328 | 298 | 272 | 254 | -1.3 | -1.6 | -1.4 | 30 | 24 |
| 6.1 | 1.5 | 1.5 | 1.5 | 32 | 56 | 59 | 62 | 560 | 607 | 646 | 692 | 720 | 1.5 | 1.1 | 1.4 | 66 | 69 |
| n.a. | 1.6 | 0.0 | 1.0 | - | 1.1 | 1.2 | 1.1 | 13 | 17 | 21 | 23 | 25 | 4.4 | 1.8 | 3.4 | 2.2 | 2.4 |
| 1.5 | 2.7 | 0.6 | 1.9 | 0.5 | 0.2 | 0.2 | 0.2 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.6 | 0.6 | 1.9 | 0.3 | 0.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 7.5 | 10.0 | 3.0 | 7.3 | 0.2 | 0.5 | 2.1 | 2.5 | 20 | 30 | 42 | 57 | 74 | 14.1 | 5.6 | 10.9 | 4.3 | 7.1 |
| 3.4 | 1.1 | 0.9 | 1.0 | 0.2 | 0.2 | 0.2 | 0.2 | 1.7 | 1.8 | 2.0 | 2.4 | 2.9 | 2.1 | 3.7 | 2.7 | 0.2 | 0.3 |
| n.a. | n.a. | 1.4 | n.a. | - | - | -0.1 | -0.1 | -3.8 | -18 | -32 | -41 | -42 | n.a. | 2.6 | n.a. | -3.3 | -4.0 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.2 | 1.2 | 0.8 | 1.1 | 100 | 100 | 100 | 100 | 655 | 662 | 656 | 654 | 657 | 0.4 | 0.0 | 0.3 | 100 | 100 |
| 8.5 | 0.4 | -0.4 | 0.1 | 0.1 | 0.5 | 0.4 | 0.3 | 2.1 | 1.6 | 1.5 | 1.5 | 1.4 | -3.5 | -0.5 | -2.4 | 0.2 | 0.2 |
| 2.8 | 1.2 | 0.8 | 1.0 | 68 | 45 | 45 | 44 | 290 | 291 | 284 | 273 | 263 | 0.2 | -0.8 | -0.1 | 43 | 40 |
| 6.2 | 0.7 | 0.0 | 0.5 | 20 | 38 | 35 | 32 | 239 | 224 | 201 | 177 | 155 | -0.8 | -2.6 | -1.5 | 31 | 24 |
| 5.5 | 2.3 | 2.2 | 2.2 | 11 | 17 | 20 | 23 | 122 | 141 | 162 | 189 | 215 | 2.8 | 2.9 | 2.8 | 25 | 33 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | 22.1 | n.a. | - | - | 0.0 | 0.3 | 0.0 | 1.9 | 5.3 | 10 | 19 | n.a. | 13.4 | n.a. | 0.8 | 2.8 |
| 2.9 | 0.6 | 0.7 | 0.7 | 0.5 | 0.3 | 0.3 | 0.3 | 2.1 | 2.2 | 2.4 | 2.8 | 3.3 | 1.2 | 3.1 | 1.9 | 0.4 | 0.5 |
| 4.1 | 1.3 | 0.4 | 1.0 | 27 | 26 | 27 | 26 | 174 | 169 | 159 | 147 | 138 | -0.1 | -1.4 | -0.5 | 24 | 21 |
| 3.5 | 0.8 | 0.6 | 0.8 | 32 | 26 | 24 | 24 | 160 | 156 | 149 | 142 | 137 | -0.3 | -0.8 | -0.5 | 23 | 21 |
| 4.5 | 1.1 | 0.8 | 1.0 | 29 | 32 | 32 | 32 | 212 | 216 | 217 | 223 | 227 | 0.6 | 0.4 | 0.5 | 33 | 35 |
| 5.1 | 1.9 | 1.7 | 1.8 | 12 | 16 | 18 | 19 | 110 | 120 | 131 | 143 | 155 | 1.9 | 1.7 | 1.8 | 20 | 24 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 5.7 | 2.0 | 2.1 | 2.1 | 100 | 100 | 100 | 100 | 1 786 | 2 073 | 2 406 | 2 886 | 3 382 | 2.8 | 3.5 | 3.1 | 100 | 100 |
| 1.4 | -10.5 | -2.3 | -7.5 | 4.3 | 1.1 | 0.1 | 0.1 | 7.0 | 2.9 | 1.4 | 1.8 | 2.2 | -13.6 | 4.5 | -7.3 | 0.1 | 0.1 |
| 3.7 | -2.8 | -5.4 | -3.8 | 44 | 24 | 11 | 4.9 | 240 | 163 | 88 | 53 | 44 | -8.0 | -6.7 | -7.5 | 3.7 | 1.3 |
| 6.9 | 2.4 | 2.8 | 2.6 | 47 | 68 | 73 | 78 | 1 245 | 1 478 | 1 720 | 2 047 | 2 342 | 3.1 | 3.1 | 3.1 | 72 | 69 |
| n.a. | 1.6 | 0.0 | 1.0 | - | 2.6 | 2.5 | 2.0 | 51 | 63 | 81 | 89 | 97 | 4.4 | 1.8 | 3.4 | 3.4 | 2.9 |
| 1.5 | 2.7 | 0.6 | 1.9 | 4.9 | 1.3 | 1.5 | 1.3 | 28 | 30 | 31 | 32 | 33 | 2.6 | 0.6 | 1.9 | 1.3 | 1.0 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | 12.2 | 2.9 | 8.6 | - | 2.1 | 11 | 11 | 199 | 308 | 441 | 586 | 748 | 16.7 | 5.4 | 12.4 | 18 | 22 |
| 29.2 | 8.9 | 5.5 | 7.6 | 0.0 | 0.3 | 1.0 | 1.3 | 11 | 19 | 31 | 53 | 80 | 11.7 | 10.0 | 11.1 | 1.3 | 2.4 |
| n.a. | 2.3 | 0.8 | 1.7 | - | 0.1 | 0.1 | 0.1 | 3.0 | 3.5 | 3.9 | 4.7 | 5.6 | 4.0 | 3.6 | 3.8 | 0.2 | 0.2 |
| n.a. | 27.4 | 1.5 | 17.1 | - | 0.0 | 0.1 | 0.1 | 1.2 | 1.4 | 1.6 | 1.7 | 1.8 | 29.2 | 1.6 | 18.2 | 0.1 | 0.1 |
| n.a. | n.a. | 23.2 | n.a. | - | - | 0.1 | 0.7 | - | 2.9 | 5.8 | 17 | 28 | n.a. | 17.2 | n.a. | 0.2 | 0.8 |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.1 | 0.8 | 0.8 | 0.8 | 2 055 | 1 958 | 1 819 | 1 646 | 1 476 | -0.7 | -2.1 | -1.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | 34 | 78 | n.a. | n.a. | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 3.7 | 2.8 | 2.6 | 2.7 | 3 661 | 4 200 | 4 791 | 5 446 | 6 167 | 2.8 | 2.6 | 2.7 |
| 2.4 | 1.5 | 1.0 | 1.3 | 320 | 342 | 364 | 384 | 404 | 1.5 | 1.0 | 1.3 |
| 1.3 | 1.3 | 1.5 | 1.4 | 11 | 12 | 13 | 14 | 15 | 1.3 | 1.5 | 1.4 |
| 1.9 | -0.3 | 0.0 | -0.2 | 3.0 | 2.8 | 2.7 | 2.6 | 2.6 | -0.9 | -0.5 | -0.8 |
| 0.6 | -1.6 | -1.5 | -1.6 | 259 | 231 | 205 | 186 | 169 | -2.2 | -1.9 | -2.1 |
| 0.4 | -2.0 | -1.7 | -1.9 | 561 | 466 | 380 | 302 | 239 | -3.4 | -4.5 | -3.8 |
| -0.2 | -0.4 | -0.2 | -0.3 | 2.2 | 2.0 | 1.9 | 1.6 | 1.4 | -1.2 | -2.6 | -1.8 |

## Table A45 | Oceania

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 99 | 125 | 145 | 150 | 154 | 152 | 151 | 149 | 148 |
| Coal | 36 | 49 | 52 | 36 | 26 | 23 | 21 | 19 | 18 |
| Oil | 35 | 40 | 48 | 53 | 61 | 59 | 56 | 53 | 49 |
| Natural gas | 19 | 24 | 32 | 39 | 38 | 39 | 39 | 40 | 41 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 3.2 | 3.5 | 3.3 | 3.6 | 3.8 | 3.8 | 3.9 | 4.0 | 4.2 |
| Geothermal | 1.5 | 2.0 | 3.3 | 4.9 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 |
| Solar, wind, etc. | 0.1 | 0.1 | 0.9 | 7.2 | 13 | 16 | 19 | 21 | 24 |
| Biomass and waste | 4.8 | 6.1 | 6.1 | 5.9 | 6.0 | 6.0 | 6.1 | 6.0 | 6.0 |
| Hydrogen | - | - | - | - | -0.1 | -0.1 | -0.1 | -0.1 | 0.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 66 | 82 | 90 | 95 | 98 | 99 | 99 | 99 | 99 |
| Coal | 5.2 | 4.7 | 3.1 | 3.0 | 3.2 | 3.1 | 2.9 | 2.8 | 2.6 |
| Oil | 33 | 40 | 45 | 49 | 49 | 48 | 47 | 44 | 42 |
| Natural gas | 10 | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 15 |
| Electricity | 14 | 18 | 22 | 23 | 25 | 27 | 29 | 32 | 34 |
| Heat | - | - | - | - | - | - | - | - | - |
| Hydrogen | - | - | - | - | - | - | 0.0 | 0.1 | 0.2 |
| Renewables and waste | 3.8 | 5.2 | 5.3 | 5.4 | 5.3 | 5.4 | 5.3 | 5.3 | 5.2 |
| Industry | 23 | 28 | 26 | 27 | 28 | 29 | 30 | 30 | 31 |
| Transport | 24 | 30 | 35 | 38 | 39 | 38 | 37 | 36 | 34 |
| Buildings, etc. | 15 | 19 | 23 | 25 | 26 | 26 | 27 | 28 | 28 |
| Non-energy use | 4.6 | 6.1 | 5.9 | 5.6 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 187 | 249 | 298 | 318 | 356 | 383 | 412 | 445 | 480 |
| Coal | 122 | 176 | 182 | 129 | 100 | 89 | 80 | 77 | 74 |
| Oil | 3.6 | 1.8 | 6.1 | 4.9 | 3.5 | 3.0 | 2.5 | 2.2 | 1.9 |
| Natural gas | 20 | 26 | 54 | 53 | 49 | 51 | 52 | 56 | 60 |
| Nuclear | - | - | - | - | - | - | - | - | - |
| Hydro | 37 | 41 | 38 | 42 | 44 | 45 | 46 | 47 | 49 |
| Geothermal | 2.1 | 2.9 | 5.9 | 8.2 | 11 | 11 | 11 | 11 | 11 |
| Solar photovoltaics | - | 0.0 | 0.4 | 42 | 73 | 93 | 114 | 134 | 153 |
| Wind | - | 0.2 | 6.7 | 35 | 70 | 82 | 95 | 106 | 117 |
| Concentrated solar power and marine | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Biomass and waste | 1.6 | 2.0 | 3.5 | 3.8 | 4.7 | 5.0 | 5.2 | 5.4 | 5.5 |
| Hydrogen | - | - | - | - | 1.3 | 4.0 | 6.7 | 7.5 | 8.4 |
| Others | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 280 | 360 | 422 | 383 | 357 | 340 | 324 | 310 | 296 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 656 | 907 | 1 220 | 1 704 | 1 953 | 2 177 | 2 417 | 2 676 | 2 950 |
| Population (million) | 20 | 23 | 26 | 32 | 34 | 35 | 36 | 37 | 39 |
| GDP per capita ($2015 thousand) | 32 | 40 | 46 | 53 | 58 | 62 | 67 | 71 | 76 |
| Primary energy consumption per capita (toe/person) | 4.9 | 5.5 | 5.5 | 4.7 | 4.5 | 4.3 | 4.2 | 4.0 | 3.8 |
| Primary energy consumption per GDP (toe/$2015 million) | 151 | 138 | 119 | 88 | 79 | 70 | 62 | 56 | 50 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 426 | 397 | 345 | 225 | 183 | 156 | 134 | 116 | 100 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.8 | 2.9 | 2.9 | 2.5 | 2.3 | 2.2 | 2.2 | 2.1 | 2.0 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 1.3 | 0.0 | -0.2 | -0.1 | 100 | 100 | 100 | 100 | 153 | 144 | 135 | 133 | 131 | -0.6 | -0.3 | -0.5 | 100 | 100 |
| 0.0 | -3.2 | -1.3 | -2.5 | 36 | 24 | 14 | 12 | 27 | 29 | 31 | 35 | 34 | -0.8 | 1.0 | -0.2 | 23 | 26 |
| 1.3 | 0.3 | -1.3 | -0.3 | 35 | 36 | 37 | 33 | 57 | 48 | 37 | 27 | 18 | -2.1 | -6.9 | -3.9 | 28 | 14 |
| 2.3 | -0.1 | 0.4 | 0.1 | 19 | 26 | 26 | 27 | 39 | 38 | 36 | 35 | 34 | -0.6 | -0.4 | -0.5 | 27 | 26 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 0.4 | 0.4 | 0.7 | 0.5 | 3.2 | 2.4 | 2.6 | 2.8 | 3.8 | 3.9 | 4.0 | 4.2 | 4.4 | 0.6 | 0.9 | 0.7 | 3.0 | 3.4 |
| 3.7 | 1.5 | 0.0 | 0.9 | 1.5 | 3.3 | 4.2 | 4.2 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 1.5 | 0.0 | 0.9 | 4.7 | 4.8 |
| 13.0 | 5.7 | 2.5 | 4.5 | 0.1 | 4.8 | 12 | 16 | 14 | 17 | 22 | 29 | 36 | 6.8 | 5.0 | 6.1 | 16 | 27 |
| 0.6 | 0.2 | -0.1 | 0.1 | 4.9 | 3.9 | 4.0 | 4.1 | 6.0 | 5.8 | 5.6 | 5.4 | 5.3 | -0.3 | -0.6 | -0.4 | 4.2 | 4.1 |
| n.a. | n.a. | n.a. | n.a. | - | - | -0.1 | 0.0 | -0.9 | -4.0 | -7.0 | -8.7 | -8.1 | n.a. | 1.5 | n.a. | -5.2 | -6.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) 1990 | 2023 | 2040 | 2050 | (Mtoe) 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) 2040 | 2050 |
| 1.1 | 0.3 | 0.0 | 0.2 | 100 | 100 | 100 | 100 | 95 | 90 | 84 | 81 | 79 | -0.7 | -0.5 | -0.7 | 100 | 100 |
| -1.7 | -0.2 | -1.0 | -0.5 | 7.9 | 3.2 | 2.9 | 2.6 | 2.8 | 2.2 | 1.7 | 1.4 | 1.2 | -3.2 | -3.6 | -3.3 | 2.1 | 1.5 |
| 1.2 | -0.4 | -1.0 | -0.6 | 50 | 52 | 47 | 42 | 47 | 41 | 35 | 28 | 23 | -2.1 | -3.9 | -2.8 | 41 | 29 |
| 1.0 | 0.2 | -0.3 | 0.0 | 16 | 15 | 15 | 15 | 14 | 13 | 11 | 9.1 | 7.1 | -1.5 | -4.3 | -2.6 | 13 | 9.0 |
| 1.6 | 1.6 | 1.6 | 1.6 | 21 | 24 | 30 | 35 | 26 | 28 | 31 | 35 | 40 | 1.8 | 2.7 | 2.1 | 37 | 50 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| n.a. | n.a. | 21.8 | n.a. | - | - | 0.0 | 0.2 | 0.0 | 0.3 | 0.8 | 1.7 | 3.6 | n.a. | 15.7 | n.a. | 1.0 | 4.5 |
| 1.1 | -0.1 | -0.2 | -0.1 | 5.8 | 5.7 | 5.4 | 5.3 | 5.3 | 5.1 | 4.8 | 4.5 | 4.4 | -0.7 | -0.9 | -0.8 | 5.8 | 5.5 |
| 0.5 | 0.6 | 0.2 | 0.5 | 34 | 28 | 30 | 31 | 27 | 26 | 24 | 22 | 21 | -0.7 | -1.5 | -1.0 | 29 | 26 |
| 1.4 | -0.2 | -0.7 | -0.4 | 36 | 40 | 37 | 35 | 37 | 33 | 30 | 26 | 24 | -1.5 | -2.0 | -1.6 | 35 | 31 |
| 1.6 | 0.5 | 0.5 | 0.5 | 22 | 26 | 27 | 29 | 25 | 25 | 25 | 27 | 29 | 0.0 | 1.6 | 0.6 | 29 | 36 |
| 0.6 | 0.1 | 0.0 | 0.0 | 6.9 | 5.9 | 5.7 | 5.8 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 0.1 | 0.0 | 0.0 | 6.8 | 7.2 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) 1990 | 2023 | 2040 | 2050 | (TWh) 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) 2040 | 2050 |
| 1.6 | 1.5 | 1.5 | 1.5 | 100 | 100 | 100 | 100 | 365 | 410 | 460 | 565 | 662 | 2.2 | 3.7 | 2.7 | 100 | 100 |
| 0.2 | -2.7 | -0.8 | -2.0 | 65 | 40 | 20 | 15 | 96 | 86 | 76 | 82 | 81 | -3.1 | 0.7 | -1.7 | 16 | 12 |
| 1.0 | -3.9 | -2.6 | -3.4 | 1.9 | 1.5 | 0.6 | 0.4 | 3.1 | 2.1 | 1.3 | 0.7 | 0.0 | -7.5 | -35.6 | -19.1 | 0.3 | 0.0 |
| 3.0 | -0.1 | 1.5 | 0.5 | 11 | 17 | 13 | 13 | 53 | 60 | 64 | 81 | 94 | 1.1 | 4.0 | 2.1 | 14 | 14 |
| n.a. | n.a. | n.a. | n.a. | - | - | - | - | - | - | - | - | - | n.a. | n.a. | n.a. | - | - |
| 0.4 | 0.4 | 0.7 | 0.5 | 20 | 13 | 11 | 10 | 44 | 45 | 47 | 49 | 51 | 0.6 | 0.9 | 0.7 | 10 | 7.7 |
| 4.2 | 1.5 | 0.0 | 1.0 | 1.1 | 2.6 | 2.6 | 2.2 | 11 | 11 | 11 | 11 | 11 | 1.5 | 0.0 | 1.0 | 2.3 | 1.6 |
| n.a. | 6.0 | 3.0 | 4.9 | - | 13 | 28 | 32 | 81 | 110 | 143 | 188 | 233 | 7.4 | 5.0 | 6.5 | 31 | 35 |
| n.a. | 6.1 | 2.1 | 4.6 | - | 11 | 23 | 24 | 71 | 86 | 105 | 140 | 176 | 6.8 | 5.3 | 6.2 | 23 | 27 |
| n.a. | 6.1 | 0.0 | 3.8 | - | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 22.1 | 8.6 | 17.0 | 0.0 | 0.0 |
| 2.7 | 1.8 | 0.5 | 1.4 | 0.9 | 1.2 | 1.3 | 1.1 | 4.7 | 5.0 | 5.3 | 5.6 | 5.9 | 2.0 | 0.9 | 1.6 | 1.2 | 0.9 |
| n.a. | n.a. | 2.3 | n.a. | - | - | 1.6 | 1.7 | 1.4 | 4.2 | 7.0 | 7.9 | 8.8 | n.a. | 2.3 | n.a. | 1.5 | 1.3 |
| -1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 1.0 | -1.0 | -0.9 | -1.0 | 347 | 268 | 196 | 108 | 25 | -3.9 | -18.5 | -9.6 |
| n.a. | n.a. | n.a. | n.a. | - | - | 0.3 | 18 | 45 | n.a. | 62.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| 2.9 | 2.1 | 2.0 | 2.1 | 1 953 | 2 177 | 2 417 | 2 676 | 2 950 | 2.1 | 2.0 | 2.1 |
| 1.4 | 0.8 | 0.6 | 0.7 | 34 | 35 | 36 | 37 | 39 | 0.8 | 0.6 | 0.7 |
| 1.5 | 1.3 | 1.4 | 1.3 | 58 | 62 | 67 | 71 | 76 | 1.3 | 1.4 | 1.3 |
| -0.1 | -0.7 | -0.8 | -0.8 | 4.5 | 4.1 | 3.7 | 3.6 | 3.4 | -1.4 | -0.9 | -1.2 |
| -1.6 | -2.0 | -2.1 | -2.1 | 78 | 66 | 56 | 50 | 44 | -2.7 | -2.3 | -2.5 |
| -1.9 | -3.0 | -2.9 | -2.9 | 178 | 123 | 81 | 40 | 8.6 | -5.8 | -20.1 | -11.4 |
| -0.3 | -1.0 | -0.7 | -0.9 | 2.3 | 1.9 | 1.5 | 0.8 | 0.2 | -3.3 | -18.3 | -9.1 |

## Table A46 | Advanced Economies

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 4 467 | 5 233 | 5 355 | 4 943 | 4 722 | 4 613 | 4 474 | 4 330 | 4 210 |
| Coal | 1 087 | 1 115 | 1 109 | 622 | 433 | 368 | 320 | 286 | 254 |
| Oil | 1 827 | 2 070 | 1 919 | 1 733 | 1 577 | 1 477 | 1 371 | 1 258 | 1 145 |
| Natural gas | 827 | 1 136 | 1 287 | 1 457 | 1 417 | 1 398 | 1 358 | 1 316 | 1 277 |
| Nuclear | 463 | 596 | 606 | 479 | 500 | 508 | 498 | 470 | 458 |
| Hydro | 100 | 111 | 112 | 111 | 123 | 125 | 127 | 128 | 130 |
| Geothermal | 22 | 25 | 25 | 41 | 51 | 62 | 64 | 65 | 66 |
| Solar, wind, etc. | 2.1 | 6.1 | 31 | 167 | 275 | 335 | 401 | 477 | 556 |
| Biomass and waste | 139 | 172 | 262 | 331 | 349 | 344 | 339 | 330 | 321 |
| Hydrogen | - | - | - | - | 0.7 | 1.2 | 0.7 | 2.7 | 5.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 3 059 | 3 579 | 3 649 | 3 523 | 3 429 | 3 345 | 3 240 | 3 135 | 3 039 |
| Coal | 230 | 137 | 130 | 82 | 79 | 72 | 65 | 60 | 55 |
| Oil | 1 561 | 1 812 | 1 740 | 1 610 | 1 486 | 1 396 | 1 300 | 1 197 | 1 095 |
| Natural gas | 578 | 732 | 717 | 730 | 725 | 705 | 673 | 636 | 600 |
| Electricity | 553 | 715 | 809 | 812 | 856 | 899 | 941 | 993 | 1 050 |
| Heat | 48 | 52 | 66 | 57 | 57 | 55 | 52 | 49 | 46 |
| Hydrogen | - | - | - | - | 0.1 | 0.1 | 1.0 | 3.3 | 6.5 |
| Renewables and waste | 89 | 131 | 186 | 232 | 226 | 218 | 207 | 196 | 186 |
| Industry | 827 | 905 | 805 | 772 | 773 | 767 | 751 | 731 | 711 |
| Transport | 921 | 1 121 | 1 151 | 1 182 | 1 082 | 1 008 | 937 | 865 | 796 |
| Buildings, etc. | 1 024 | 1 185 | 1 311 | 1 201 | 1 188 | 1 178 | 1 156 | 1 140 | 1 130 |
| Non-energy use | 288 | 368 | 382 | 369 | 385 | 391 | 396 | 399 | 401 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 7 673 | 9 704 | 10 843 | 10 818 | 11 496 | 12 092 | 12 704 | 13 450 | 14 272 |
| Coal | 3 136 | 3 835 | 3 813 | 1 965 | 1 224 | 979 | 798 | 677 | 553 |
| Oil | 667 | 539 | 274 | 131 | 74 | 59 | 47 | 37 | 28 |
| Natural gas | 766 | 1 528 | 2 501 | 3 312 | 3 170 | 3 206 | 3 175 | 3 186 | 3 177 |
| Nuclear | 1 776 | 2 288 | 2 324 | 1 837 | 1 919 | 1 951 | 1 912 | 1 806 | 1 759 |
| Hydro | 1 158 | 1 293 | 1 302 | 1 291 | 1 435 | 1 454 | 1 472 | 1 489 | 1 506 |
| Geothermal | 23 | 27 | 37 | 54 | 69 | 85 | 89 | 90 | 92 |
| Solar photovoltaics | 0.1 | 0.7 | 31 | 685 | 1 545 | 1 997 | 2 515 | 3 064 | 3 627 |
| Wind | 3.8 | 29 | 269 | 1 119 | 1 519 | 1 752 | 2 007 | 2 339 | 2 696 |
| Concentrated solar power and marine | 1.2 | 1.1 | 2.1 | 9.2 | 8.3 | 8.7 | 9.0 | 10.0 | 11 |
| Biomass and waste | 122 | 143 | 258 | 375 | 475 | 498 | 537 | 554 | 571 |
| Hydrogen | - | - | - | - | 17 | 60 | 104 | 158 | 212 |
| Others | 20 | 22 | 33 | 40 | 40 | 40 | 40 | 40 | 40 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 10 763 | 12 180 | 11 931 | 10 038 | 8 647 | 8 037 | 7 424 | 6 828 | 6 256 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 27 250 | 35 877 | 42 387 | 54 216 | 60 965 | 66 212 | 71 633 | 77 139 | 82 582 |
| Population (million) | 1 000 | 1 072 | 1 140 | 1 209 | 1 219 | 1 223 | 1 223 | 1 221 | 1 215 |
| GDP per capita ($2015 thousand) | 27 | 33 | 37 | 45 | 50 | 54 | 59 | 63 | 68 |
| Primary energy consumption per capita (toe/person) | 4.5 | 4.9 | 4.7 | 4.1 | 3.9 | 3.8 | 3.7 | 3.5 | 3.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 164 | 146 | 126 | 91 | 77 | 70 | 62 | 56 | 51 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 395 | 339 | 281 | 185 | 142 | 121 | 104 | 89 | 76 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.3 | 2.2 | 2.0 | 1.8 | 1.7 | 1.7 | 1.6 | 1.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 0.3 | -0.6 | -0.6 | -0.6 | 100 | 100 | 100 | 100 | 4 614 | 4 359 | 4 061 | 3 863 | 3 734 | -1.2 | -0.8 | -1.0 | 100 | 100 |
| -1.7 | -3.8 | -2.3 | -3.3 | 24 | 13 | 7.1 | 6.0 | 362 | 265 | 209 | 189 | 175 | -6.2 | -1.7 | -4.6 | 5.1 | 4.7 |
| -0.2 | -1.4 | -1.8 | -1.5 | 41 | 35 | 31 | 27 | 1 475 | 1 226 | 974 | 728 | 540 | -3.3 | -5.7 | -4.2 | 24 | 14 |
| 1.7 | -0.4 | -0.6 | -0.5 | 19 | 29 | 30 | 30 | 1 381 | 1 311 | 1 152 | 1 009 | 859 | -1.4 | -2.9 | -1.9 | 28 | 23 |
| 0.1 | 0.2 | -0.8 | -0.2 | 10 | 9.7 | 11 | 11 | 545 | 582 | 623 | 643 | 675 | 1.6 | 0.8 | 1.3 | 15 | 18 |
| 0.3 | 0.8 | 0.2 | 0.6 | 2.2 | 2.2 | 2.8 | 3.1 | 124 | 126 | 127 | 129 | 130 | 0.8 | 0.2 | 0.6 | 3.1 | 3.5 |
| 1.9 | 2.7 | 0.3 | 1.8 | 0.5 | 0.8 | 1.4 | 1.6 | 51 | 65 | 68 | 69 | 70 | 3.0 | 0.3 | 2.0 | 1.7 | 1.9 |
| 14.3 | 5.3 | 3.3 | 4.6 | 0.0 | 3.4 | 9.0 | 13 | 303 | 412 | 536 | 710 | 880 | 7.1 | 5.1 | 6.3 | 13 | 24 |
| 2.7 | 0.1 | -0.5 | -0.1 | 3.1 | 6.7 | 7.6 | 7.6 | 374 | 366 | 360 | 354 | 350 | 0.5 | -0.3 | 0.2 | 8.9 | 9.4 |
| n.a. | n.a. | 21.5 | n.a. | - | - | 0.0 | 0.1 | 5.1 | 12 | 16 | 36 | 58 | n.a. | 13.7 | n.a. | 0.4 | 1.6 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.4 | -0.5 | -0.6 | -0.5 | 100 | 100 | 100 | 100 | 3 326 | 3 070 | 2 787 | 2 565 | 2 411 | -1.4 | -1.4 | -1.4 | 100 | 100 |
| -3.1 | -1.4 | -1.7 | -1.5 | 7.5 | 2.3 | 2.0 | 1.8 | 69 | 53 | 43 | 35 | 30 | -3.8 | -3.4 | -3.7 | 1.5 | 1.3 |
| 0.1 | -1.3 | -1.7 | -1.4 | 51 | 46 | 40 | 36 | 1 403 | 1 190 | 969 | 777 | 624 | -2.9 | -4.3 | -3.5 | 35 | 26 |
| 0.7 | -0.5 | -1.1 | -0.7 | 19 | 21 | 21 | 20 | 686 | 599 | 492 | 388 | 292 | -2.3 | -5.1 | -3.3 | 18 | 12 |
| 1.2 | 0.9 | 1.1 | 1.0 | 18 | 23 | 29 | 35 | 877 | 939 | 989 | 1 051 | 1 093 | 1.2 | 1.0 | 1.1 | 35 | 45 |
| 0.5 | -0.5 | -1.3 | -0.8 | 1.6 | 1.6 | 1.6 | 1.5 | 55 | 52 | 47 | 41 | 37 | -1.2 | -2.4 | -1.6 | 1.7 | 1.5 |
| n.a. | n.a. | 20.6 | n.a. | - | - | 0.0 | 0.2 | 0.3 | 14 | 36 | 69 | 138 | n.a. | 14.6 | n.a. | 1.3 | 5.7 |
| 3.0 | -0.7 | -1.1 | -0.8 | 2.9 | 6.6 | 6.4 | 6.1 | 235 | 223 | 212 | 204 | 198 | -0.5 | -0.7 | -0.6 | 7.6 | 8.2 |
| -0.2 | -0.2 | -0.5 | -0.3 | 27 | 22 | 23 | 23 | 743 | 689 | 619 | 556 | 508 | -1.3 | -1.9 | -1.5 | 22 | 21 |
| 0.8 | -1.4 | -1.6 | -1.5 | 30 | 34 | 29 | 26 | 1 030 | 873 | 728 | 615 | 550 | -2.8 | -2.8 | -2.8 | 26 | 23 |
| 0.5 | -0.2 | -0.2 | -0.2 | 33 | 34 | 36 | 37 | 1 168 | 1 117 | 1 044 | 995 | 952 | -0.8 | -0.9 | -0.9 | 37 | 39 |
| 0.8 | 0.4 | 0.1 | 0.3 | 9.4 | 10 | 12 | 13 | 385 | 391 | 396 | 399 | 401 | 0.4 | 0.1 | 0.3 | 14 | 17 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 1.0 | 0.9 | 1.2 | 1.0 | 100 | 100 | 100 | 100 | 11 822 | 13 056 | 14 207 | 16 100 | 17 897 | 1.6 | 2.3 | 1.9 | 100 | 100 |
| -1.4 | -5.2 | -3.6 | -4.6 | 41 | 18 | 6.3 | 3.9 | 940 | 560 | 337 | 265 | 231 | -9.9 | -3.7 | -7.6 | 2.4 | 1.3 |
| -4.8 | -5.8 | -5.2 | -5.6 | 8.7 | 1.2 | 0.4 | 0.2 | 63 | 49 | 39 | 29 | 18 | -6.8 | -7.3 | -7.0 | 0.3 | 0.1 |
| 4.5 | -0.2 | 0.0 | -0.2 | 10.0 | 31 | 25 | 22 | 3 208 | 3 276 | 2 914 | 2 654 | 2 262 | -0.7 | -2.5 | -1.4 | 21 | 13 |
| 0.1 | 0.2 | -0.8 | -0.2 | 23 | 17 | 15 | 12 | 2 090 | 2 232 | 2 392 | 2 467 | 2 589 | 1.6 | 0.8 | 1.3 | 17 | 14 |
| 0.3 | 0.8 | 0.2 | 0.6 | 15 | 12 | 12 | 11 | 1 441 | 1 461 | 1 481 | 1 499 | 1 516 | 0.8 | 0.2 | 0.6 | 10 | 8.5 |
| 2.6 | 2.9 | 0.4 | 2.0 | 0.3 | 0.5 | 0.7 | 0.6 | 69 | 91 | 94 | 97 | 99 | 3.3 | 0.5 | 2.2 | 0.7 | 0.6 |
| 31.2 | 7.9 | 3.7 | 6.4 | 0.0 | 6.3 | 20 | 25 | 1 801 | 2 563 | 3 415 | 4 438 | 5 392 | 9.9 | 4.7 | 7.9 | 24 | 30 |
| 18.8 | 3.5 | 3.0 | 3.3 | 0.1 | 10 | 16 | 19 | 1 593 | 2 087 | 2 679 | 3 674 | 4 688 | 5.3 | 5.8 | 5.4 | 19 | 26 |
| 6.4 | -0.1 | 1.8 | 0.6 | 0.0 | 0.1 | 0.1 | 0.1 | 8.9 | 10 | 12 | 16 | 20 | 1.7 | 5.1 | 2.9 | 0.1 | 0.1 |
| 3.5 | 2.1 | 0.6 | 1.6 | 1.6 | 3.5 | 4.2 | 4.0 | 544 | 577 | 613 | 635 | 657 | 2.9 | 0.7 | 2.1 | 4.3 | 3.7 |
| n.a. | n.a. | 7.4 | n.a. | - | - | 0.8 | 1.5 | 26 | 108 | 190 | 288 | 385 | n.a. | 7.4 | n.a. | 1.3 | 2.2 |
| 2.2 | 0.0 | 0.0 | 0.0 | 0.3 | 0.4 | 0.3 | 0.3 | 40 | 40 | 40 | 40 | 40 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.2 | -1.8 | -1.7 | -1.7 | 7 957 | 6 208 | 4 475 | 2 697 | 1 281 | -4.6 | -11.8 | -7.3 |
| n.a. | n.a. | n.a. | n.a. | - | - | 89 | 332 | 615 | n.a. | 21.3 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.1 | 1.7 | 1.4 | 1.6 | 60 965 | 66 212 | 71 633 | 77 139 | 82 582 | 1.7 | 1.4 | 1.6 |
| 0.6 | 0.1 | -0.1 | 0.0 | 1 219 | 1 223 | 1 223 | 1 221 | 1 215 | 0.1 | -0.1 | 0.0 |
| 1.5 | 1.6 | 1.5 | 1.6 | 50 | 54 | 59 | 63 | 68 | 1.6 | 1.5 | 1.6 |
| -0.3 | -0.7 | -0.5 | -0.6 | 3.8 | 3.6 | 3.3 | 3.2 | 3.1 | -1.2 | -0.8 | -1.1 |
| -1.8 | -2.2 | -2.0 | -2.1 | 76 | 66 | 57 | 50 | 45 | -2.8 | -2.2 | -2.6 |
| -2.3 | -3.4 | -3.1 | -3.3 | 131 | 94 | 62 | 35 | 16 | -6.2 | -13.0 | -8.8 |
| -0.5 | -1.2 | -1.1 | -1.2 | 1.7 | 1.4 | 1.1 | 0.7 | 0.3 | -3.5 | -11.0 | -6.4 |

## Table A47 | Group of Seven

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 3 490 | 4 024 | 3 945 | 3 555 | 3 365 | 3 270 | 3 161 | 3 050 | 2 974 |
| Coal | 787 | 811 | 776 | 367 | 221 | 178 | 148 | 132 | 118 |
| Oil | 1 447 | 1 578 | 1 413 | 1 247 | 1 104 | 1 025 | 942 | 856 | 771 |
| Natural gas | 704 | 941 | 992 | 1 162 | 1 132 | 1 115 | 1 081 | 1 049 | 1 025 |
| Nuclear | 370 | 485 | 482 | 356 | 397 | 395 | 380 | 351 | 346 |
| Hydro | 66 | 72 | 72 | 69 | 80 | 81 | 82 | 83 | 84 |
| Geothermal | 19 | 21 | 16 | 19 | 23 | 26 | 27 | 28 | 29 |
| Solar, wind, etc. | 1.6 | 4.1 | 20 | 111 | 187 | 235 | 286 | 338 | 396 |
| Biomass and waste | 95 | 114 | 175 | 221 | 226 | 221 | 219 | 212 | 206 |
| Hydrogen | - | - | - | - | 0.1 | -0.0 | -0.7 | -0.2 | 0.5 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2 378 | 2 737 | 2 676 | 2 558 | 2 457 | 2 389 | 2 308 | 2 229 | 2 159 |
| Coal | 146 | 76 | 68 | 42 | 38 | 36 | 33 | 30 | 28 |
| Oil | 1 238 | 1 395 | 1 294 | 1 175 | 1 062 | 990 | 916 | 837 | 759 |
| Natural gas | 495 | 613 | 568 | 583 | 578 | 560 | 533 | 502 | 473 |
| Electricity | 435 | 548 | 594 | 576 | 605 | 639 | 670 | 711 | 757 |
| Heat | 13 | 19 | 26 | 22 | 21 | 20 | 19 | 18 | 17 |
| Hydrogen | - | - | - | - | 0.0 | 0.0 | 0.7 | 2.4 | 4.8 |
| Renewables and waste | 51 | 85 | 126 | 160 | 152 | 144 | 137 | 128 | 121 |
| Industry | 602 | 646 | 545 | 516 | 505 | 499 | 486 | 472 | 459 |
| Transport | 768 | 915 | 909 | 913 | 828 | 770 | 715 | 659 | 606 |
| Buildings, etc. | 783 | 904 | 972 | 887 | 878 | 872 | 855 | 844 | 839 |
| Non-energy use | 226 | 272 | 250 | 243 | 245 | 248 | 251 | 254 | 255 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 6 042 | 7 437 | 7 990 | 7 639 | 8 119 | 8 574 | 9 041 | 9 554 | 10 248 |
| Coal | 2 506 | 2 963 | 2 844 | 1 206 | 618 | 446 | 330 | 272 | 217 |
| Oil | 553 | 373 | 189 | 92 | 61 | 50 | 40 | 32 | 25 |
| Natural gas | 647 | 1 236 | 1 845 | 2 624 | 2 489 | 2 520 | 2 493 | 2 520 | 2 564 |
| Nuclear | 1 419 | 1 862 | 1 849 | 1 367 | 1 524 | 1 516 | 1 459 | 1 348 | 1 327 |
| Hydro | 765 | 832 | 834 | 805 | 932 | 944 | 954 | 964 | 973 |
| Geothermal | 21 | 23 | 26 | 29 | 36 | 41 | 44 | 45 | 47 |
| Solar photovoltaics | 0.1 | 0.6 | 21 | 448 | 1 052 | 1 420 | 1 833 | 2 225 | 2 647 |
| Wind | 3.1 | 17 | 176 | 775 | 1 054 | 1 234 | 1 419 | 1 628 | 1 880 |
| Concentrated solar power and marine | 1.2 | 1.1 | 1.4 | 3.6 | 3.6 | 4.0 | 4.1 | 4.2 | 4.3 |
| Biomass and waste | 107 | 110 | 175 | 257 | 309 | 325 | 357 | 369 | 382 |
| Hydrogen | - | - | - | - | 11 | 43 | 76 | 113 | 151 |
| Others | 20 | 21 | 31 | 32 | 32 | 32 | 32 | 32 | 32 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 8 377 | 9 354 | 8 791 | 7 248 | 6 137 | 5 687 | 5 241 | 4 828 | 4 450 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 21 501 | 27 927 | 31 987 | 40 084 | 44 720 | 48 450 | 52 410 | 56 468 | 60 526 |
| Population (million) | 652 | 699 | 741 | 781 | 791 | 795 | 798 | 800 | 800 |
| GDP per capita ($2015 thousand) | 33 | 40 | 43 | 51 | 57 | 61 | 66 | 71 | 76 |
| Primary energy consumption per capita (toe/person) | 5.4 | 5.8 | 5.3 | 4.6 | 4.3 | 4.1 | 4.0 | 3.8 | 3.7 |
| Primary energy consumption per GDP (toe/$2015 million) | 162 | 144 | 123 | 89 | 75 | 68 | 60 | 54 | 49 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 390 | 335 | 275 | 181 | 137 | 117 | 100 | 86 | 74 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.4 | 2.3 | 2.2 | 2.0 | 1.8 | 1.7 | 1.7 | 1.6 | 1.5 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 0.1 | -0.7 | -0.6 | -0.7 | 100 | 100 | 100 | 100 | 3 279 | 3 075 | 2 854 | 2 701 | 2 612 | -1.3 | -0.9 | -1.1 | 100 | 100 |
| -2.3 | -5.2 | -2.2 | -4.1 | 23 | 10 | 4.7 | 4.0 | 173 | 107 | 84 | 77 | 74 | -8.3 | -1.2 | -5.7 | 2.9 | 2.8 |
| -0.4 | -1.6 | -2.0 | -1.8 | 41 | 35 | 30 | 26 | 1 029 | 846 | 658 | 478 | 341 | -3.7 | -6.4 | -4.7 | 23 | 13 |
| 1.5 | -0.4 | -0.5 | -0.5 | 20 | 33 | 34 | 34 | 1 112 | 1 066 | 949 | 839 | 711 | -1.2 | -2.8 | -1.8 | 33 | 27 |
| -0.1 | 0.4 | -0.9 | -0.1 | 11 | 10 | 12 | 12 | 413 | 423 | 442 | 442 | 473 | 1.3 | 0.7 | 1.1 | 15 | 18 |
| 0.2 | 1.0 | 0.2 | 0.7 | 1.9 | 1.9 | 2.6 | 2.8 | 81 | 82 | 83 | 84 | 84 | 1.1 | 0.2 | 0.7 | 2.9 | 3.2 |
| 0.0 | 2.2 | 0.6 | 1.6 | 0.5 | 0.5 | 0.9 | 1.0 | 23 | 27 | 29 | 30 | 31 | 2.6 | 0.7 | 1.9 | 1.0 | 1.2 |
| 13.6 | 5.7 | 3.3 | 4.8 | 0.0 | 3.1 | 9.1 | 13 | 206 | 290 | 379 | 511 | 646 | 7.5 | 5.5 | 6.7 | 13 | 25 |
| 2.6 | -0.1 | -0.6 | -0.3 | 2.7 | 6.2 | 6.9 | 6.9 | 249 | 244 | 243 | 242 | 242 | 0.5 | -0.1 | 0.3 | 8.5 | 9.2 |
| n.a. | n.a. | n.a. | n.a. | - | - | -0.0 | 0.0 | -1.1 | -6.4 | -7.9 | -1.1 | 11 | n.a. | n.a. | n.a. | -0.3 | 0.4 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.2 | -0.6 | -0.7 | -0.6 | 100 | 100 | 100 | 100 | 2 380 | 2 185 | 1 974 | 1 811 | 1 701 | -1.5 | -1.5 | -1.5 | 100 | 100 |
| -3.7 | -1.4 | -1.5 | -1.4 | 6.1 | 1.6 | 1.4 | 1.3 | 34 | 27 | 22 | 19 | 17 | -3.6 | -3.0 | -3.4 | 1.1 | 1.0 |
| -0.2 | -1.5 | -1.9 | -1.6 | 52 | 46 | 40 | 35 | 998 | 834 | 667 | 522 | 406 | -3.3 | -4.8 | -3.9 | 34 | 24 |
| 0.5 | -0.5 | -1.2 | -0.8 | 21 | 23 | 23 | 22 | 545 | 474 | 389 | 306 | 230 | -2.4 | -5.1 | -3.4 | 20 | 14 |
| 0.9 | 0.9 | 1.2 | 1.0 | 18 | 23 | 29 | 35 | 622 | 668 | 705 | 752 | 784 | 1.2 | 1.1 | 1.1 | 36 | 46 |
| 1.6 | -0.7 | -1.3 | -1.0 | 0.5 | 0.8 | 0.8 | 0.8 | 20 | 19 | 17 | 15 | 13 | -1.4 | -2.2 | -1.7 | 0.9 | 0.8 |
| n.a. | n.a. | 20.9 | n.a. | - | - | 0.0 | 0.2 | 0.1 | 11 | 27 | 53 | 109 | n.a. | 14.9 | n.a. | 1.4 | 6.4 |
| 3.5 | -0.9 | -1.2 | -1.0 | 2.1 | 6.3 | 5.9 | 5.6 | 161 | 152 | 147 | 144 | 142 | -0.5 | -0.3 | -0.5 | 7.4 | 8.3 |
| -0.5 | -0.3 | -0.6 | -0.4 | 25 | 20 | 21 | 21 | 485 | 445 | 396 | 353 | 320 | -1.5 | -2.1 | -1.8 | 20 | 19 |
| 0.5 | -1.4 | -1.6 | -1.5 | 32 | 36 | 31 | 28 | 787 | 666 | 555 | 469 | 420 | -2.9 | -2.7 | -2.8 | 28 | 25 |
| 0.4 | -0.2 | -0.2 | -0.2 | 33 | 35 | 37 | 39 | 863 | 826 | 771 | 736 | 706 | -0.8 | -0.9 | -0.8 | 39 | 42 |
| 0.2 | 0.2 | 0.2 | 0.2 | 9.5 | 9.5 | 11 | 12 | 245 | 248 | 251 | 254 | 255 | 0.2 | 0.2 | 0.2 | 13 | 15 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 0.7 | 1.0 | 1.3 | 1.1 | 100 | 100 | 100 | 100 | 8 368 | 9 304 | 10 152 | 11 520 | 12 900 | 1.7 | 2.4 | 2.0 | 100 | 100 |
| -2.2 | -7.3 | -4.1 | -6.2 | 41 | 16 | 3.6 | 2.1 | 425 | 164 | 81 | 68 | 68 | -14.7 | -1.8 | -10.1 | 0.8 | 0.5 |
| -5.3 | -4.8 | -4.6 | -4.7 | 9.2 | 1.2 | 0.4 | 0.2 | 52 | 42 | 35 | 26 | 18 | -5.5 | -6.5 | -5.9 | 0.3 | 0.1 |
| 4.3 | -0.3 | 0.3 | -0.1 | 11 | 34 | 28 | 25 | 2 587 | 2 675 | 2 414 | 2 180 | 1 780 | -0.5 | -3.0 | -1.4 | 24 | 14 |
| -0.1 | 0.4 | -0.9 | -0.1 | 23 | 18 | 16 | 13 | 1 584 | 1 625 | 1 696 | 1 697 | 1 816 | 1.3 | 0.7 | 1.1 | 17 | 14 |
| 0.2 | 1.0 | 0.2 | 0.7 | 13 | 11 | 11 | 9.5 | 937 | 950 | 962 | 972 | 980 | 1.1 | 0.2 | 0.7 | 9.5 | 7.6 |
| 1.0 | 2.4 | 0.7 | 1.8 | 0.3 | 0.4 | 0.5 | 0.5 | 36 | 44 | 47 | 49 | 50 | 2.8 | 0.8 | 2.1 | 0.5 | 0.4 |
| 30.1 | 8.6 | 3.7 | 6.8 | 0.0 | 5.9 | 20 | 26 | 1 195 | 1 796 | 2 421 | 3 227 | 4 033 | 10.4 | 5.2 | 8.5 | 24 | 31 |
| 18.2 | 3.6 | 2.9 | 3.3 | 0.1 | 10 | 16 | 18 | 1 127 | 1 505 | 1 916 | 2 635 | 3 403 | 5.5 | 5.9 | 5.6 | 19 | 26 |
| 3.4 | 0.9 | 0.4 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 4.6 | 4.9 | 5.3 | 5.7 | 1.9 | 1.6 | 1.8 | 0.0 | 0.0 |
| 2.7 | 1.9 | 0.7 | 1.5 | 1.8 | 3.4 | 3.9 | 3.7 | 371 | 396 | 423 | 440 | 456 | 3.0 | 0.8 | 2.1 | 4.2 | 3.5 |
| n.a. | n.a. | 7.1 | n.a. | - | - | 0.8 | 1.5 | 18 | 70 | 121 | 190 | 259 | n.a. | 7.9 | n.a. | 1.2 | 2.0 |
| 1.5 | 0.0 | 0.0 | 0.0 | 0.3 | 0.4 | 0.4 | 0.3 | 32 | 32 | 32 | 32 | 32 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| -0.4 | -1.9 | -1.6 | -1.8 | 5 663 | 4 398 | 3 169 | 1 865 | 823 | -4.7 | -12.6 | -7.7 |
| n.a. | n.a. | n.a. | n.a. | - | - | 69 | 269 | 499 | n.a. | 21.8 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 1.9 | 1.6 | 1.5 | 1.5 | 44 720 | 48 450 | 52 410 | 56 468 | 60 526 | 1.6 | 1.5 | 1.5 |
| 0.5 | 0.1 | 0.0 | 0.1 | 791 | 795 | 798 | 800 | 800 | 0.1 | 0.0 | 0.1 |
| 1.4 | 1.5 | 1.4 | 1.4 | 57 | 61 | 66 | 71 | 76 | 1.5 | 1.4 | 1.4 |
| -0.5 | -0.8 | -0.6 | -0.7 | 4.1 | 3.9 | 3.6 | 3.4 | 3.3 | -1.4 | -0.9 | -1.2 |
| -1.8 | -2.2 | -2.0 | -2.2 | 73 | 63 | 54 | 48 | 43 | -2.8 | -2.3 | -2.6 |
| -2.3 | -3.4 | -3.0 | -3.3 | 127 | 91 | 60 | 33 | 14 | -6.2 | -13.9 | -9.1 |
| -0.5 | -1.2 | -1.0 | -1.1 | 1.7 | 1.4 | 1.1 | 0.7 | 0.3 | -3.5 | -11.8 | -6.7 |

## Table A48 | Emerging and Developing Economies

| Primary energy consumption | Reference Scenario (Million tonnes of oil equivalent [Mtoe]) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total*1 | 4 032 | 4 430 | 7 020 | 9 800 | 10 481 | 10 999 | 11 461 | 11 941 | 12 361 |
| Coal | 1 133 | 1 198 | 2 536 | 3 581 | 3 235 | 3 084 | 3 018 | 2 984 | 2 890 |
| Oil | 1 208 | 1 338 | 1 873 | 2 454 | 2 621 | 2 723 | 2 837 | 2 940 | 3 017 |
| Natural gas | 835 | 933 | 1 450 | 1 985 | 2 190 | 2 387 | 2 597 | 2 855 | 3 138 |
| Nuclear | 62 | 79 | 113 | 236 | 330 | 393 | 448 | 484 | 513 |
| Hydro | 85 | 114 | 185 | 255 | 290 | 308 | 326 | 345 | 365 |
| Geothermal | 12 | 26 | 35 | 69 | 106 | 182 | 201 | 213 | 225 |
| Solar, wind, etc. | 0.5 | 2.1 | 17 | 218 | 592 | 792 | 927 | 1 049 | 1 173 |
| Biomass and waste | 697 | 740 | 813 | 1 006 | 1 111 | 1 127 | 1 103 | 1 069 | 1 045 |
| Hydrogen | - | - | - | - | -0.7 | -1.2 | -0.7 | -2.7 | -5.0 |

| Final energy consumption | Reference Scenario (Mtoe) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 2 922 | 3 074 | 4 710 | 6 334 | 7 002 | 7 349 | 7 627 | 7 887 | 8 123 |
| Coal | 521 | 404 | 916 | 800 | 815 | 789 | 762 | 739 | 717 |
| Oil | 845 | 1 042 | 1 521 | 2 123 | 2 298 | 2 406 | 2 525 | 2 631 | 2 717 |
| Natural gas | 369 | 390 | 632 | 949 | 1 042 | 1 090 | 1 122 | 1 144 | 1 158 |
| Electricity | 281 | 372 | 729 | 1 360 | 1 685 | 1 911 | 2 125 | 2 347 | 2 565 |
| Heat | 288 | 197 | 210 | 328 | 369 | 368 | 352 | 332 | 310 |
| Hydrogen | - | - | - | - | 0.2 | 0.2 | 1.2 | 3.7 | 7.4 |
| Renewables and waste | 618 | 670 | 702 | 775 | 792 | 786 | 741 | 691 | 650 |
| Industry | 971 | 959 | 1 816 | 2 308 | 2 620 | 2 765 | 2 853 | 2 921 | 2 948 |
| Transport | 456 | 570 | 919 | 1 362 | 1 498 | 1 571 | 1 658 | 1 748 | 1 832 |
| Buildings, etc. | 1 306 | 1 294 | 1 562 | 2 030 | 2 159 | 2 246 | 2 306 | 2 374 | 2 465 |
| Non-energy use | 190 | 251 | 413 | 633 | 725 | 767 | 810 | 845 | 878 |

| Electricity generated | Reference Scenario (TWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Total | 4 177 | 5 721 | 10 680 | 19 160 | 23 470 | 26 624 | 29 466 | 32 471 | 35 391 |
| Coal | 1 301 | 2 158 | 4 869 | 8 723 | 7 424 | 7 044 | 6 975 | 7 115 | 7 043 |
| Oil | 656 | 648 | 694 | 647 | 520 | 478 | 428 | 382 | 315 |
| Natural gas | 977 | 1 237 | 2 318 | 3 336 | 3 717 | 4 341 | 5 164 | 6 210 | 7 404 |
| Nuclear | 236 | 303 | 432 | 904 | 1 267 | 1 509 | 1 718 | 1 859 | 1 967 |
| Hydro | 985 | 1 326 | 2 154 | 2 961 | 3 374 | 3 581 | 3 792 | 4 010 | 4 239 |
| Geothermal | 13 | 25 | 31 | 44 | 68 | 118 | 134 | 145 | 157 |
| Solar photovoltaics | 0.0 | 0.1 | 1.4 | 919 | 4 236 | 5 911 | 6 846 | 7 679 | 8 522 |
| Wind | 0.0 | 2.8 | 73 | 1 214 | 2 213 | 2 857 | 3 489 | 4 069 | 4 659 |
| Concentrated solar power and marine | 0.0 | 0.0 | 0.0 | 7.3 | 8.4 | 8.6 | 8.9 | 9.3 | 9.6 |
| Biomass and waste | 8.5 | 21 | 106 | 397 | 636 | 704 | 772 | 825 | 879 |
| Hydrogen | - | - | - | - | - | 66 | 132 | 161 | 189 |
| Others | - | 0.5 | 1.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 |

| Carbon dioxide [$CO_2$] | Reference Scenario ($MtCO_2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Energy-related $CO_2$ emissions*2 | 9 050 | 9 984 | 17 446 | 23 330 | 22 847 | 22 861 | 23 281 | 23 897 | 24 250 |
| Avoidance by carbon dioxide removal [CDR] | - | - | - | - | - | - | - | - | - |

| Energy and economic indicators | Reference Scenario | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 2023 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Gross domestic product [GDP] ($2015 billion) | 8 766 | 12 502 | 22 694 | 39 290 | 51 285 | 61 496 | 73 380 | 86 869 | 101 663 |
| Population (million) | 4 291 | 5 081 | 5 851 | 6 845 | 7 307 | 7 616 | 7 903 | 8 164 | 8 391 |
| GDP per capita ($2015 thousand) | 2.0 | 2.5 | 3.9 | 5.7 | 7.0 | 8.1 | 9.3 | 11 | 12 |
| Primary energy consumption per capita (toe/person) | 0.9 | 0.9 | 1.2 | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 |
| Primary energy consumption per GDP (toe/$2015 million) | 460 | 354 | 309 | 249 | 204 | 179 | 156 | 137 | 122 |
| Energy-related $CO_2$ emissions per GDP*2 (t/$2015 million) | 1 032 | 799 | 769 | 594 | 445 | 372 | 317 | 275 | 239 |
| Energy-related $CO_2$ per primary energy consumption*2 (t/toe) | 2.2 | 2.3 | 2.5 | 2.4 | 2.2 | 2.1 | 2.0 | 2.0 | 2.0 |

*1 The total and breakdown do not necessarily match since international exports/imports of electricity and heat are not shown.
*2 After avoidance by carbon dioxide removal [CDR].

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGR (%) | | | | Shares (%) | | | | (Mtoe) | | | | | CAGR (%) | | | Shares (%) | |
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | 2040 | 2050 |
| 2.7 | 0.9 | 0.8 | 0.9 | 100 | 100 | 100 | 100 | 10 195 | 10 219 | 10 088 | 10 011 | 9 977 | 0.2 | -0.1 | 0.1 | 100 | 100 |
| 3.5 | -1.0 | -0.4 | -0.8 | 28 | 37 | 26 | 23 | 3 069 | 2 608 | 2 211 | 1 869 | 1 523 | -2.8 | -3.7 | -3.1 | 22 | 15 |
| 2.2 | 0.9 | 0.6 | 0.8 | 30 | 25 | 25 | 24 | 2 482 | 2 360 | 2 217 | 2 051 | 1 888 | -0.6 | -1.6 | -1.0 | 22 | 19 |
| 2.7 | 1.6 | 1.9 | 1.7 | 21 | 20 | 23 | 25 | 2 172 | 2 276 | 2 348 | 2 411 | 2 464 | 1.0 | 0.5 | 0.8 | 23 | 25 |
| 4.1 | 3.8 | 1.4 | 2.9 | 1.5 | 2.4 | 3.9 | 4.1 | 336 | 496 | 619 | 750 | 870 | 5.8 | 3.5 | 5.0 | 6.1 | 8.7 |
| 3.4 | 1.5 | 1.1 | 1.3 | 2.1 | 2.6 | 2.8 | 2.9 | 298 | 323 | 350 | 380 | 413 | 1.9 | 1.7 | 1.8 | 3.5 | 4.1 |
| 5.4 | 6.5 | 1.1 | 4.5 | 0.3 | 0.7 | 1.8 | 1.8 | 103 | 196 | 231 | 260 | 289 | 7.3 | 2.3 | 5.4 | 2.3 | 2.9 |
| 20.3 | 8.9 | 2.4 | 6.4 | 0.0 | 2.2 | 8.1 | 9.5 | 647 | 940 | 1 166 | 1 415 | 1 704 | 10.4 | 3.9 | 7.9 | 12 | 17 |
| 1.1 | 0.5 | -0.5 | 0.1 | 17 | 10 | 9.6 | 8.5 | 1 088 | 1 042 | 986 | 947 | 926 | -0.1 | -0.6 | -0.3 | 9.8 | 9.3 |
| n.a. | n.a. | 21.5 | n.a. | - | - | -0.0 | -0.0 | -5.1 | -26 | -44 | -73 | -103 | n.a. | 8.9 | n.a. | -0.4 | -1.0 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (Mtoe) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 2.4 | 1.1 | 0.6 | 0.9 | 100 | 100 | 100 | 100 | 6 753 | 6 685 | 6 522 | 6 376 | 6 299 | 0.2 | -0.3 | 0.0 | 100 | 100 |
| 1.3 | -0.3 | -0.6 | -0.4 | 18 | 13 | 10.0 | 8.8 | 752 | 643 | 553 | 482 | 429 | -2.2 | -2.5 | -2.3 | 8.5 | 6.8 |
| 2.8 | 1.0 | 0.7 | 0.9 | 29 | 34 | 33 | 33 | 2 196 | 2 129 | 2 033 | 1 915 | 1 791 | -0.3 | -1.3 | -0.6 | 31 | 28 |
| 2.9 | 1.0 | 0.3 | 0.7 | 13 | 15 | 15 | 14 | 987 | 936 | 852 | 763 | 683 | -0.6 | -2.2 | -1.2 | 13 | 11 |
| 4.9 | 2.7 | 1.9 | 2.4 | 9.6 | 21 | 28 | 32 | 1 731 | 1 972 | 2 179 | 2 385 | 2 599 | 2.8 | 1.8 | 2.4 | 33 | 41 |
| 0.4 | 0.4 | -1.3 | -0.2 | 9.9 | 5.2 | 4.6 | 3.8 | 340 | 316 | 282 | 248 | 219 | -0.9 | -2.5 | -1.5 | 4.3 | 3.5 |
| n.a. | n.a. | 20.2 | n.a. | - | - | 0.0 | 0.1 | 0.1 | 8.0 | 21 | 42 | 81 | n.a. | 14.7 | n.a. | 0.3 | 1.3 |
| 0.7 | -0.3 | -1.3 | -0.7 | 21 | 12 | 9.7 | 8.0 | 748 | 681 | 602 | 541 | 497 | -1.5 | -1.9 | -1.6 | 9.2 | 7.9 |
| 2.7 | 1.3 | 0.3 | 0.9 | 33 | 36 | 37 | 36 | 2 500 | 2 439 | 2 302 | 2 166 | 2 076 | 0.0 | -1.0 | -0.4 | 35 | 33 |
| 3.4 | 1.2 | 1.0 | 1.1 | 16 | 22 | 22 | 23 | 1 437 | 1 403 | 1 362 | 1 326 | 1 307 | 0.0 | -0.4 | -0.2 | 21 | 21 |
| 1.3 | 0.8 | 0.7 | 0.7 | 45 | 32 | 30 | 30 | 2 091 | 2 078 | 2 049 | 2 040 | 2 040 | 0.1 | 0.0 | 0.0 | 31 | 32 |
| 3.7 | 1.5 | 0.8 | 1.2 | 6.5 | 10 | 11 | 11 | 724 | 766 | 809 | 844 | 877 | 1.5 | 0.8 | 1.2 | 12 | 14 |

| Reference Scenario | | | | | | | | Advanced Technologies Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | | | | (TWh) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | Shares (%) | |
| | | | | 1990 | 2023 | 2040 | 2050 | 2030 | 2035 | 2040 | 2045 | 2050 | | | | 2040 | 2050 |
| 4.7 | 2.6 | 1.8 | 2.3 | 100 | 100 | 100 | 100 | 24 194 | 28 156 | 31 408 | 35 293 | 39 681 | 3.0 | 2.4 | 2.7 | 100 | 100 |
| 5.9 | -1.3 | 0.1 | -0.8 | 31 | 46 | 24 | 20 | 7 057 | 5 779 | 4 610 | 3 557 | 2 474 | -3.7 | -6.0 | -4.6 | 15 | 6.2 |
| 0.0 | -2.4 | -3.0 | -2.6 | 16 | 3.4 | 1.5 | 0.9 | 440 | 336 | 245 | 189 | 155 | -5.5 | -4.5 | -5.2 | 0.8 | 0.4 |
| 3.8 | 2.6 | 3.7 | 3.0 | 23 | 17 | 18 | 21 | 4 069 | 4 849 | 5 715 | 6 691 | 7 695 | 3.2 | 3.0 | 3.1 | 18 | 19 |
| 4.1 | 3.9 | 1.4 | 2.9 | 5.7 | 4.7 | 5.8 | 5.6 | 1 289 | 1 902 | 2 377 | 2 879 | 3 341 | 5.9 | 3.5 | 5.0 | 7.6 | 8.4 |
| 3.4 | 1.5 | 1.1 | 1.3 | 24 | 15 | 13 | 12 | 3 466 | 3 753 | 4 068 | 4 416 | 4 806 | 1.9 | 1.7 | 1.8 | 13 | 12 |
| 3.8 | 6.8 | 1.6 | 4.9 | 0.3 | 0.2 | 0.5 | 0.4 | 68 | 136 | 162 | 185 | 207 | 8.7 | 2.5 | 6.4 | 0.5 | 0.5 |
| 46.6 | 12.5 | 2.2 | 8.6 | 0.0 | 4.8 | 23 | 24 | 4 807 | 7 228 | 8 908 | 10 606 | 12 513 | 14.3 | 3.5 | 10.2 | 28 | 32 |
| 37.2 | 6.4 | 2.9 | 5.1 | 0.0 | 6.3 | 12 | 13 | 2 290 | 3 256 | 4 197 | 5 386 | 6 849 | 7.6 | 5.0 | 6.6 | 13 | 17 |
| 23.4 | 1.2 | 0.7 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 11 | 12 | 15 | 17 | 3.2 | 3.2 | 3.2 | 0.0 | 0.0 |
| 12.4 | 4.0 | 1.3 | 3.0 | 0.2 | 2.1 | 2.6 | 2.5 | 691 | 771 | 850 | 931 | 1 012 | 4.6 | 1.8 | 3.5 | 2.7 | 2.6 |
| n.a. | n.a. | 3.7 | n.a. | - | - | 0.4 | 0.5 | - | 128 | 256 | 431 | 605 | n.a. | 9.0 | n.a. | 0.8 | 1.5 |
| n.a. | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | ($MtCO_2$) | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 2.9 | 0.0 | 0.4 | 0.1 | 21 739 | 18 475 | 15 836 | 13 553 | 11 757 | -2.3 | -2.9 | -2.5 |
| n.a. | n.a. | n.a. | n.a. | - | - | 83 | 212 | 360 | n.a. | 15.7 | n.a. |

| Reference Scenario | | | | Advanced Technologies Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990/ 2023 | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 | | | | | | 2023/ 2040 | 2040/ 2050 | 2023/ 2050 |
| | | | | 2030 | 2035 | 2040 | 2045 | 2050 | | | |
| 4.7 | 3.7 | 3.3 | 3.6 | 51 285 | 61 496 | 73 380 | 86 869 | 101 663 | 3.7 | 3.3 | 3.6 |
| 1.4 | 0.8 | 0.6 | 0.8 | 7 307 | 7 616 | 7 903 | 8 164 | 8 391 | 0.8 | 0.6 | 0.8 |
| 3.2 | 2.9 | 2.7 | 2.8 | 7.0 | 8.1 | 9.3 | 11 | 12 | 2.9 | 2.7 | 2.8 |
| 1.3 | 0.1 | 0.2 | 0.1 | 1.4 | 1.3 | 1.3 | 1.2 | 1.2 | -0.7 | -0.7 | -0.7 |
| -1.8 | -2.7 | -2.5 | -2.6 | 199 | 166 | 137 | 115 | 98 | -3.4 | -3.3 | -3.4 |
| -1.7 | -3.6 | -2.8 | -3.3 | 424 | 300 | 216 | 156 | 116 | -5.8 | -6.0 | -5.9 |
| 0.2 | -0.9 | -0.3 | -0.7 | 2.1 | 1.8 | 1.6 | 1.4 | 1.2 | -2.4 | -2.8 | -2.6 |

**Table A49 | Conversion factors**

| From \ To | Megajoule (MJ) | Kilowatt hour (kWh) | Kilocalorie (kcal) | Tonne of oil equivalent (toe) | British thermal unit (Btu) | Tonne of coal equivalent (tce) |
|---|---|---|---|---|---|---|
| MJ | 1 | $2.77778\times10^{-1}$ | $2.38846\times10^{2}$ | $2.38846\times10^{-5}$ | $9.47817\times10^{2}$ | $3.41209\times10^{-5}$ |
| kWh | 3.60000 | 1 | $8.59845\times10^{2}$ | $8.59845\times10^{-5}$ | $3.41214\times10^{3}$ | $1.22835\times10^{-4}$ |
| Kcal | $4.18680\times10^{-3}$ | $1.16300\times10^{-3}$ | 1 | $1\times10^{-7}$ | 3.96832 | $1.42857\times10^{-7}$ |
| Toe | $4.18680\times10^{4}$ | $1.16300\times10^{4}$ | $1\times10^{7}$ | 1 | $3.96832\times10^{7}$ | 1.42857 |
| Btu | $1.05506\times10^{-3}$ | $2.93071\times10^{-4}$ | $2.51996\times10^{-1}$ | $2.51996\times10^{-8}$ | 1 | $3.59994\times10^{-8}$ |
| Tce | $2.93076\times10^{4}$ | $0.8141\times10^{4}$ | $0.7\times10^{7}$ | 0.7 | $2.77782\times10^{7}$ | 1 |

Crude oil is calculated as 1 million barrels per day (1 Mb/d) = 47.26 Mtoe, natural gas as 1 billion cubic metres (1 Bcm) = 0.8373 Mtoe, steam coal as 1 Mt = 0.5222 Mtoe, coking coal as 1 Mt = 0.6480 Mtoe, and liquid biofuels as 1 Mb/d = 35.34 Mtoe.