

Table F1. Total world delivered energy consumption by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	9.4	9.5	9.9	10.3	10.7	11.1	11.5	0.7%
Natural gas	23.1	23.7	24.8	25.9	27.0	28.2	29.4	0.9%
Coal	3.6	3.5	3.5	3.4	3.4	3.3	3.2	-0.4%
Electricity	25.4	26.7	29.6	32.4	36.0	40.1	44.0	2.0%
Renewables	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0.1%
Total	63.1	65.1	69.4	73.7	78.6	84.2	89.7	1.3%
Commercial								
Liquid fuels	3.5	3.6	3.7	3.8	4.0	4.0	4.1	0.6%
Natural gas	9.4	9.6	10.1	10.5	10.8	11.1	11.5	0.7%
Coal	1.3	1.3	1.4	1.4	1.4	1.4	1.5	0.5%
Electricity	18.4	19.2	20.9	22.3	23.9	25.6	27.2	1.4%
Renewables	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4%
Total	32.8	34.0	36.3	38.2	40.3	42.5	44.6	1.1%
Industrial								
Liquid fuels	62.4	64.9	69.4	73.9	78.0	82.1	85.6	1.1%
Natural gas	63.9	65.7	70.1	74.2	78.7	83.4	88.1	1.2%
Coal	62.8	62.8	63.0	63.2	63.4	64.2	65.1	0.1%
Electricity	41.5	43.3	46.2	48.8	51.1	53.4	55.3	1.0%
Renewables	24.1	26.7	30.1	33.5	36.6	39.7	42.5	2.1%
Total	254.6	263.3	278.8	293.6	307.9	322.8	336.7	1.0%
Transportation								
Liquid fuels	109.7	114.0	115.5	117.3	120.1	124.4	129.3	0.6%
Natural gas	4.2	4.5	4.7	4.9	5.3	5.8	6.7	1.7%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	1.9	2.2	2.7	3.5	4.4	5.2	5.9	4.1%
Total	115.8	120.7	123.0	125.8	129.7	135.4	141.8	0.7%
Components of energy use								
End-use consumption								
Liquid fuels	184.9	192.0	198.6	205.4	212.8	221.7	230.5	0.8%
Natural gas	100.6	103.6	109.7	115.5	121.8	128.6	135.7	1.1%
Coal	67.7	67.7	67.9	68.0	68.2	69.0	69.8	0.1%
Electricity	87.3	91.3	99.4	107.1	115.4	124.3	132.4	1.5%
Renewables	25.9	28.5	31.9	35.3	38.5	41.6	44.5	1.9%
Total end-use consumption	466.4	483.1	507.5	531.2	556.6	585.0	612.8	1.0%
Electricity-related losses	171.3	177.5	190.0	203.2	213.8	225.5	236.5	1.2%
Discrepancy	0.0	-0.5	-0.2	0.1	0.4	0.7	0.9	11.6%
Total	637.7	660.2	697.3	734.6	770.7	811.2	850.2	1.0%
Electric power								
Liquid fuels	5.4	6.4	3.9	2.0	1.1	0.8	0.7	-7.1%
Natural gas	52.5	51.7	53.4	54.1	57.1	61.7	66.0	0.8%
Coal	98.3	96.5	100.1	105.1	105.4	105.7	106.8	0.3%
Nuclear	27.7	29.3	32.1	33.7	34.7	35.0	35.9	0.9%
Renewables	74.5	84.8	99.8	115.2	130.5	146.2	159.2	2.7%
Total	258.4	268.7	289.2	310.1	328.9	349.5	368.5	1.3%
Total energy consumption								
Liquid fuels	190.3	197.9	202.3	207.5	214.3	223.2	232.1	0.7%
Natural gas	153.2	155.4	163.2	169.8	179.1	190.5	201.8	1.0%
Coal	166.0	164.3	168.0	173.2	173.7	174.8	176.7	0.2%
Nuclear	27.7	29.3	32.1	33.7	34.7	35.0	35.9	0.9%
Renewables	100.4	113.4	131.7	150.5	169.0	187.8	203.7	2.6%

Total	637.7	660.2	697.3	734.6	770.7	811.2	850.2	1.0%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F2. Delivered energy consumption in the Americas by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	1.8	1.7	1.7	1.6	1.6	1.6	1.6	-0.4%
Natural gas	6.3	6.2	6.2	6.2	6.2	6.2	6.2	0.0%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1%
Electricity	7.5	7.5	7.8	8.0	8.3	8.7	9.1	0.7%
Renewables	0.6	0.5	0.5	0.4	0.4	0.4	0.4	-1.7%
Total	16.2	15.9	16.1	16.3	16.5	16.9	17.3	0.2%
Commercial								
Liquid fuels	1.1	1.1	1.1	1.1	1.2	1.2	1.2	0.2%
Natural gas	4.3	4.3	4.4	4.5	4.5	4.5	4.5	0.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3%
Electricity	6.4	6.4	6.7	7.0	7.2	7.5	7.9	0.8%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1%
Total	12.0	12.0	12.4	12.8	13.0	13.3	13.8	0.5%
Industrial								
Liquid fuels	15.2	15.4	16.3	17.3	18.2	19.2	20.0	1.0%
Natural gas	17.6	17.6	19.0	19.9	21.0	22.1	23.4	1.0%
Coal	1.8	1.8	1.8	1.8	1.8	1.9	1.9	0.2%
Electricity	6.2	6.3	6.8	7.1	7.5	7.9	8.2	1.0%
Renewables	6.6	6.8	7.4	7.9	8.3	8.7	9.1	1.1%
Total	47.4	47.9	51.3	54.1	56.8	59.7	62.6	1.0%
Transportation								
Liquid fuels	38.5	38.2	37.2	36.5	36.6	37.3	38.4	0.0%
Natural gas	1.4	1.3	1.2	1.2	1.3	1.3	1.4	0.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.1	0.2	0.3	0.5	0.7	0.9	1.1	8.8%
Total	40.0	39.6	38.7	38.3	38.6	39.5	40.9	0.1%
Components of energy use								
End-use consumption								
Liquid fuels	56.6	56.4	56.3	56.6	57.6	59.2	61.2	0.3%
Natural gas	29.6	29.4	30.9	31.8	32.9	34.1	35.6	0.7%
Coal	1.8	1.8	1.8	1.8	1.9	1.9	1.9	0.2%
Electricity	20.3	20.4	21.5	22.6	23.7	25.0	26.3	0.9%
Renewables	7.3	7.4	8.0	8.5	8.9	9.2	9.6	1.0%
Total end-use consumption	115.7	115.4	118.5	121.4	124.9	129.4	134.6	0.5%
Electricity-related losses	37.2	36.8	37.4	38.8	40.2	41.8	43.7	0.6%
Discrepancy	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	--
Total	152.6	152.0	155.8	160.0	164.9	171.1	178.2	0.6%
Electric power								
Liquid fuels	1.3	1.5	0.8	0.3	0.1	0.1	0.1	-10.4%
Natural gas	16.1	14.3	14.7	14.0	14.7	15.7	16.7	0.1%
Coal	9.5	8.5	6.0	6.3	6.4	6.6	6.4	-1.4%
Nuclear	9.4	9.3	9.6	9.1	8.9	8.6	8.5	-0.3%
Renewables	21.3	23.5	28.0	31.7	33.8	35.9	38.5	2.1%
Total	57.5	57.2	59.0	61.4	63.9	66.8	70.1	0.7%
Total energy consumption								
Liquid fuels	57.6	57.7	56.9	56.7	57.5	59.1	61.1	0.2%
Natural gas	45.7	43.7	45.6	45.8	47.6	49.8	52.3	0.5%
Coal	11.3	10.3	7.8	8.2	8.3	8.4	8.3	-1.1%
Nuclear	9.4	9.3	9.6	9.1	8.9	8.6	8.5	-0.3%
Renewables	28.6	30.9	35.9	40.2	42.7	45.1	48.0	1.9%

Total	152.6	152.0	155.8	160.0	164.9	171.1	178.2	0.6%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F3. Delivered energy consumption in the United States by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.9	0.8	0.8	0.7	0.7	0.7	0.6	-1.3%
Natural gas	5.1	5.0	5.0	4.9	4.9	4.9	4.9	-0.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	5.1	5.2	5.3	5.4	5.6	5.8	6.1	0.6%
Renewables	0.5	0.5	0.4	0.4	0.3	0.3	0.3	-2.0%
Total	11.8	11.4	11.5	11.4	11.5	11.7	11.9	0.1%
Commercial								
Liquid fuels	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0%
Natural gas	3.6	3.5	3.6	3.6	3.6	3.6	3.6	0.0%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3%
Electricity	4.6	4.5	4.6	4.7	4.8	4.9	5.1	0.4%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0%
Total	9.2	9.1	9.3	9.4	9.4	9.5	9.7	0.2%
Industrial								
Liquid fuels	9.0	9.0	9.3	9.7	10.1	10.4	10.7	0.6%
Natural gas	10.9	10.7	11.3	11.6	12.0	12.3	12.8	0.6%
Coal	0.9	0.8	0.8	0.8	0.7	0.7	0.6	-1.0%
Electricity	3.5	3.4	3.6	3.7	3.8	3.9	4.0	0.5%
Renewables	2.4	2.4	2.5	2.6	2.6	2.7	2.8	0.5%
Total	26.6	26.4	27.5	28.3	29.1	30.0	31.0	0.6%
Transportation								
Liquid fuels	26.6	25.9	24.7	23.7	23.3	23.5	24.1	-0.4%
Natural gas	1.0	0.9	0.8	0.8	0.8	0.9	1.0	0.0%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.1	0.1	0.2	0.4	0.6	0.7	0.8	9.6%
Total	27.6	26.9	25.7	24.9	24.7	25.0	25.8	-0.2%
Components of energy use								
End-use consumption								
Liquid fuels	37.3	36.6	35.7	35.1	35.0	35.4	36.3	-0.1%
Natural gas	20.7	20.1	20.7	21.0	21.3	21.7	22.3	0.3%
Coal	0.9	0.8	0.8	0.8	0.7	0.7	0.7	-1.0%
Electricity	13.3	13.2	13.7	14.2	14.7	15.3	16.0	0.7%
Renewables	3.1	3.0	3.0	3.1	3.1	3.1	3.2	0.2%
Total end-use consumption	75.2	73.7	74.0	74.0	74.8	76.2	78.4	0.2%
Electricity-related losses	24.3	23.8	23.6	24.3	24.9	25.7	26.4	0.3%
Discrepancy	-0.6	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	--
Total	98.9	97.3	97.5	98.2	99.5	101.7	104.7	0.2%
Electric power								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-2.8%
Natural gas	12.2	10.2	9.8	9.0	9.6	10.6	11.5	-0.2%
Coal	8.8	8.0	5.3	5.2	4.7	4.6	4.3	-2.6%
Nuclear	8.1	8.2	8.1	7.7	7.7	7.7	7.7	-0.2%
Renewables	8.3	10.5	14.1	16.6	17.6	18.0	18.8	2.9%
Total	37.6	37.0	37.3	38.5	39.6	40.9	42.3	0.4%
Total energy consumption								
Liquid fuels	36.8	36.5	35.6	35.0	34.9	35.3	36.2	-0.1%
Natural gas	32.9	30.3	30.5	29.9	30.9	32.3	33.8	0.1%
Coal	9.7	8.8	6.1	5.9	5.5	5.3	4.9	-2.4%
Nuclear	8.1	8.2	8.1	7.7	7.7	7.7	7.7	-0.2%
Renewables	11.4	13.5	17.1	19.7	20.6	21.1	22.1	2.4%

Total	98.9	97.3	97.5	98.2	99.5	101.7	104.7	0.2%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

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Table F4. Delivered energy consumption in Canada by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.0	0.0	-0.1%
Natural gas	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.7%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Total	1.3	1.3	1.3	1.4	1.4	1.5	1.5	0.6%
Commercial								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4%
Natural gas	0.6	0.6	0.7	0.7	0.8	0.8	0.8	1.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.5	0.6	0.6	0.7	0.7	0.8	0.8	1.5%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Total	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.3%
Industrial								
Liquid fuels	2.2	2.3	2.5	2.8	3.0	3.2	3.4	1.6%
Natural gas	2.5	2.6	2.9	3.1	3.4	3.8	4.1	1.7%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3%
Electricity	0.7	0.7	0.8	0.9	1.0	1.1	1.2	2.1%
Renewables	0.4	0.4	0.5	0.5	0.5	0.5	0.6	1.1%
Total	6.0	6.1	6.8	7.4	8.0	8.8	9.4	1.6%
Transportation								
Liquid fuels	2.5	2.5	2.4	2.4	2.3	2.4	2.4	-0.1%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.1	0.1	0.1	0.1	11.7%
Total	2.6	2.6	2.5	2.5	2.5	2.6	2.6	0.1%
Components of energy use								
End-use consumption								
Liquid fuels	4.7	4.9	5.0	5.2	5.4	5.7	5.9	0.8%
Natural gas	3.8	3.9	4.2	4.5	4.9	5.3	5.7	1.4%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3%
Electricity	1.9	1.9	2.1	2.3	2.5	2.7	2.9	1.6%
Renewables	0.4	0.4	0.5	0.5	0.5	0.5	0.6	1.1%
Total end-use consumption	11.0	11.3	11.9	12.6	13.4	14.4	15.2	1.2%
Electricity-related losses	3.8	3.5	3.8	4.1	4.3	4.7	5.2	1.2%
Discrepancy	-0.1	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	--
Total	14.7	14.5	15.5	16.4	17.5	18.8	20.2	1.1%
Electric power								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-10.2%
Natural gas	0.6	0.6	1.0	1.2	1.2	1.1	1.3	3.0%
Coal	0.3	0.2	0.0	0.0	0.0	0.0	0.0	-100.0%
Nuclear	0.9	0.8	0.8	0.8	0.5	0.4	0.3	-3.8%
Renewables	3.9	3.9	4.1	4.5	5.1	5.9	6.7	1.9%
Total	5.7	5.5	6.0	6.4	6.9	7.5	8.2	1.3%
Total energy consumption								
Liquid fuels	4.6	4.6	4.7	4.9	5.1	5.4	5.6	0.7%
Natural gas	4.4	4.5	5.3	5.7	6.1	6.4	7.0	1.7%
Coal	0.4	0.3	0.1	0.1	0.1	0.1	0.1	-4.2%
Nuclear	0.9	0.8	0.8	0.8	0.5	0.4	0.3	-3.8%
Renewables	4.3	4.4	4.6	4.9	5.6	6.4	7.2	1.8%

Total	14.7	14.5	15.5	16.4	17.5	18.8	20.2	1.1%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F5. Delivered energy consumption in Mexico by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.3	0.3	0.3	0.4	0.4	0.4	0.5	1.0%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.4%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.2	0.2	0.2	0.2	0.2	0.2	0.3	1.8%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.2	0.2	0.3	0.3	0.3	0.3	0.4	1.7%
Industrial								
Liquid fuels	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.4%
Natural gas	1.4	1.5	1.7	1.8	2.0	2.1	2.2	1.6%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9%
Electricity	0.6	0.6	0.6	0.7	0.7	0.8	0.8	1.4%
Renewables	0.2	0.2	0.2	0.2	0.2	0.3	0.3	1.3%
Total	3.1	3.2	3.6	3.9	4.1	4.4	4.6	1.5%
Transportation								
Liquid fuels	2.1	2.1	2.1	2.2	2.2	2.4	2.5	0.6%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0%
Total	2.1	2.1	2.1	2.2	2.3	2.4	2.6	0.7%
Components of energy use								
End-use consumption								
Liquid fuels	3.1	3.2	3.3	3.4	3.6	3.8	4.0	0.8%
Natural gas	1.4	1.5	1.8	1.9	2.0	2.1	2.3	1.6%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9%
Electricity	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.4%
Renewables	0.2	0.2	0.2	0.2	0.3	0.3	0.3	1.3%
Total end-use consumption	6.0	6.1	6.6	7.0	7.4	7.8	8.2	1.2%
Electricity-related losses	1.6	1.6	1.8	1.8	1.9	2.0	2.1	1.1%
Discrepancy	0.2	0.1	0.1	0.1	0.1	0.1	0.1	-5.0%
Total	7.7	7.8	8.4	8.8	9.3	9.8	10.4	1.1%
Electric power								
Liquid fuels	0.4	0.5	0.3	0.1	0.0	0.0	0.0	-18.3%
Natural gas	1.3	1.4	1.4	1.5	1.7	1.8	1.8	1.2%
Coal	0.1	0.1	0.2	0.2	0.2	0.2	0.2	4.1%
Nuclear	0.1	0.1	0.2	0.3	0.2	0.2	0.2	1.5%
Renewables	0.8	0.7	0.9	0.9	1.0	1.2	1.5	2.5%
Total	2.6	2.7	2.9	3.1	3.2	3.4	3.7	1.2%
Total energy consumption								
Liquid fuels	3.7	3.7	3.6	3.6	3.7	3.8	4.0	0.3%
Natural gas	2.8	2.9	3.2	3.4	3.8	3.9	4.1	1.4%
Coal	0.2	0.2	0.3	0.3	0.3	0.3	0.3	2.4%
Nuclear	0.1	0.1	0.2	0.3	0.2	0.2	0.2	1.5%
Renewables	1.0	0.9	1.1	1.2	1.3	1.5	1.8	2.3%

Total	7.7	7.8	8.4	8.8	9.3	9.8	10.4	1.1%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F6. Delivered energy consumption in Brazil by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.0	1.0	1.0	1.1	1.1	1.2	1.2	0.8%
Commercial								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.9%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.9%
Industrial								
Liquid fuels	1.4	1.4	1.5	1.6	1.7	1.7	1.7	0.7%
Natural gas	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9%
Coal	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7%
Electricity	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4%
Renewables	2.7	2.8	3.1	3.4	3.6	3.7	3.8	1.2%
Total	6.1	6.2	6.8	7.3	7.6	7.8	7.9	0.9%
Transportation								
Liquid fuels	3.6	3.7	3.8	3.8	3.9	4.0	4.1	0.4%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-1.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.0	0.1	0.1	0.1	3.5%
Total	3.7	3.8	3.9	4.0	4.1	4.1	4.2	0.5%
Components of energy use								
End-use consumption								
Liquid fuels	5.3	5.4	5.6	5.8	5.9	6.1	6.2	0.5%
Natural gas	0.8	0.9	0.9	1.0	1.0	1.0	1.0	0.8%
Coal	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7%
Electricity	2.0	2.1	2.2	2.3	2.4	2.4	2.5	0.8%
Renewables	2.7	2.9	3.2	3.5	3.7	3.8	3.8	1.2%
Total end-use consumption	11.4	11.7	12.4	13.1	13.5	13.9	14.1	0.8%
Electricity-related losses	3.5	3.8	4.0	4.2	4.2	4.3	4.5	0.8%
Discrepancy	0.0	0.1	0.1	0.1	0.1	0.1	0.1	--
Total	14.9	15.6	16.4	17.3	17.9	18.3	18.7	0.8%
Electric power								
Liquid fuels	0.1	0.2	0.1	0.0	0.0	0.0	0.0	-14.9%
Natural gas	0.5	0.7	0.9	0.7	0.6	0.5	0.5	-0.5%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1%
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	0.2	1.0%
Renewables	4.7	4.7	4.9	5.4	5.7	6.0	6.2	1.0%
Total	5.6	5.9	6.1	6.5	6.6	6.8	7.0	0.8%
Total energy consumption								
Liquid fuels	5.5	5.7	5.8	5.9	6.0	6.2	6.3	0.5%
Natural gas	1.4	1.5	1.8	1.7	1.5	1.5	1.5	0.3%
Coal	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6%
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	0.2	1.0%
Renewables	7.4	7.6	8.0	8.9	9.3	9.7	10.1	1.1%

Total	14.9	15.6	16.4	17.3	17.9	18.3	18.7	0.8%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F7. Delivered energy consumption in Other Americas by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5%
Natural gas	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1%
Electricity	0.8	0.7	0.8	0.8	0.9	0.9	1.0	0.8%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.6	1.6	1.7	1.7	1.8	1.9	1.9	0.7%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5%
Electricity	0.5	0.6	0.6	0.7	0.8	0.9	1.0	2.2%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.7	0.8	0.8	0.9	1.0	1.1	1.3	2.0%
Industrial								
Liquid fuels	1.8	1.9	2.0	2.2	2.4	2.7	2.9	1.7%
Natural gas	2.0	2.1	2.3	2.5	2.8	3.0	3.4	1.8%
Coal	0.2	0.2	0.3	0.3	0.3	0.3	0.4	2.1%
Electricity	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.8%
Renewables	0.9	0.9	1.1	1.2	1.3	1.5	1.7	2.3%
Total	5.7	5.9	6.6	7.3	8.0	8.8	9.6	1.9%
Transportation								
Liquid fuels	3.8	4.0	4.2	4.4	4.7	5.1	5.4	1.3%
Natural gas	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.4%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.2%
Total	4.0	4.3	4.5	4.7	5.0	5.4	5.7	1.2%
Components of energy use								
End-use consumption								
Liquid fuels	6.1	6.3	6.7	7.1	7.7	8.3	8.9	1.4%
Natural gas	2.8	2.9	3.2	3.5	3.7	4.0	4.3	1.5%
Coal	0.2	0.2	0.3	0.3	0.3	0.3	0.4	2.1%
Electricity	2.1	2.1	2.3	2.6	2.8	3.1	3.3	1.7%
Renewables	0.9	0.9	1.1	1.2	1.4	1.5	1.7	2.3%
Total end-use consumption	12.1	12.6	13.6	14.6	15.8	17.1	18.6	1.5%
Electricity-related losses	4.0	4.0	4.2	4.5	4.8	5.1	5.5	1.1%
Discrepancy	0.3	0.1	0.1	0.1	0.2	0.2	0.2	-1.9%
Total	16.4	16.8	18.0	19.3	20.8	22.4	24.2	1.4%
Electric power								
Liquid fuels	0.6	0.7	0.3	0.1	0.0	0.0	0.0	-17.4%
Natural gas	1.5	1.5	1.6	1.6	1.6	1.6	1.6	0.3%
Coal	0.2	0.2	0.4	0.9	1.4	1.7	1.8	8.1%
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.5%
Renewables	3.6	3.6	4.0	4.3	4.4	4.7	5.3	1.3%
Total	6.1	6.2	6.6	7.0	7.6	8.2	8.8	1.3%
Total energy consumption								
Liquid fuels	7.0	7.2	7.2	7.4	7.8	8.4	9.0	0.9%
Natural gas	4.3	4.5	4.8	5.1	5.3	5.6	5.9	1.1%
Coal	0.4	0.4	0.7	1.2	1.7	2.0	2.2	6.1%
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.5%
Renewables	4.5	4.6	5.1	5.5	5.8	6.2	6.9	1.5%

Total	16.4	16.8	18.0	19.3	20.8	22.4	24.2	1.4%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F8. Delivered energy consumption in Europe and Eurasia by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	2.4	2.4	2.4	2.3	2.3	2.3	2.2	-0.2%
Natural gas	10.3	10.6	10.8	11.1	11.4	11.6	11.9	0.5%
Coal	1.0	1.0	1.0	1.0	1.0	0.9	0.9	-0.3%
Electricity	4.7	4.8	5.1	5.4	5.7	6.0	6.2	1.0%
Renewables	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.8%
Total	18.6	19.0	19.4	19.9	20.5	21.0	21.5	0.5%
Commercial								
Liquid fuels	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.2%
Natural gas	3.1	3.2	3.3	3.5	3.6	3.8	4.0	0.9%
Coal	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-0.3%
Electricity	4.2	4.4	4.7	5.0	5.3	5.5	5.8	1.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	8.5	8.8	9.2	9.6	10.1	10.6	11.0	0.9%
Industrial								
Liquid fuels	11.8	11.9	12.2	12.6	13.3	14.1	14.8	0.8%
Natural gas	16.5	16.4	16.6	16.9	17.5	18.2	19.1	0.5%
Coal	6.2	6.2	6.3	6.6	6.9	7.2	7.6	0.7%
Electricity	7.0	7.1	7.4	7.8	8.3	8.7	9.3	1.0%
Renewables	3.1	3.1	3.1	3.2	3.3	3.4	3.5	0.5%
Total	44.5	44.7	45.6	47.1	49.2	51.7	54.3	0.7%
Transportation								
Liquid fuels	22.6	22.5	21.3	20.5	20.1	20.0	20.1	-0.4%
Natural gas	0.5	0.8	0.9	1.0	1.0	1.1	1.2	2.9%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.8	0.8	0.9	1.2	1.4	1.7	1.8	3.1%
Total	23.9	24.2	23.2	22.6	22.5	22.7	23.2	-0.1%
Components of energy use								
End-use consumption								
Liquid fuels	37.5	37.6	36.6	36.2	36.4	37.1	38.0	0.0%
Natural gas	30.5	31.1	31.7	32.5	33.5	34.8	36.2	0.6%
Coal	7.6	7.7	7.8	8.0	8.3	8.6	8.9	0.6%
Electricity	16.8	17.1	18.0	19.3	20.7	21.9	23.2	1.2%
Renewables	3.2	3.2	3.3	3.3	3.4	3.5	3.7	0.5%
Total end-use consumption	95.5	96.7	97.4	99.3	102.4	105.9	109.9	0.5%
Electricity-related losses	34.9	36.2	37.1	38.9	40.8	42.6	44.2	0.9%
Discrepancy	-0.4	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	--
Total	130.0	132.4	134.0	137.7	142.6	147.9	153.6	0.6%
Electric power								
Liquid fuels	0.8	1.1	1.1	0.7	0.6	0.5	0.5	-1.4%
Natural gas	13.2	13.3	14.1	14.5	15.4	16.4	17.5	1.0%
Coal	8.9	8.5	7.0	6.8	6.6	7.6	7.5	-0.6%
Nuclear	10.4	10.6	11.1	11.3	11.2	11.0	11.1	0.2%
Renewables	18.2	19.6	21.7	24.6	27.4	28.7	30.5	1.9%
Total	51.5	53.1	54.9	58.0	61.2	64.2	67.1	1.0%
Total energy consumption								
Liquid fuels	38.0	38.4	37.4	36.6	36.7	37.3	38.2	0.0%
Natural gas	43.7	44.4	45.8	47.0	49.0	51.2	53.8	0.7%
Coal	16.5	16.2	14.7	14.8	14.9	16.1	16.4	0.0%
Nuclear	10.4	10.6	11.1	11.3	11.2	11.0	11.1	0.2%
Renewables	21.4	22.8	24.9	27.9	30.8	32.2	34.1	1.7%

Total	130.0	132.4	134.0	137.7	142.6	147.9	153.6	0.6%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F9. Delivered energy consumption in Western Europe by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	1.5	1.5	1.5	1.4	1.4	1.3	1.2	-0.8%
Natural gas	5.3	5.3	5.3	5.4	5.5	5.5	5.6	0.2%
Coal	0.5	0.5	0.4	0.4	0.4	0.4	0.4	-0.6%
Electricity	3.7	3.7	3.9	4.1	4.3	4.5	4.6	0.8%
Renewables	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.8%
Total	11.1	11.2	11.3	11.5	11.7	11.8	12.0	0.3%
Commercial								
Liquid fuels	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0%
Natural gas	2.1	2.1	2.1	2.2	2.2	2.2	2.2	0.3%
Coal	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-0.5%
Electricity	3.5	3.6	3.8	4.0	4.2	4.3	4.4	0.9%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	6.4	6.6	6.7	7.0	7.2	7.3	7.5	0.6%
Industrial								
Liquid fuels	8.0	7.9	8.0	8.2	8.6	9.0	9.4	0.6%
Natural gas	8.1	8.0	7.8	7.8	7.9	8.0	8.1	0.0%
Coal	2.8	2.7	2.6	2.7	2.7	2.8	2.8	0.1%
Electricity	4.4	4.4	4.5	4.6	4.9	5.1	5.4	0.7%
Renewables	2.8	2.7	2.8	2.9	2.9	3.0	3.1	0.4%
Total	25.9	25.7	25.8	26.3	27.0	27.9	28.8	0.4%
Transportation								
Liquid fuels	18.4	18.4	17.1	16.2	15.6	15.4	15.4	-0.6%
Natural gas	0.1	0.2	0.2	0.2	0.3	0.4	0.5	5.4%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.3	0.4	0.5	0.7	1.0	1.2	1.4	5.4%
Total	18.9	18.9	17.8	17.2	17.0	17.1	17.3	-0.3%
Components of energy use								
End-use consumption								
Liquid fuels	28.6	28.4	27.2	26.4	26.2	26.3	26.6	-0.3%
Natural gas	15.5	15.6	15.5	15.6	15.8	16.2	16.5	0.2%
Coal	3.5	3.4	3.3	3.3	3.4	3.4	3.4	-0.1%
Electricity	11.9	12.0	12.6	13.4	14.4	15.1	15.8	1.0%
Renewables	2.9	2.9	3.0	3.0	3.1	3.2	3.3	0.4%
Total end-use consumption	62.3	62.3	61.5	61.9	62.9	64.1	65.6	0.2%
Electricity-related losses	21.8	23.6	25.1	26.5	28.0	29.3	30.2	1.2%
Discrepancy	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	--
Total	84.2	85.8	86.6	88.3	90.8	93.3	95.8	0.5%
Electric power								
Liquid fuels	0.5	0.8	0.8	0.6	0.5	0.5	0.5	-0.6%
Natural gas	5.0	5.6	6.9	6.6	6.5	6.4	6.4	0.9%
Coal	5.0	4.7	3.4	3.4	3.2	4.2	4.1	-0.7%
Nuclear	7.6	7.6	7.8	7.8	7.7	7.5	7.5	0.0%
Renewables	15.5	16.8	18.8	21.4	24.4	25.7	27.5	2.1%
Total	33.6	35.5	37.6	39.9	42.3	44.3	46.0	1.1%
Total energy consumption								
Liquid fuels	29.2	29.2	28.0	27.1	26.7	26.8	27.1	-0.3%
Natural gas	20.5	21.2	22.4	22.3	22.3	22.6	23.0	0.4%
Coal	8.5	8.1	6.7	6.7	6.6	7.5	7.5	-0.4%
Nuclear	7.6	7.6	7.8	7.8	7.7	7.5	7.5	0.0%
Renewables	18.4	19.7	21.8	24.5	27.5	28.9	30.8	1.9%

Total	84.2	85.8	86.6	88.3	90.8	93.3	95.8	0.5%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F10. Delivered energy consumption in Russia by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.4%
Natural gas	3.7	3.8	4.0	4.2	4.4	4.5	4.7	0.9%
Coal	0.3	0.3	0.3	0.2	0.2	0.2	0.2	-0.9%
Electricity	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.3%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Total	5.2	5.4	5.7	5.9	6.1	6.3	6.6	0.8%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4%
Natural gas	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.8%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-1.3%
Electricity	0.6	0.6	0.6	0.7	0.7	0.7	0.8	1.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Total	1.3	1.4	1.4	1.4	1.5	1.6	1.6	0.8%
Industrial								
Liquid fuels	3.2	3.4	3.5	3.7	3.9	4.2	4.5	1.2%
Natural gas	7.2	7.1	7.2	7.5	7.9	8.4	8.9	0.8%
Coal	2.5	2.6	2.6	2.7	2.8	2.9	3.0	0.7%
Electricity	1.9	2.0	2.0	2.1	2.3	2.4	2.5	0.9%
Renewables	0.2	0.3	0.3	0.3	0.3	0.3	0.3	1.1%
Total	15.1	15.2	15.7	16.3	17.2	18.2	19.2	0.9%
Transportation								
Liquid fuels	3.1	3.0	3.0	3.0	3.0	3.0	2.9	-0.1%
Natural gas	0.2	0.3	0.3	0.3	0.3	0.3	0.3	1.4%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-1.1%
Total	3.6	3.7	3.7	3.6	3.6	3.6	3.5	-0.1%
Components of energy use								
End-use consumption								
Liquid fuels	7.0	7.2	7.3	7.5	7.7	8.0	8.3	0.6%
Natural gas	11.6	11.7	12.2	12.6	13.2	13.9	14.6	0.8%
Coal	2.9	2.9	3.0	3.0	3.1	3.2	3.3	0.5%
Electricity	3.5	3.5	3.7	3.8	4.0	4.2	4.4	0.8%
Renewables	0.2	0.3	0.3	0.3	0.3	0.3	0.3	1.1%
Total end-use consumption	25.2	25.6	26.4	27.3	28.3	29.6	31.0	0.7%
Electricity-related losses	8.8	8.7	8.2	8.5	8.6	8.8	8.9	0.0%
Discrepancy	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	--
Total	33.5	33.8	34.1	35.2	36.4	37.8	39.3	0.6%
Electric power								
Liquid fuels	0.2	0.3	0.2	0.1	0.1	0.0	0.0	-6.8%
Natural gas	5.9	5.6	5.5	6.1	6.6	7.0	7.4	0.8%
Coal	1.9	2.1	1.8	1.5	1.5	1.5	1.5	-0.8%
Nuclear	2.3	2.4	2.5	2.5	2.5	2.5	2.4	0.2%
Renewables	1.9	1.9	1.9	2.1	1.9	1.9	1.9	0.0%
Total	12.3	12.2	11.8	12.3	12.6	12.9	13.3	0.3%
Total energy consumption								
Liquid fuels	6.7	6.9	7.0	7.1	7.3	7.5	7.8	0.5%
Natural gas	17.6	17.3	17.6	18.7	19.8	20.9	22.1	0.8%
Coal	4.8	5.0	4.8	4.6	4.6	4.7	4.8	0.0%
Nuclear	2.3	2.4	2.5	2.5	2.5	2.5	2.4	0.2%
Renewables	2.2	2.1	2.2	2.4	2.2	2.2	2.2	0.1%

Total	33.5	33.8	34.1	35.2	36.4	37.8	39.3	0.6%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F11. Delivered energy consumption in Eastern Europe and Eurasia by end-use sector and fuel, High Zero-carbon Technology Cost case
quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.2	0.2	0.2	0.2	0.2	0.2	0.3	1.0%
Natural gas	1.4	1.5	1.5	1.5	1.5	1.6	1.6	0.5%
Coal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4%
Electricity	0.4	0.4	0.5	0.5	0.6	0.7	0.7	2.0%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	2.3	2.4	2.5	2.6	2.7	2.8	2.9	0.9%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.3%
Natural gas	0.5	0.6	0.6	0.7	0.8	1.0	1.1	2.9%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0%
Electricity	0.2	0.2	0.3	0.3	0.4	0.5	0.6	4.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.8	0.9	1.1	1.2	1.4	1.6	1.9	3.0%
Industrial								
Liquid fuels	0.6	0.7	0.7	0.7	0.8	0.9	1.0	1.7%
Natural gas	1.2	1.4	1.5	1.6	1.7	1.8	2.0	1.8%
Coal	0.9	1.0	1.1	1.2	1.4	1.5	1.8	2.4%
Electricity	0.7	0.8	0.9	1.0	1.1	1.3	1.4	2.6%
Renewables	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.7%
Total	3.5	3.8	4.2	4.6	5.0	5.6	6.2	2.1%
Transportation								
Liquid fuels	1.1	1.1	1.2	1.3	1.4	1.6	1.8	1.9%
Natural gas	0.2	0.4	0.4	0.4	0.4	0.3	0.3	2.0%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.1	0.1	0.1	0.1	0.2	0.2	0.2	1.8%
Total	1.4	1.6	1.7	1.8	2.0	2.1	2.3	1.9%
Components of energy use								
End-use consumption								
Liquid fuels	1.9	2.0	2.2	2.3	2.5	2.8	3.1	1.7%
Natural gas	3.3	3.7	4.0	4.2	4.5	4.7	5.1	1.5%
Coal	1.3	1.3	1.5	1.6	1.8	2.0	2.2	2.0%
Electricity	1.4	1.5	1.8	2.0	2.3	2.6	2.9	2.6%
Renewables	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.7%
Total end-use consumption	8.0	8.7	9.5	10.2	11.1	12.2	13.4	1.9%
Electricity-related losses	4.3	3.9	3.8	3.9	4.2	4.6	5.1	0.6%
Discrepancy	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.9%
Total	12.3	12.7	13.3	14.2	15.4	16.8	18.5	1.5%
Electric power								
Liquid fuels	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-1.0%
Natural gas	2.3	2.1	1.8	1.8	2.4	3.0	3.7	1.7%
Coal	2.0	1.8	1.8	1.9	1.9	1.9	1.9	-0.1%
Nuclear	0.5	0.6	0.8	1.1	1.1	1.1	1.2	3.3%
Renewables	0.8	0.9	1.0	1.0	1.0	1.1	1.1	0.9%
Total	5.6	5.4	5.5	5.8	6.4	7.0	7.9	1.2%
Total energy consumption								
Liquid fuels	2.1	2.2	2.4	2.5	2.8	3.1	3.4	1.7%
Natural gas	5.7	5.9	5.8	6.0	6.8	7.7	8.8	1.6%
Coal	3.2	3.1	3.3	3.5	3.7	3.8	4.1	0.8%
Nuclear	0.5	0.6	0.8	1.1	1.1	1.1	1.2	3.3%
Renewables	0.9	1.0	1.0	1.1	1.1	1.1	1.1	0.9%

Total	12.3	12.7	13.3	14.2	15.4	16.8	18.5	1.5%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F12. Delivered energy consumption in Asia Pacific by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	4.3	4.6	5.0	5.5	5.9	6.3	6.7	1.6%
Natural gas	3.9	4.3	5.0	5.6	6.2	6.9	7.5	2.3%
Coal	2.5	2.4	2.3	2.3	2.3	2.2	2.2	-0.5%
Electricity	10.2	11.3	13.4	15.3	17.8	20.8	23.6	3.0%
Renewables	0.9	0.9	0.9	1.0	1.0	1.1	1.1	0.8%
Total	21.9	23.5	26.7	29.7	33.2	37.3	41.1	2.3%
Commercial								
Liquid fuels	1.5	1.6	1.7	1.8	1.9	2.0	2.1	1.1%
Natural gas	1.3	1.4	1.6	1.7	1.9	2.0	2.1	1.7%
Coal	0.8	0.8	0.9	0.9	0.9	1.0	1.0	0.8%
Electricity	6.0	6.5	7.4	8.0	8.9	9.8	10.6	2.1%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8%
Total	9.7	10.5	11.7	12.6	13.7	14.9	15.9	1.8%
Industrial								
Liquid fuels	28.0	30.0	32.8	35.2	37.0	38.8	40.1	1.3%
Natural gas	16.1	17.3	19.3	21.2	22.8	24.4	25.8	1.7%
Coal	52.7	52.5	52.2	51.7	51.1	51.0	50.8	-0.1%
Electricity	26.6	28.1	30.2	31.9	33.2	34.4	35.3	1.0%
Renewables	11.0	13.2	15.1	17.2	19.0	20.7	22.2	2.5%
Total	134.5	141.1	149.7	157.2	163.0	169.3	174.3	0.9%
Transportation								
Liquid fuels	35.8	39.5	42.4	44.6	46.5	48.7	50.8	1.3%
Natural gas	1.8	1.9	2.1	2.3	2.5	2.8	3.3	2.3%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	1.0	1.2	1.4	1.8	2.1	2.5	2.8	3.7%
Total	38.6	42.6	45.9	48.6	51.1	54.1	56.9	1.4%
Components of energy use								
End-use consumption								
Liquid fuels	69.6	75.7	81.9	87.1	91.3	95.8	99.7	1.3%
Natural gas	23.1	25.0	27.9	30.8	33.3	36.1	38.8	1.9%
Coal	56.0	55.7	55.4	54.9	54.3	54.2	54.0	-0.1%
Electricity	43.8	47.0	52.4	57.0	62.0	67.5	72.3	1.8%
Renewables	12.0	14.2	16.2	18.3	20.1	21.9	23.5	2.4%
Total end-use consumption	204.6	217.7	233.9	248.0	261.1	275.5	288.3	1.2%
Electricity-related losses	86.8	90.7	101.4	110.8	117.6	124.8	131.4	1.5%
Discrepancy	1.1	0.7	0.9	1.2	1.5	1.8	2.1	2.2%
Total	292.6	309.0	336.2	360.0	380.2	402.1	421.7	1.3%
Electric power								
Liquid fuels	0.7	0.8	0.4	0.2	0.1	0.1	0.1	-7.5%
Natural gas	12.1	12.5	12.6	12.5	13.2	14.7	16.0	1.0%
Coal	77.6	77.5	84.9	89.5	89.8	88.7	90.1	0.5%
Nuclear	7.6	8.7	10.5	12.0	13.2	14.0	14.9	2.4%
Renewables	32.7	38.3	45.4	53.6	63.4	74.8	82.7	3.4%
Total	130.7	137.8	153.8	167.8	179.7	192.3	203.6	1.6%
Total energy consumption								
Liquid fuels	71.4	77.0	83.3	88.5	92.9	97.7	101.8	1.3%
Natural gas	35.2	37.5	40.6	43.2	46.5	50.8	54.7	1.6%
Coal	133.7	133.2	140.3	144.4	144.2	143.0	144.2	0.3%
Nuclear	7.6	8.7	10.5	12.0	13.2	14.0	14.9	2.4%
Renewables	44.7	52.5	61.6	71.8	83.5	96.7	106.1	3.1%

Total	292.6	309.0	336.2	360.0	380.2	402.1	421.7	1.3%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F13. Delivered energy consumption in Japan by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-0.1%
Natural gas	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.3%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.8	1.9	1.9	1.8	1.8	1.8	1.9	0.1%
Commercial								
Liquid fuels	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1%
Natural gas	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.7%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4%
Electricity	1.2	1.2	1.2	1.2	1.2	1.2	1.2	-0.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.9	2.0	2.0	2.0	2.0	2.0	2.0	0.1%
Industrial								
Liquid fuels	2.7	2.7	2.5	2.4	2.3	2.2	2.1	-0.9%
Natural gas	0.7	0.7	0.7	0.7	0.6	0.6	0.6	-0.5%
Coal	1.7	1.6	1.5	1.4	1.2	1.1	1.0	-1.8%
Electricity	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.0%
Renewables	0.5	0.5	0.5	0.4	0.4	0.4	0.3	-1.3%
Total	6.4	6.4	6.1	5.8	5.6	5.3	5.1	-0.8%
Transportation								
Liquid fuels	3.0	3.0	2.8	2.6	2.4	2.3	2.2	-1.1%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.8%
Total	3.1	3.1	2.9	2.7	2.5	2.4	2.3	-1.0%
Components of energy use								
End-use consumption								
Liquid fuels	6.5	6.5	6.1	5.8	5.5	5.3	5.1	-0.9%
Natural gas	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.1%
Coal	1.7	1.6	1.5	1.4	1.2	1.1	1.0	-1.8%
Electricity	3.1	3.2	3.3	3.2	3.2	3.3	3.3	0.2%
Renewables	0.5	0.5	0.5	0.4	0.4	0.4	0.4	-1.2%
Total end-use consumption	13.3	13.4	12.9	12.3	11.9	11.6	11.3	-0.6%
Electricity-related losses	5.2	5.3	4.3	4.4	4.5	4.5	4.6	-0.4%
Discrepancy	0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	--
Total	18.5	18.5	17.0	16.5	16.2	15.9	15.7	-0.6%
Electric power								
Liquid fuels	0.1	0.2	0.1	0.1	0.0	0.0	0.0	-4.0%
Natural gas	2.7	2.7	2.5	2.2	2.0	2.0	1.9	-1.3%
Coal	2.7	2.7	1.6	1.7	1.7	1.7	1.7	-1.6%
Nuclear	0.8	1.2	1.5	1.5	1.3	1.1	1.1	1.0%
Renewables	1.9	1.7	2.0	2.2	2.7	2.9	3.2	1.8%
Total	8.2	8.5	7.6	7.7	7.7	7.7	7.9	-0.2%
Total energy consumption								
Liquid fuels	6.8	6.5	6.1	5.7	5.4	5.2	5.0	-1.1%
Natural gas	4.2	4.3	4.0	3.7	3.5	3.5	3.4	-0.7%
Coal	4.4	4.3	3.1	3.1	3.0	2.8	2.7	-1.7%
Nuclear	0.8	1.2	1.5	1.5	1.3	1.1	1.1	1.0%
Renewables	2.4	2.2	2.4	2.6	3.1	3.3	3.5	1.4%

Total	18.5	18.5	17.0	16.5	16.2	15.9	15.7	-0.6%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F14. Delivered energy consumption in South Korea by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3%
Natural gas	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5%
Electricity	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.9%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.7%
Total	0.8	0.9	0.9	0.9	0.9	1.0	1.0	0.6%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.4%
Natural gas	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.5%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3%
Total	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.4%
Industrial								
Liquid fuels	2.8	2.8	3.0	3.1	3.1	3.1	3.1	0.4%
Natural gas	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2%
Coal	1.2	1.1	1.2	1.2	1.2	1.2	1.2	0.1%
Electricity	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.2%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.3%
Total	5.7	5.8	6.0	6.1	6.1	6.2	6.2	0.3%
Transportation								
Liquid fuels	2.0	2.1	2.0	1.9	1.8	1.7	1.6	-0.9%
Natural gas	0.0	0.0	0.0	0.0	0.1	0.1	0.1	1.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.1	0.1	0.1	0.1	5.9%
Total	2.1	2.2	2.1	2.0	1.9	1.8	1.7	-0.7%
Components of energy use								
End-use consumption								
Liquid fuels	5.0	5.1	5.2	5.1	5.1	5.0	4.9	-0.1%
Natural gas	1.3	1.3	1.3	1.3	1.3	1.4	1.4	0.4%
Coal	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.1%
Electricity	2.0	2.0	2.1	2.1	2.2	2.2	2.3	0.6%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.3%
Total end-use consumption	9.5	9.7	9.9	9.9	9.9	9.9	9.9	0.1%
Electricity-related losses	3.2	3.4	3.6	3.8	3.9	4.0	4.0	0.8%
Discrepancy	0.2	0.3	0.3	0.3	0.3	0.3	0.3	1.1%
Total	13.0	13.4	13.8	14.0	14.1	14.2	14.2	0.3%
Electric power								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5%
Natural gas	1.3	1.2	1.1	1.0	1.0	0.9	0.9	-1.3%
Coal	1.4	1.4	1.4	1.5	1.6	1.6	1.6	0.5%
Nuclear	2.0	2.3	2.4	2.4	2.4	2.3	2.3	0.5%
Renewables	0.5	0.5	0.7	0.9	1.1	1.4	1.5	4.2%
Total	5.2	5.4	5.7	5.9	6.1	6.2	6.3	0.7%
Total energy consumption								
Liquid fuels	5.3	5.5	5.5	5.5	5.4	5.3	5.2	0.0%
Natural gas	2.6	2.6	2.5	2.4	2.3	2.3	2.3	-0.4%
Coal	2.6	2.5	2.6	2.7	2.8	2.8	2.8	0.3%
Nuclear	2.0	2.3	2.4	2.4	2.4	2.3	2.3	0.5%
Renewables	0.6	0.6	0.8	1.0	1.2	1.5	1.6	3.6%

Total	13.0	13.4	13.8	14.0	14.1	14.2	14.2	0.3%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F15. Delivered energy consumption in Australia and New Zealand by end-use sector and fuel, High Zero-carbon Technology Cost case
quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1%
Natural gas	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.0%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.9%
Electricity	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6%
Commercial								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.4%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1%
Electricity	0.3	0.3	0.4	0.4	0.4	0.5	0.5	1.7%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.4	0.4	0.5	0.5	0.6	0.6	0.6	1.5%
Industrial								
Liquid fuels	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.3%
Natural gas	1.1	1.1	1.1	1.1	1.2	1.3	1.3	0.8%
Coal	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.1%
Electricity	0.3	0.4	0.4	0.5	0.5	0.5	0.6	1.8%
Renewables	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.4%
Total	2.6	2.7	2.9	3.1	3.3	3.5	3.7	1.2%
Transportation								
Liquid fuels	1.7	1.9	1.9	1.9	1.8	1.9	1.9	0.4%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.1	0.1	0.1	0.1	0.1	0.1	3.2%
Total	1.7	2.0	2.0	1.9	1.9	2.0	2.0	0.6%
Components of energy use								
End-use consumption								
Liquid fuels	2.5	2.7	2.9	2.9	2.9	3.0	3.0	0.7%
Natural gas	1.3	1.3	1.4	1.4	1.5	1.6	1.7	0.9%
Coal	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.1%
Electricity	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.5%
Renewables	0.2	0.3	0.3	0.3	0.3	0.3	0.4	1.4%
Total end-use consumption	5.2	5.6	5.9	6.1	6.3	6.6	6.9	1.0%
Electricity-related losses	1.9	1.9	2.0	2.2	2.3	2.4	2.6	1.1%
Discrepancy	0.0	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	--
Total	7.2	7.2	7.7	8.0	8.4	8.8	9.2	0.9%
Electric power								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.3%
Natural gas	0.4	0.4	0.4	0.3	0.3	0.3	0.3	-1.4%
Coal	1.3	1.2	1.3	1.4	1.4	1.4	1.4	0.3%
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Renewables	1.1	1.3	1.4	1.6	1.9	2.1	2.3	2.6%
Total	2.8	2.8	3.1	3.4	3.6	3.8	4.0	1.2%
Total energy consumption								
Liquid fuels	2.5	2.6	2.7	2.7	2.7	2.8	2.9	0.4%
Natural gas	1.7	1.7	1.8	1.8	1.8	1.9	2.0	0.5%
Coal	1.5	1.4	1.6	1.7	1.7	1.7	1.7	0.4%
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Renewables	1.4	1.5	1.7	1.9	2.2	2.4	2.7	2.4%

Total	7.2	7.2	7.7	8.0	8.4	8.8	9.2	0.9%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F16. Delivered energy consumption in China by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	1.8	1.9	2.1	2.3	2.5	2.7	2.9	1.8%
Natural gas	2.3	2.7	3.2	3.8	4.3	4.9	5.4	3.1%
Coal	2.3	2.1	2.1	2.0	2.0	2.0	1.9	-0.6%
Electricity	5.0	5.6	6.8	7.9	9.2	10.6	11.9	3.2%
Renewables	0.8	0.8	0.9	0.9	0.9	1.0	1.0	0.8%
Total	12.1	13.1	15.0	16.9	18.9	21.1	23.2	2.3%
Commercial								
Liquid fuels	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.3%
Natural gas	0.6	0.7	0.8	0.8	0.9	1.0	1.1	2.2%
Coal	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-0.5%
Electricity	2.0	2.2	2.6	2.8	3.2	3.6	3.8	2.4%
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8%
Total	3.8	4.1	4.7	5.0	5.5	6.0	6.4	1.8%
Industrial								
Liquid fuels	14.5	15.7	16.8	17.5	17.8	17.9	17.6	0.7%
Natural gas	7.4	7.8	8.0	8.2	8.3	8.4	8.3	0.4%
Coal	39.1	38.2	35.7	32.8	29.8	27.3	24.8	-1.6%
Electricity	19.2	20.2	20.8	21.2	21.2	21.1	20.7	0.3%
Renewables	3.3	4.8	4.9	4.9	4.9	4.8	4.6	1.2%
Total	83.5	86.7	86.1	84.6	81.9	79.5	76.1	-0.3%
Transportation								
Liquid fuels	13.6	15.0	15.3	14.7	13.6	13.0	12.5	-0.3%
Natural gas	1.4	1.4	1.4	1.4	1.4	1.5	1.6	0.7%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.7	0.8	1.0	1.3	1.5	1.7	1.8	3.4%
Total	15.7	17.2	17.8	17.4	16.6	16.2	15.9	0.1%
Components of energy use								
End-use consumption								
Liquid fuels	30.5	33.3	34.9	35.3	34.7	34.5	33.9	0.4%
Natural gas	11.6	12.6	13.4	14.3	15.0	15.8	16.5	1.3%
Coal	41.9	40.9	38.3	35.3	32.3	29.7	27.2	-1.5%
Electricity	26.9	28.8	31.2	33.1	35.0	36.9	38.2	1.3%
Renewables	4.2	5.7	5.8	5.9	5.9	5.9	5.8	1.1%
Total end-use consumption	115.2	121.2	123.6	123.9	122.9	122.8	121.6	0.2%
Electricity-related losses	57.1	58.3	62.9	66.7	68.9	71.1	72.9	0.9%
Discrepancy	0.2	0.3	0.4	0.5	0.5	0.6	0.7	4.8%
Total	172.4	179.8	186.9	191.1	192.4	194.4	195.2	0.4%
Electric power								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-10.9%
Natural gas	2.7	2.9	3.1	3.9	5.4	7.0	8.3	4.1%
Coal	54.9	54.2	56.1	57.6	55.3	52.5	52.6	-0.2%
Nuclear	4.0	4.4	5.7	7.1	8.4	9.5	10.4	3.5%
Renewables	22.4	25.8	29.4	31.3	35.1	39.2	40.0	2.1%
Total	84.1	87.3	94.3	100.0	104.1	108.2	111.3	1.0%
Total energy consumption								
Liquid fuels	30.6	33.5	35.2	35.6	35.1	34.9	34.4	0.4%
Natural gas	14.4	15.4	16.5	18.2	20.3	22.8	24.8	2.0%
Coal	96.9	95.1	94.4	92.9	87.6	82.2	79.7	-0.7%
Nuclear	4.0	4.4	5.7	7.1	8.4	9.5	10.4	3.5%
Renewables	26.6	31.5	35.2	37.3	41.0	45.1	45.8	2.0%

Total	172.4	179.8	186.9	191.1	192.4	194.4	195.2	0.4%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F17. Delivered energy consumption in India by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	1.3	1.4	1.6	1.8	2.0	2.1	2.3	2.1%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.0%
Coal	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.6%
Electricity	1.5	1.7	2.2	2.9	3.8	4.9	6.0	5.2%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8%
Total	3.0	3.3	4.1	5.0	6.0	7.4	8.7	3.9%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.2	0.2	0.2	0.2	3.2%
Natural gas	0.1	0.1	0.1	0.1	0.2	0.2	0.2	2.9%
Coal	0.2	0.3	0.3	0.4	0.4	0.5	0.5	2.6%
Electricity	0.4	0.5	0.7	0.9	1.1	1.3	1.5	4.5%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.9	1.0	1.3	1.5	1.8	2.1	2.4	3.8%
Industrial								
Liquid fuels	3.8	4.1	5.1	6.3	7.5	8.7	9.9	3.5%
Natural gas	1.8	2.1	3.0	4.0	5.0	6.0	6.9	4.8%
Coal	6.1	6.5	8.1	10.0	11.8	13.7	15.6	3.4%
Electricity	3.1	3.4	4.3	5.2	6.0	6.9	7.8	3.4%
Renewables	3.9	4.3	5.5	6.9	8.2	9.5	10.8	3.7%
Total	18.6	20.3	26.0	32.3	38.4	44.7	51.1	3.7%
Transportation								
Liquid fuels	4.8	5.4	6.9	8.8	10.7	12.5	14.1	4.0%
Natural gas	0.2	0.2	0.3	0.5	0.6	0.7	0.9	6.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.1	0.1	0.2	0.2	0.3	0.3	0.5	4.4%
Total	5.1	5.7	7.4	9.4	11.6	13.6	15.4	4.1%
Components of energy use								
End-use consumption								
Liquid fuels	9.9	11.0	13.7	17.0	20.3	23.6	26.6	3.6%
Natural gas	2.2	2.4	3.5	4.7	5.9	7.0	8.1	4.9%
Coal	6.4	6.9	8.6	10.5	12.4	14.3	16.3	3.4%
Electricity	5.1	5.7	7.3	9.1	11.1	13.4	15.8	4.1%
Renewables	3.9	4.3	5.6	6.9	8.2	9.5	10.9	3.7%
Total end-use consumption	27.5	30.3	38.7	48.2	57.8	67.9	77.6	3.8%
Electricity-related losses	10.5	12.2	16.3	19.9	22.8	26.2	29.2	3.7%
Discrepancy	0.2	0.7	0.9	1.1	1.3	1.5	1.7	7.3%
Total	38.3	43.2	55.9	69.2	81.9	95.5	108.5	3.8%
Electric power								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-14.3%
Natural gas	0.5	0.4	0.8	0.8	1.0	1.0	1.0	2.7%
Coal	11.2	12.0	15.5	16.5	17.2	16.8	16.0	1.3%
Nuclear	0.5	0.5	0.6	0.7	0.7	0.7	0.7	1.6%
Renewables	3.5	4.9	6.7	10.9	14.9	21.0	27.2	7.6%
Total	15.6	17.8	23.6	29.0	33.8	39.5	44.8	3.8%
Total energy consumption								
Liquid fuels	10.3	11.8	14.7	18.2	21.7	25.2	28.5	3.7%
Natural gas	2.6	2.9	4.3	5.5	6.7	7.9	9.0	4.6%
Coal	17.6	18.9	24.1	27.0	29.5	31.1	32.3	2.2%
Nuclear	0.5	0.5	0.6	0.7	0.7	0.7	0.7	1.6%
Renewables	7.4	9.2	12.3	17.8	23.2	30.5	38.0	6.0%

Total	38.3	43.2	55.9	69.2	81.9	95.5	108.5	3.8%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F18. Delivered energy consumption in Other Asia Pacific by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.8	0.8	0.8	0.9	0.9	1.0	1.0	0.9%
Natural gas	0.5	0.6	0.6	0.7	0.7	0.7	0.8	1.4%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3%
Electricity	2.2	2.4	2.8	3.0	3.3	3.7	4.0	2.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	3.6	3.8	4.3	4.6	5.0	5.5	5.9	1.8%
Commercial								
Liquid fuels	0.3	0.3	0.3	0.3	0.4	0.4	0.4	1.3%
Natural gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.4%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7%
Electricity	1.5	1.6	1.9	2.1	2.4	2.6	2.9	2.5%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.8	2.0	2.3	2.6	2.9	3.2	3.5	2.3%
Industrial								
Liquid fuels	3.5	3.8	4.5	5.0	5.4	5.9	6.3	2.1%
Natural gas	4.5	5.0	5.9	6.5	7.0	7.5	8.0	2.0%
Coal	4.5	4.8	5.5	6.2	6.8	7.4	7.9	2.1%
Electricity	2.1	2.3	2.6	3.0	3.4	3.7	4.0	2.4%
Renewables	3.0	3.3	3.9	4.5	5.1	5.6	6.0	2.5%
Total	17.6	19.2	22.5	25.2	27.7	30.1	32.2	2.2%
Transportation								
Liquid fuels	10.7	12.2	13.5	14.8	16.1	17.4	18.5	2.0%
Natural gas	0.2	0.2	0.2	0.3	0.3	0.5	0.7	4.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.1	0.1	0.2	0.3	11.8%
Total	10.9	12.4	13.8	15.2	16.6	18.1	19.5	2.1%
Components of energy use								
End-use consumption								
Liquid fuels	15.3	17.1	19.2	21.0	22.9	24.6	26.2	2.0%
Natural gas	5.3	5.9	6.8	7.6	8.2	8.8	9.6	2.1%
Coal	4.6	4.9	5.6	6.3	6.9	7.5	8.0	2.0%
Electricity	5.8	6.3	7.3	8.1	9.2	10.2	11.2	2.4%
Renewables	3.0	3.3	3.9	4.5	5.1	5.6	6.0	2.5%
Total end-use consumption	33.9	37.5	42.9	47.6	52.2	56.8	61.0	2.1%
Electricity-related losses	9.0	9.6	12.1	13.9	15.2	16.7	18.1	2.5%
Discrepancy	0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	--
Total	43.2	46.9	54.8	61.2	67.2	73.3	78.9	2.2%
Electric power								
Liquid fuels	0.4	0.5	0.2	0.1	0.1	0.0	0.0	-14.5%
Natural gas	4.5	4.8	4.7	4.1	3.6	3.6	3.6	-0.7%
Coal	6.1	6.1	8.9	10.8	12.6	14.7	16.8	3.7%
Nuclear	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-0.5%
Renewables	3.3	4.2	5.2	6.6	7.7	8.3	8.5	3.5%
Total	14.8	15.9	19.5	22.0	24.4	27.0	29.3	2.5%
Total energy consumption								
Liquid fuels	16.0	17.3	19.1	20.9	22.6	24.3	25.9	1.7%
Natural gas	9.8	10.7	11.5	11.7	11.8	12.5	13.2	1.1%
Coal	10.7	11.1	14.6	17.1	19.6	22.3	24.9	3.1%
Nuclear	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-0.5%
Renewables	6.3	7.5	9.1	11.2	12.8	13.9	14.5	3.1%

Total	43.2	46.9	54.8	61.2	67.2	73.3	78.9	2.2%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F19. Delivered energy consumption in Africa and Middle East by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.8	0.8	0.9	0.9	0.9	0.9	1.0	0.6%
Natural gas	2.5	2.7	2.8	3.0	3.2	3.4	3.6	1.3%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6%
Electricity	2.9	3.1	3.4	3.8	4.1	4.6	5.0	2.0%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	6.4	6.7	7.2	7.8	8.4	9.1	9.7	1.5%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4%
Natural gas	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.2%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.4%
Electricity	1.8	1.9	2.1	2.3	2.5	2.7	2.9	1.7%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	2.6	2.8	3.0	3.3	3.5	3.8	3.9	1.5%
Industrial								
Liquid fuels	7.3	7.6	8.1	8.8	9.5	10.1	10.6	1.3%
Natural gas	13.8	14.3	15.2	16.2	17.5	18.7	19.8	1.3%
Coal	2.1	2.3	2.7	3.1	3.6	4.2	4.8	3.0%
Electricity	1.6	1.7	1.9	2.0	2.2	2.4	2.5	1.6%
Renewables	3.4	3.7	4.4	5.2	6.0	6.9	7.7	3.0%
Total	28.3	29.6	32.2	35.2	38.8	42.2	45.5	1.7%
Transportation								
Liquid fuels	12.8	13.8	14.7	15.8	16.9	18.3	19.9	1.6%
Natural gas	0.5	0.5	0.5	0.5	0.5	0.6	0.7	1.5%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.1	0.1	0.1	0.2	0.2	5.8%
Total	13.3	14.3	15.2	16.3	17.6	19.1	20.8	1.6%
Components of energy use								
End-use consumption								
Liquid fuels	21.1	22.3	23.7	25.5	27.4	29.5	31.6	1.5%
Natural gas	17.4	18.1	19.2	20.4	22.0	23.6	25.0	1.3%
Coal	2.3	2.5	2.9	3.3	3.8	4.4	5.0	2.8%
Electricity	6.4	6.8	7.5	8.2	8.9	9.9	10.6	1.8%
Renewables	3.4	3.7	4.4	5.2	6.1	6.9	7.8	3.0%
Total end-use consumption	50.6	53.4	57.7	62.6	68.2	74.2	80.0	1.7%
Electricity-related losses	12.4	13.8	14.0	14.7	15.2	16.3	17.2	1.2%
Discrepancy	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	--
Total	62.5	66.7	71.3	76.9	83.0	90.1	96.7	1.6%
Electric power								
Liquid fuels	2.7	3.1	1.6	0.7	0.3	0.1	0.0	-15.2%
Natural gas	11.1	11.5	11.9	13.1	13.9	14.9	15.8	1.3%
Coal	2.2	2.0	2.3	2.5	2.6	2.9	2.9	0.9%
Nuclear	0.4	0.6	0.9	1.2	1.4	1.4	1.4	4.9%
Renewables	2.3	3.4	4.8	5.3	5.9	6.9	7.6	4.3%
Total	18.7	20.5	21.5	22.8	24.1	26.2	27.7	1.4%
Total energy consumption								
Liquid fuels	23.3	24.8	24.7	25.6	27.2	29.0	31.0	1.0%
Natural gas	28.6	29.8	31.2	33.7	36.1	38.6	41.0	1.3%
Coal	4.6	4.5	5.2	5.8	6.4	7.2	7.9	2.0%
Nuclear	0.4	0.6	0.9	1.2	1.4	1.4	1.4	4.9%
Renewables	5.7	7.1	9.2	10.5	12.0	13.8	15.4	3.6%

Total	62.5	66.7	71.3	76.9	83.0	90.1	96.7	1.6%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F20. Delivered energy consumption in Africa by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.9%
Natural gas	0.6	0.6	0.7	0.8	0.9	1.0	1.2	2.7%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6%
Electricity	0.9	1.1	1.3	1.6	1.9	2.3	2.6	3.6%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	2.1	2.4	2.7	3.2	3.6	4.1	4.6	2.7%
Commercial								
Liquid fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7%
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3%
Coal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.4%
Electricity	0.5	0.5	0.6	0.6	0.7	0.8	0.8	1.9%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.8%
Industrial								
Liquid fuels	1.5	1.6	1.8	2.1	2.3	2.6	2.9	2.3%
Natural gas	2.4	2.5	2.7	3.0	3.3	3.6	3.9	1.7%
Coal	1.9	2.1	2.4	2.8	3.3	3.9	4.5	3.2%
Electricity	1.1	1.1	1.3	1.4	1.6	1.8	1.9	2.1%
Renewables	3.4	3.7	4.4	5.2	6.0	6.9	7.7	3.0%
Total	10.3	11.0	12.7	14.5	16.6	18.7	21.0	2.6%
Transportation								
Liquid fuels	5.5	6.1	6.7	7.5	8.4	9.5	10.7	2.4%
Natural gas	0.1	0.1	0.2	0.2	0.2	0.3	0.3	3.7%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.0	0.1	0.1	0.1	3.6%
Total	5.7	6.2	6.9	7.8	8.7	9.9	11.2	2.5%
Components of energy use								
End-use consumption								
Liquid fuels	7.6	8.3	9.2	10.3	11.5	12.9	14.4	2.3%
Natural gas	3.1	3.2	3.6	4.0	4.5	5.0	5.4	2.0%
Coal	2.0	2.3	2.6	3.0	3.5	4.1	4.7	3.1%
Electricity	2.5	2.7	3.2	3.7	4.2	4.9	5.4	2.8%
Renewables	3.4	3.7	4.4	5.2	6.0	6.9	7.7	3.0%
Total end-use consumption	18.7	20.3	23.1	26.2	29.8	33.7	37.7	2.5%
Electricity-related losses	5.4	5.5	6.3	6.8	7.3	8.4	9.1	1.9%
Discrepancy	0.3	0.2	0.2	0.2	0.3	0.3	0.3	1.0%
Total	24.3	26.0	29.6	33.2	37.4	42.4	47.2	2.4%
Electric power								
Liquid fuels	0.4	0.4	0.2	0.0	0.0	0.0	0.0	-16.4%
Natural gas	3.1	3.1	3.2	3.6	3.9	4.5	5.1	1.8%
Coal	2.2	2.0	2.3	2.5	2.6	2.9	2.9	0.9%
Nuclear	0.1	0.1	0.3	0.4	0.5	0.5	0.5	5.2%
Renewables	2.0	2.6	3.5	3.9	4.5	5.3	6.0	4.1%
Total	7.9	8.3	9.5	10.5	11.5	13.3	14.5	2.2%
Total energy consumption								
Liquid fuels	8.3	8.9	9.6	10.5	11.8	13.2	14.8	2.1%
Natural gas	6.2	6.4	6.9	7.6	8.5	9.5	10.5	1.9%
Coal	4.3	4.2	4.9	5.5	6.1	6.9	7.6	2.1%
Nuclear	0.1	0.1	0.3	0.4	0.5	0.5	0.5	5.2%
Renewables	5.3	6.3	7.9	9.1	10.5	12.2	13.7	3.4%

Total	24.3	26.0	29.6	33.2	37.4	42.4	47.2	2.4%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).

Table F21. Delivered energy consumption in Middle East by end-use sector and fuel, High Zero-carbon Technology Cost case

quadrillion British thermal units

Sector and fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Residential								
Liquid fuels	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-0.3%
Natural gas	2.0	2.0	2.1	2.2	2.3	2.4	2.5	0.8%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1%
Electricity	2.0	2.0	2.1	2.1	2.2	2.3	2.4	0.8%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	4.2	4.3	4.5	4.6	4.8	5.0	5.2	0.7%
Commercial								
Liquid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1%
Natural gas	0.6	0.6	0.7	0.7	0.8	0.8	0.8	1.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	1.3	1.4	1.5	1.7	1.8	1.9	2.0	1.6%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8%
Total	1.9	2.1	2.3	2.5	2.6	2.8	2.9	1.4%
Industrial								
Liquid fuels	5.8	5.9	6.2	6.7	7.1	7.5	7.7	1.0%
Natural gas	11.4	11.8	12.4	13.2	14.2	15.1	15.9	1.2%
Coal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2%
Electricity	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5%
Total	18.0	18.6	19.5	20.7	22.2	23.5	24.6	1.1%
Transportation								
Liquid fuels	7.3	7.7	8.0	8.2	8.5	8.8	9.1	0.8%
Natural gas	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.2%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Electricity	0.0	0.0	0.0	0.0	0.1	0.1	0.1	9.1%
Total	7.7	8.1	8.3	8.6	8.8	9.2	9.6	0.8%
Components of energy use								
End-use consumption								
Liquid fuels	13.4	14.0	14.5	15.2	16.0	16.6	17.2	0.9%
Natural gas	14.3	14.9	15.6	16.4	17.5	18.6	19.6	1.1%
Coal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2%
Electricity	3.8	4.0	4.2	4.5	4.7	5.0	5.2	1.1%
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7%
Total end-use consumption	31.9	33.1	34.6	36.4	38.5	40.5	42.2	1.0%
Electricity-related losses	7.0	8.3	7.7	7.9	7.9	8.0	8.0	0.5%
Discrepancy	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	--
Total	38.2	40.7	41.6	43.6	45.7	47.7	49.5	0.9%
Electric power								
Liquid fuels	2.3	2.7	1.4	0.6	0.3	0.1	0.0	-15.0%
Natural gas	7.9	8.4	8.6	9.5	10.0	10.4	10.7	1.1%
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1%
Nuclear	0.2	0.4	0.6	0.8	0.9	0.9	0.9	4.7%
Renewables	0.4	0.8	1.3	1.4	1.5	1.5	1.6	5.4%
Total	10.8	12.3	12.0	12.4	12.6	12.9	13.2	0.7%
Total energy consumption								
Liquid fuels	15.0	15.8	15.1	15.1	15.4	15.8	16.3	0.3%
Natural gas	22.4	23.4	24.3	26.1	27.6	29.1	30.5	1.1%
Coal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1%
Nuclear	0.2	0.4	0.6	0.8	0.9	0.9	0.9	4.7%
Renewables	0.4	0.8	1.3	1.4	1.5	1.6	1.6	5.3%

Total	38.2	40.7	41.6	43.6	45.7	47.7	49.5	0.9%
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Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. End-use sector electricity consumption and end-use sector delivered energy consumption do not include electrical system energy losses incurred in the generation, transmission, and distribution of electricity. Electricity-related losses include energy losses during generation due to thermal efficiency, energy losses during transmission and distribution, and parasitic load. In all regions except the United States, fuel consumed to produce district heat is allocated to the residential, commercial, and industrial end-use sectors according to their respective share of heat demand. We converted electricity generation from renewable sources such as hydroelectric, wind, or solar to British thermal units at a rate of 8,124 British thermal units per kilowatthour, which reflects the average projected conversion efficiency of the U.S. fossil-fueled generating fleet in the Annual Energy Outlook 2021 over the projection period (2022–2050).