

Table E1.cap. Electricity installed generating capacity: World, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	391	378	219	143	110	99	95	-4.9%
Natural gas	1,931	2,045	2,181	2,299	2,489	2,741	2,963	1.5%
Coal	2,271	2,321	2,196	2,222	2,275	2,319	2,364	0.1%
Nuclear	400	425	425	450	465	470	482	0.7%
Renewables	3,297	4,035	4,800	5,380	6,026	6,762	7,415	2.9%
Hydro	1,211	1,317	1,376	1,414	1,437	1,463	1,485	0.7%
Wind	873	1,028	1,296	1,523	1,804	2,121	2,325	3.6%
Geothermal	15	17	27	30	33	34	35	3.1%
Solar	1,019	1,467	1,883	2,188	2,512	2,897	3,317	4.3%
Other	179	205	218	225	240	246	253	1.2%
Battery storage	52	69	105	181	271	451	625	9.3%
Pumped hydro	169	200	211	213	213	213	213	0.8%
Total capacity	8,511	9,473	10,137	10,889	11,848	13,055	14,155	1.8%

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.

Table E2.cap. Electricity installed generating capacity: Americas, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	141	127	83	62	55	52	52	-3.5%
Natural gas	629	660	739	804	867	942	1,030	1.8%
Coal	227	196	141	138	136	137	138	-1.8%
Nuclear	114	115	114	109	105	102	100	-0.4%
Renewables	788	938	1,113	1,266	1,381	1,507	1,660	2.7%
Hydro	362	376	383	386	388	389	391	0.3%
Wind	200	238	344	401	442	499	572	3.8%
Geothermal	4	4	5	6	6	7	8	2.0%
Solar	159	257	317	408	478	545	622	5.0%
Other	62	63	64	65	66	67	67	0.3%
Battery storage	6	16	19	26	37	43	47	7.4%
Pumped hydro	23	23	23	23	23	23	23	0.0%
Total capacity	1,929	2,075	2,232	2,427	2,603	2,806	3,050	1.6%

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.

Table E3.cap. Electricity installed generating capacity: United States, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	75	60	54	51	51	52	52	-1.3%
Natural gas	445	466	530	586	646	719	800	2.1%
Coal	201	170	122	113	103	99	97	-2.6%
Nuclear	95	96	95	89	89	89	89	-0.2%
Renewables	389	511	669	797	873	938	1,021	3.5%
Hydro	79	79	80	80	80	80	80	0.0%
Wind	145	171	270	310	320	328	346	3.2%
Geothermal	3	3	3	3	4	4	5	2.6%
Solar	125	220	278	365	431	486	550	5.4%
Other	37	38	38	39	40	40	41	0.3%
Battery storage	6	16	19	26	37	43	47	7.4%
Pumped hydro	22	22	22	22	22	22	22	0.0%
Total capacity	1,234	1,342	1,511	1,683	1,821	1,962	2,128	2.0%

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.

Table E4.cap. Electricity installed generating capacity: Canada, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	4	4	0	0	0	0	0	-13.5%
Natural gas	33	36	52	59	62	62	69	2.7%
Coal	6	6	0	0	0	0	0	-100.0%
Nuclear	14	14	11	10	7	6	4	-4.4%
Renewables	105	109	119	133	158	190	225	2.8%
Hydro	83	86	89	89	89	89	89	0.3%
Wind	16	17	23	37	62	94	129	7.8%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	4	4	4	4	4	4	4	0.0%
Other	2	2	3	3	3	3	3	1.3%
Battery storage	0	0	0	0	0	0	0	--
Pumped hydro	0	0	0	0	0	0	0	0.0%
Total capacity	161	169	183	203	228	259	299	2.2%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E5.cap. Electricity installed generating capacity: Mexico, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	13	14	7	4	1	0	0	-19.0%
Natural gas	44	45	45	49	53	55	56	0.9%
Coal	9	9	9	9	9	9	9	0.0%
Nuclear	2	2	3	4	3	2	2	1.5%
Renewables	30	33	36	40	45	56	69	3.0%
Hydro	13	14	15	15	15	15	16	0.7%
Wind	8	8	8	8	8	8	8	0.0%
Geothermal	1	1	1	1	1	1	1	0.0%
Solar	8	9	11	15	19	31	44	6.5%
Other	1	1	1	1	1	1	1	0.0%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	0	0	0	0	0	0	0	0.0%
Total capacity	98	102	99	105	111	123	137	1.2%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E6.cap. Electricity installed generating capacity: Brazil, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	14	14	6	1	0	0	0	-15.6%
Natural gas	24	27	27	22	18	17	16	-1.4%
Coal	6	6	4	4	4	4	4	-1.3%
Nuclear	2	2	3	3	3	2	2	0.9%
Renewables	161	173	173	174	178	187	195	0.7%
Hydro	112	117	117	117	117	117	117	0.2%
Wind	20	26	27	28	32	41	48	3.3%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	13	13	13	13	13	13	13	0.0%
Other	16	16	16	16	16	16	16	0.0%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	0	0	0	0	0	0	0	0.0%
Total capacity	207	222	213	205	203	211	217	0.2%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E7.cap. Electricity installed generating capacity: Other Americas, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	35	35	16	6	2	0	0	-20.2%
Natural gas	84	85	85	88	88	88	88	0.2%
Coal	6	6	6	13	20	26	28	5.7%
Nuclear	2	2	2	2	2	2	2	0.8%
Renewables	103	111	116	122	127	135	149	1.3%
Hydro	75	79	82	85	87	88	90	0.6%
Wind	12	15	16	17	21	27	41	4.5%
Geothermal	1	1	1	1	1	1	1	2.0%
Solar	10	11	11	12	12	12	12	0.8%
Other	5	5	5	6	6	6	6	0.1%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	1	1	1	1	1	1	1	0.0%
Total capacity	230	239	226	232	240	252	268	0.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E8.cap. Electricity installed generating capacity: Europe and Eurasia, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	77	78	53	41	34	34	33	-3.0%
Natural gas	474	483	508	512	525	544	571	0.7%
Coal	269	272	224	228	228	228	228	-0.6%
Nuclear	168	173	151	156	156	154	155	-0.3%
Renewables	782	908	1,015	1,032	1,057	1,108	1,181	1.5%
Hydro	272	297	300	301	301	302	302	0.4%
Wind	245	283	324	327	330	336	344	1.2%
Geothermal	3	6	8	8	8	8	8	3.1%
Solar	206	247	300	308	323	363	422	2.6%
Other	56	75	83	88	94	99	105	2.2%
Battery storage	0	0	0	0	0	42	84	--
Pumped hydro	50	51	52	52	52	52	52	0.1%
Total capacity	1,820	1,964	2,003	2,020	2,051	2,162	2,303	0.8%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E9.cap. Electricity installed generating capacity: Western Europe, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	60	60	41	30	24	24	23	-3.3%
Natural gas	299	305	305	285	268	257	251	-0.6%
Coal	171	171	118	118	118	118	118	-1.3%
Nuclear	124	127	107	108	109	107	107	-0.5%
Renewables	683	802	908	924	949	998	1,071	1.6%
Hydro	191	214	217	217	217	217	217	0.5%
Wind	241	277	318	321	324	329	337	1.2%
Geothermal	3	6	8	8	8	8	8	3.1%
Solar	193	233	286	294	309	349	407	2.7%
Other	55	71	79	85	90	96	101	2.2%
Battery storage	0	0	0	0	0	42	84	--
Pumped hydro	47	48	48	48	48	48	48	0.1%
Total capacity	1,384	1,514	1,528	1,514	1,515	1,594	1,702	0.7%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E10.cap. Electricity installed generating capacity: Russia, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	7	7	3	1	1	1	0	-10.4%
Natural gas	136	137	162	182	197	210	226	1.8%
Coal	55	55	55	55	55	55	55	0.0%
Nuclear	30	31	32	32	32	32	31	0.2%
Renewables	59	62	62	62	62	62	62	0.2%
Hydro	54	54	54	54	54	54	54	0.0%
Wind	1	3	3	3	3	3	3	2.4%
Geothermal	0	0	0	0	0	0	0	0.4%
Solar	2	2	2	2	2	2	2	0.0%
Other	1	3	3	3	3	3	3	2.5%
Battery storage	0	0	0	0	0	0	0	--
Pumped hydro	1	1	1	1	1	1	1	0.0%
Total capacity	288	293	314	333	347	360	375	1.0%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E11.cap. Electricity installed generating capacity: Eastern Europe and Eurasia, High Zero-carbon Technology Cost case
gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	10	10	10	10	10	10	10	-0.2%
Natural gas	38	41	41	45	60	77	94	3.2%
Coal	43	45	51	55	55	55	55	0.9%
Nuclear	15	15	12	16	16	16	17	0.6%
Renewables	40	44	45	46	46	48	48	0.6%
Hydro	26	29	29	30	30	30	30	0.5%
Wind	2	3	3	4	4	4	4	2.4%
Geothermal	0	0	0	0	0	0	0	--
Solar	11	12	12	12	12	13	13	0.4%
Other	0	1	1	1	1	1	1	2.9%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	2	2	2	2	2	2	2	0.6%
Total capacity	148	158	161	173	189	208	226	1.5%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E12.cap. Electricity installed generating capacity: Asia Pacific, High Zero-carbon Technology Cost case
gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	93	93	44	25	14	11	9	-8.1%
Natural gas	460	520	550	553	613	716	777	1.9%
Coal	1,725	1,803	1,781	1,806	1,861	1,903	1,947	0.4%
Nuclear	108	126	146	168	183	193	206	2.3%
Renewables	1,633	2,033	2,444	2,833	3,317	3,840	4,236	3.5%
Hydro	523	577	620	651	666	679	691	1.0%
Wind	417	483	585	750	986	1,241	1,362	4.3%
Geothermal	6	6	9	10	11	11	11	2.0%
Solar	628	902	1,163	1,355	1,580	1,835	2,097	4.4%
Other	59	65	66	67	75	75	75	0.9%
Battery storage	46	52	85	155	234	366	494	8.8%
Pumped hydro	91	120	131	133	133	133	133	1.3%
Total capacity	4,158	4,747	5,182	5,673	6,355	7,162	7,802	2.3%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E13.cap. Electricity installed generating capacity: Japan, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	35	35	19	11	7	7	7	-5.6%
Natural gas	95	101	101	89	80	78	78	-0.7%
Coal	64	65	42	41	41	41	41	-1.6%
Nuclear	14	20	25	25	21	18	18	0.9%
Renewables	108	112	118	125	139	153	166	1.6%
Hydro	22	22	22	22	22	22	22	0.0%
Wind	4	4	4	5	13	21	28	6.9%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	76	81	86	93	99	105	111	1.3%
Other	5	5	5	5	5	5	5	0.1%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	28	28	28	28	28	28	28	0.0%
Total capacity	344	362	332	318	316	325	338	-0.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E14.cap. Electricity installed generating capacity: South Korea, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	5	5	2	2	1	1	1	-4.4%
Natural gas	43	46	46	41	38	35	35	-0.7%
Coal	43	46	46	46	46	46	46	0.3%
Nuclear	27	31	31	31	31	29	29	0.2%
Renewables	22	27	33	45	56	70	79	4.8%
Hydro	2	2	2	2	2	2	2	1.1%
Wind	2	7	13	24	36	50	59	13.0%
Geothermal	0	0	0	0	0	0	0	--
Solar	16	16	16	16	16	16	16	0.0%
Other	2	2	2	2	2	2	2	0.0%
Battery storage	0	0	0	0	0	0	0	--
Pumped hydro	5	5	5	5	5	5	5	0.0%
Total capacity	144	158	162	168	176	186	195	1.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E15.cap. Electricity installed generating capacity: Australia and New Zealand, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	2	2	0	0	0	0	0	-11.7%
Natural gas	25	25	25	20	15	18	18	-1.1%
Coal	28	28	28	28	28	28	28	0.0%
Nuclear	0	0	0	0	0	0	0	0.0%
Renewables	48	56	62	72	84	92	104	2.8%
Hydro	12	14	16	16	16	16	16	1.1%
Wind	11	16	18	24	27	29	33	3.8%
Geothermal	1	1	1	1	1	1	1	0.0%
Solar	23	24	26	30	39	45	53	3.0%
Other	1	1	1	1	1	1	1	0.1%
Battery storage	0	0	0	0	1	2	6	--
Pumped hydro	2	4	4	4	4	4	4	3.1%
Total capacity	105	114	119	124	133	144	160	1.5%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E16.cap. Electricity installed generating capacity: China, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	5	5	1	0	0	0	0	-16.3%
Natural gas	106	144	157	193	280	384	446	5.3%
Coal	1,164	1,203	1,203	1,203	1,203	1,203	1,203	0.1%
Nuclear	55	59	77	96	114	129	142	3.5%
Renewables	1,165	1,430	1,686	1,771	1,929	2,080	2,101	2.1%
Hydro	359	375	398	412	425	437	447	0.8%
Wind	356	380	431	498	637	771	777	2.8%
Geothermal	0	0	0	0	0	0	0	0.1%
Solar	420	645	827	832	838	842	847	2.5%
Other	30	30	30	30	30	30	30	0.0%
Battery storage	46	49	58	64	76	85	86	2.3%
Pumped hydro	47	72	83	84	84	84	84	2.1%
Total capacity	2,587	2,961	3,265	3,412	3,687	3,966	4,062	1.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E17.cap. Electricity installed generating capacity: India, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	6	6	1	0	0	0	0	-14.5%
Natural gas	31	31	46	53	60	60	60	2.4%
Coal	291	310	310	322	338	338	338	0.5%
Nuclear	7	7	9	11	12	12	12	1.9%
Renewables	158	232	330	542	751	1,060	1,382	8.0%
Hydro	50	64	64	65	66	66	67	1.0%
Wind	39	66	103	168	236	332	427	8.9%
Geothermal	0	0	0	0	0	0	0	--
Solar	58	91	152	297	438	651	877	10.2%
Other	11	11	11	11	11	11	11	0.1%
Battery storage	0	3	27	92	157	279	402	--
Pumped hydro	5	6	6	6	6	6	6	1.0%
Total capacity	498	595	730	1,027	1,325	1,757	2,201	5.5%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E18.cap. Electricity installed generating capacity: Other Asia Pacific, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	40	41	22	12	6	2	0	-14.9%
Natural gas	160	175	176	157	140	140	140	-0.5%
Coal	136	151	151	166	205	247	291	2.8%
Nuclear	6	8	5	5	5	5	5	-0.2%
Renewables	133	176	215	279	357	385	404	4.1%
Hydro	78	100	118	134	135	136	137	2.0%
Wind	5	10	15	31	37	38	38	7.6%
Geothermal	4	4	7	8	9	9	9	2.6%
Solar	35	46	57	88	150	176	194	6.3%
Other	10	16	17	18	26	26	26	3.4%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	5	5	5	5	5	5	5	0.0%
Total capacity	480	555	574	623	718	784	845	2.0%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E19.cap. Electricity installed generating capacity: Africa and Middle East, High Zero-carbon Technology Cost case
gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	79	80	39	16	7	3	1	-15.4%
Natural gas	368	383	383	430	484	539	585	1.7%
Coal	49	51	50	50	50	51	51	0.1%
Nuclear	10	12	13	17	20	20	20	2.6%
Renewables	94	157	228	250	271	307	338	4.7%
Hydro	55	67	73	77	82	93	102	2.3%
Wind	10	24	43	45	46	47	47	5.7%
Geothermal	1	1	5	6	9	9	9	8.5%
Solar	26	61	103	117	130	154	176	7.0%
Other	2	3	4	4	5	5	5	3.7%
Battery storage	0	0	0	0	0	0	0	--
Pumped hydro	5	6	6	6	6	6	6	0.7%
Total capacity	604	688	720	769	839	925	1,000	1.8%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E20.cap. Electricity installed generating capacity: Africa, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	21	21	7	1	0	0	0	-16.3%
Natural gas	122	126	127	160	193	226	255	2.7%
Coal	49	50	50	50	50	50	50	0.1%
Nuclear	2	2	4	6	7	7	7	5.1%
Renewables	64	92	125	142	161	191	219	4.5%
Hydro	39	50	56	59	65	76	85	2.8%
Wind	9	16	26	27	28	28	28	4.3%
Geothermal	1	1	4	6	8	8	8	8.5%
Solar	14	23	36	45	55	75	93	7.0%
Other	2	3	4	4	4	4	4	3.6%
Battery storage	0	0	0	0	0	0	0	--
Pumped hydro	3	4	4	4	4	4	4	0.4%
Total capacity	261	296	319	363	415	479	536	2.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.

Table E21.cap. Electricity installed generating capacity: Middle East, High Zero-carbon Technology Cost case

gigawatts

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	57	59	31	15	7	2	1	-15.2%
Natural gas	246	256	256	270	292	314	330	1.1%
Coal	0	0	0	0	0	0	0	-6.2%
Nuclear	8	10	9	11	12	12	12	1.6%
Renewables	29	64	103	108	111	116	119	5.1%
Hydro	16	17	17	17	17	17	17	0.4%
Wind	1	9	17	18	18	18	18	10.2%
Geothermal	0	0	0	0	0	0	0	--
Solar	12	38	68	72	75	79	83	7.0%
Other	0	0	0	0	0	0	1	5.4%
Battery storage	0	0	0	0	0	0	0	0.0%
Pumped hydro	2	2	2	2	2	2	2	1.4%
Total capacity	343	392	401	406	424	447	465	1.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hz_230821.151430

Note: Totals may not equal sum of components due to independent rounding.