

Table E1.gen. Electricity generation: World, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	733	737	378	196	107	69	56	-8.8%
Natural gas	6,700	6,733	7,048	7,238	7,619	8,171	8,656	0.9%
Coal	9,696	9,199	8,936	9,315	9,479	9,494	9,565	0.0%
Nuclear	2,666	2,786	3,028	3,157	3,168	3,184	3,264	0.7%
Renewables	8,446	10,030	12,324	14,399	16,677	19,070	21,311	3.4%
Hydro	4,320	4,702	4,959	5,256	5,330	5,446	5,610	0.9%
Wind	1,967	2,351	3,163	3,823	4,806	5,409	5,731	3.9%
Geothermal	67	110	189	211	235	246	250	4.8%
Solar	1,421	2,232	3,340	4,426	5,614	7,153	8,820	6.7%
Other	671	635	673	684	692	815	899	1.0%
Net generation to grid	28,242	29,484	31,715	34,304	37,051	39,988	42,852	1.5%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E2.gen. Electricity generation: Americas, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	158	159	74	34	16	5	5	-11.4%
Natural gas	2,261	2,095	2,216	2,173	2,168	2,118	2,152	-0.2%
Coal	934	783	291	402	450	468	427	-2.8%
Nuclear	889	891	903	835	726	684	670	-1.0%
Renewables	2,493	2,905	3,791	4,294	4,812	5,369	5,926	3.1%
Hydro	1,472	1,538	1,616	1,714	1,724	1,725	1,732	0.6%
Wind	611	716	1,135	1,262	1,421	1,616	1,840	4.0%
Geothermal	25	21	36	38	42	47	51	2.5%
Solar	260	525	906	1,192	1,552	1,917	2,243	8.0%
Other	124	105	98	88	73	64	59	-2.6%
Net generation to grid	6,735	6,833	7,276	7,739	8,172	8,644	9,179	1.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E3.gen. Electricity generation: United States, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	11	10	7	7	7	5	5	-3.1%
Natural gas	1,686	1,497	1,546	1,463	1,431	1,375	1,396	-0.7%
Coal	849	718	221	288	278	267	224	-4.7%
Nuclear	772	782	766	696	613	594	592	-0.9%
Renewables	1,003	1,365	2,119	2,461	2,823	3,166	3,477	4.5%
Hydro	276	300	299	294	289	284	284	0.1%
Wind	440	512	896	969	1,004	1,057	1,146	3.5%
Geothermal	16	17	19	21	25	30	34	2.8%
Solar	205	468	836	1,106	1,439	1,738	1,962	8.4%
Other	67	68	70	71	66	58	51	-0.9%
Net generation to grid	4,321	4,373	4,659	4,916	5,152	5,407	5,692	1.0%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357 and Annual Energy Outlook 2023 (March 2023), www.eia.gov/aeo

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E4.gen. Electricity generation: Canada, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	5	5	0	0	0	0	0	-13.5%
Natural gas	81	85	135	164	172	167	175	2.8%
Coal	39	18	0	0	0	0	0	-100.0%
Nuclear	79	71	77	72	51	39	28	-3.7%
Renewables	452	470	503	544	626	721	812	2.1%
Hydro	399	417	430	430	430	430	430	0.3%
Wind	41	45	64	106	185	282	375	8.3%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	6	6	6	6	6	6	5	-0.5%
Other	5	3	4	2	5	2	2	-2.8%
Net generation to grid	656	648	716	780	848	927	1,016	1.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E5.gen. Electricity generation: Mexico, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	46	48	23	12	5	0	0	-19.1%
Natural gas	191	195	201	222	258	272	280	1.4%
Coal	9	9	19	19	19	19	19	2.8%
Nuclear	11	11	20	28	23	17	17	1.4%
Renewables	86	82	103	111	120	152	186	2.8%
Hydro	32	34	39	39	39	39	40	0.8%
Wind	35	33	36	36	36	36	36	0.1%
Geothermal	5	0	8	8	8	8	8	1.5%
Solar	12	13	19	28	37	69	103	8.1%
Other	2	1	1	1	0	0	0	-100.0%
Net generation to grid	342	345	366	392	425	460	501	1.4%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E6.gen. Electricity generation: Brazil, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	23	23	9	1	0	0	0	-15.6%
Natural gas	97	110	110	89	73	69	66	-1.4%
Coal	13	13	9	9	13	9	9	-1.3%
Nuclear	14	14	23	23	23	18	18	0.9%
Renewables	534	561	579	656	696	737	772	1.3%
Hydro	410	430	453	532	539	539	539	1.0%
Wind	62	83	85	90	134	174	208	4.4%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	21	21	22	22	22	22	22	0.1%
Other	40	26	19	12	1	2	3	-8.6%
Net generation to grid	681	721	730	779	805	834	866	0.9%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E7.gen. Electricity generation: Other Americas, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	73	74	34	13	4	0	0	-18.5%
Natural gas	205	208	223	234	234	234	234	0.5%
Coal	25	25	42	87	141	174	175	7.2%
Nuclear	12	12	18	15	15	15	15	0.8%
Renewables	419	428	488	523	548	593	679	1.7%
Hydro	354	357	396	419	426	433	440	0.8%
Wind	34	43	55	61	63	66	75	2.9%
Geothermal	5	4	9	9	9	9	9	2.5%
Solar	16	17	23	31	48	82	151	8.4%
Other	10	6	4	3	1	2	2	-5.2%
Net generation to grid	734	747	805	872	941	1,016	1,104	1.5%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E8.gen. Electricity generation: Europe and Eurasia, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	117	116	76	54	41	40	39	-3.8%
Natural gas	1,473	1,501	1,589	1,635	1,737	1,847	1,994	1.1%
Coal	802	750	556	532	518	611	616	-0.9%
Nuclear	995	1,003	1,044	1,062	1,055	1,036	1,039	0.2%
Renewables	1,963	2,178	2,466	2,829	3,173	3,354	3,589	2.2%
Hydro	915	982	987	1,056	1,057	1,060	1,063	0.5%
Wind	483	552	632	720	955	971	987	2.6%
Geothermal	23	39	53	52	52	59	59	3.4%
Solar	218	197	331	499	574	691	863	5.0%
Other	324	408	463	501	534	574	618	2.3%
Net generation to grid	5,350	5,548	5,730	6,112	6,524	6,888	7,278	1.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E9.gen. Electricity generation: Western Europe, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	97	97	67	50	37	36	36	-3.5%
Natural gas	777	792	792	749	717	690	675	-0.5%
Coal	501	446	269	258	246	338	343	-1.3%
Nuclear	734	723	733	727	720	702	702	-0.2%
Renewables	1,649	1,862	2,137	2,467	2,819	2,992	3,224	2.4%
Hydro	621	697	706	753	754	754	757	0.7%
Wind	474	544	623	701	936	950	967	2.6%
Geothermal	22	38	52	51	51	57	57	3.4%
Solar	209	184	308	475	550	661	830	5.1%
Other	323	398	448	487	528	569	613	2.3%
Net generation to grid	3,758	3,919	3,998	4,251	4,539	4,759	4,980	1.0%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E10.gen. Electricity generation: Russia, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	17	16	6	2	2	1	1	-10.5%
Natural gas	499	504	592	663	722	779	843	1.9%
Coal	184	188	148	123	121	121	121	-1.5%
Nuclear	217	229	234	234	234	234	227	0.2%
Renewables	220	209	210	237	230	228	228	0.1%
Hydro	211	197	192	211	211	211	211	0.0%
Wind	5	1	2	10	10	10	10	2.4%
Geothermal	0	0	0	1	1	1	1	1.0%
Solar	3	3	3	3	3	3	3	0.0%
Other	0	9	13	13	5	4	4	16.6%
Net generation to grid	1,137	1,146	1,189	1,259	1,308	1,363	1,420	0.8%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E11.gen. Electricity generation: Eastern Europe and Eurasia, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	3	3	3	3	3	3	3	-0.3%
Natural gas	197	205	205	222	298	378	476	3.2%
Coal	117	116	140	151	151	151	151	0.9%
Nuclear	44	52	77	101	101	101	111	3.4%
Renewables	94	107	119	125	124	134	137	1.4%
Hydro	82	88	89	92	92	95	95	0.5%
Wind	4	7	7	9	9	10	10	3.8%
Geothermal	0	0	1	1	1	1	1	--
Solar	6	10	20	21	21	27	30	5.8%
Other	2	2	2	2	1	1	1	-1.2%
Net generation to grid	455	483	544	602	677	766	878	2.4%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E12.gen. Electricity generation: Asia Pacific, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	110	108	49	27	16	11	8	-8.8%
Natural gas	1,617	1,738	1,778	1,713	1,793	2,103	2,249	1.2%
Coal	7,746	7,474	7,875	8,133	8,241	8,159	8,247	0.2%
Nuclear	746	837	993	1,143	1,253	1,329	1,420	2.3%
Renewables	3,721	4,545	5,496	6,608	7,940	9,440	10,709	3.8%
Hydro	1,745	1,949	2,101	2,206	2,257	2,335	2,434	1.2%
Wind	842	1,018	1,281	1,721	2,308	2,698	2,779	4.4%
Geothermal	13	44	67	74	78	78	78	6.7%
Solar	902	1,415	1,937	2,516	3,215	4,156	5,202	6.5%
Other	220	119	109	91	82	174	216	-0.1%
Net generation to grid	13,940	14,703	16,192	17,624	19,242	21,042	22,633	1.7%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E13.gen. Electricity generation: Japan, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	29	29	15	9	6	6	6	-5.8%
Natural gas	363	383	383	339	313	320	312	-0.5%
Coal	291	283	167	182	182	182	182	-1.7%
Nuclear	78	115	139	139	121	102	102	0.9%
Renewables	210	203	239	265	320	349	377	2.1%
Hydro	72	83	83	86	86	86	86	0.6%
Wind	8	8	8	14	37	57	76	8.5%
Geothermal	3	3	3	4	4	4	4	0.8%
Solar	105	101	137	154	164	173	182	2.0%
Other	23	8	8	7	30	30	30	0.9%
Net generation to grid	972	1,014	943	934	942	959	979	0.0%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E14.gen. Electricity generation: South Korea, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	8	7	3	3	2	2	2	-4.7%
Natural gas	177	174	174	161	148	146	146	-0.7%
Coal	149	139	145	152	156	157	157	0.2%
Nuclear	201	228	228	228	228	218	214	0.2%
Renewables	50	53	78	106	133	161	182	4.7%
Hydro	3	4	4	5	5	5	5	1.1%
Wind	5	18	33	59	85	113	134	12.6%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	26	26	26	26	26	26	26	0.0%
Other	16	6	15	17	17	17	17	0.2%
Net generation to grid	586	602	629	649	667	684	701	0.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E15.gen. Electricity generation: Australia and New Zealand, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	4	4	0	0	0	0	0	-11.9%
Natural gas	56	52	52	41	35	38	38	-1.4%
Coal	111	102	125	139	138	138	137	0.8%
Nuclear	0	0	0	0	0	0	0	0.0%
Renewables	127	149	164	189	225	251	284	2.9%
Hydro	36	41	45	45	45	45	45	0.8%
Wind	42	57	63	77	88	89	90	2.8%
Geothermal	9	9	9	9	9	9	9	0.0%
Solar	38	41	46	58	83	107	140	4.7%
Other	2	1	1	0	0	0	0	-10.0%
Net generation to grid	298	307	341	369	398	427	460	1.6%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E16.gen. Electricity generation: China, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	13	12	1	0	0	0	0	-16.8%
Natural gas	302	357	388	462	638	940	1,093	4.7%
Coal	5,248	5,068	5,142	5,233	5,049	4,758	4,792	-0.3%
Nuclear	383	416	538	674	799	903	998	3.5%
Renewables	2,573	3,065	3,552	3,839	4,355	4,851	4,982	2.4%
Hydro	1,221	1,300	1,379	1,428	1,474	1,515	1,551	0.9%
Wind	653	724	862	1,045	1,398	1,735	1,776	3.6%
Geothermal	0	0	0	0	0	0	0	0.1%
Solar	575	987	1,268	1,334	1,452	1,475	1,485	3.4%
Other	123	54	42	31	31	127	169	1.1%
Net generation to grid	8,519	8,919	9,622	10,208	10,841	11,453	11,865	1.2%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E17.gen. Electricity generation: India, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	4	4	1	0	0	0	0	-14.7%
Natural gas	78	73	78	83	83	83	83	0.2%
Coal	1,240	1,242	1,473	1,458	1,519	1,471	1,361	0.3%
Nuclear	41	42	52	67	70	70	70	1.9%
Renewables	395	584	840	1,408	1,958	2,770	3,617	8.2%
Hydro	154	195	197	199	201	203	205	1.0%
Wind	119	190	276	434	598	598	598	5.9%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	99	180	351	761	1,159	1,969	2,815	12.7%
Other	23	18	16	14	0	0	0	-100.0%
Net generation to grid	1,757	1,945	2,443	3,016	3,629	4,394	5,131	3.9%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E18.gen. Electricity generation: Other Asia Pacific, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	52	53	28	15	8	3	1	-14.9%
Natural gas	641	699	703	627	576	576	576	-0.4%
Coal	706	640	824	968	1,196	1,452	1,618	3.0%
Nuclear	43	36	36	36	36	36	36	-0.6%
Renewables	365	490	623	801	949	1,058	1,267	4.5%
Hydro	258	326	393	443	446	481	542	2.7%
Wind	15	20	39	92	101	105	105	7.3%
Geothermal	1	32	55	61	65	65	65	17.9%
Solar	58	80	108	183	331	406	554	8.4%
Other	33	32	28	22	5	0	0	-14.6%
Net generation to grid	1,807	1,917	2,214	2,447	2,764	3,125	3,497	2.4%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E19.gen. Electricity generation: Africa and Middle East, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	348	354	179	80	35	13	3	-15.3%
Natural gas	1,349	1,398	1,465	1,717	1,922	2,103	2,261	1.9%
Coal	214	192	214	247	269	257	276	0.9%
Nuclear	37	54	87	116	135	135	135	4.8%
Renewables	269	403	571	669	752	907	1,087	5.1%
Hydro	188	233	255	280	293	327	382	2.6%
Wind	30	65	114	121	122	124	125	5.2%
Geothermal	6	6	33	46	63	63	63	8.6%
Solar	42	95	166	218	272	390	512	9.3%
Other	2	4	4	3	2	3	5	2.8%
Net generation to grid	2,217	2,401	2,516	2,830	3,113	3,414	3,762	1.9%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E20.gen. Electricity generation: Africa, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	48	47	16	3	0	0	0	-16.4%
Natural gas	358	367	391	483	575	643	703	2.4%
Coal	214	192	213	247	269	257	276	0.9%
Nuclear	13	13	30	43	52	52	52	5.1%
Renewables	227	307	413	499	575	718	890	5.0%
Hydro	165	208	226	251	264	297	353	2.8%
Wind	28	46	76	80	81	82	82	4.0%
Geothermal	6	6	33	46	63	63	63	8.6%
Solar	26	44	75	119	164	274	387	10.2%
Other	2	3	3	3	2	2	5	2.4%
Net generation to grid	861	926	1,063	1,275	1,472	1,670	1,921	2.9%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.

Table E21.gen. Electricity generation: Middle East, High Oil Price case

billion kilowatthours

Fuel	2022	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2022–2050
Liquid fuels	300	307	164	77	34	13	3	-15.2%
Natural gas	990	1,031	1,074	1,235	1,347	1,460	1,558	1.6%
Coal	0	0	0	0	0	0	0	-5.9%
Nuclear	24	41	58	73	83	83	83	4.6%
Renewables	42	96	158	169	177	189	197	5.7%
Hydro	23	25	29	29	29	29	29	0.8%
Wind	3	19	38	40	40	42	42	10.4%
Geothermal	0	0	0	0	0	0	0	0.0%
Solar	16	51	91	100	108	117	125	7.5%
Other	0	0	0	0	0	0	1	--
Net generation to grid	1,357	1,475	1,453	1,555	1,641	1,745	1,841	1.1%

Data source: U.S. Energy Information Administration, World Energy Projection System (2023), run hp_230822.081357

Note: Totals may not equal sum of components due to independent rounding. Net generation to grid represents gross generation minus losses from thermal efficiency and parasitic load.