

Table E1.gen. Electricity generation: World, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	692	688	326	156	80	44	30	-10.0
Natural gas	6,458	6,841	7,134	6,970	6,968	7,061	7,306	0.4
Coal	8,224	7,628	7,176	7,491	7,802	8,120	8,115	0.0
Nuclear	2,630	2,836	2,914	3,053	3,084	3,020	3,025	0.5
Renewables	6,989	10,171	12,749	15,249	17,923	20,762	23,477	4.1
Hydro	4,034	4,620	4,921	5,065	5,211	5,337	5,548	1.1
Wind	1,741	2,814	3,583	4,533	5,526	6,410	6,833	4.7
Geothermal	90	129	188	214	239	249	254	3.5
Solar	832	2,275	3,656	4,949	6,391	8,145	10,152	8.7
Other	291	333	400	489	557	621	689	2.9
Net generation to grid	24,993	28,164	30,299	32,919	35,858	39,006	41,953	1.7

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829; and EIA, *Annual Energy Outlook 2021*, (February 2021), www.eia.gov/aeo

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E2.gen. Electricity generation: OECD, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	182	175	82	46	29	20	18	-7.4
Natural gas	3,353	3,294	3,346	3,302	3,348	3,424	3,517	0.2
Coal	1,834	1,536	1,413	1,394	1,386	1,304	1,263	-1.2
Nuclear	1,859	1,898	1,768	1,733	1,594	1,403	1,286	-1.2
Renewables	3,127	4,236	5,019	5,794	6,508	7,416	8,229	3.3
Hydro	1,479	1,601	1,672	1,694	1,714	1,733	1,756	0.6
Wind	960	1,489	1,811	2,300	2,767	3,359	3,708	4.6
Geothermal	52	58	79	89	98	103	108	2.5
Solar	466	908	1,264	1,480	1,670	1,941	2,359	5.6
Other	171	179	193	230	260	280	299	1.9
Net generation to grid	10,355	11,138	11,628	12,268	12,865	13,567	14,313	1.1

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829; and EIA, *Annual Energy Outlook 2021*, (February 2021), www.eia.gov/aeo

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E3.gen. Electricity generation: United States, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	16	10	9	8	8	6	6	-3.1
Natural gas	1,636	1,551	1,562	1,584	1,706	1,840	1,953	0.6
Coal	774	706	696	654	620	593	593	-0.9
Nuclear	785	745	630	609	595	599	594	-0.9
Renewables	850	1,324	1,578	1,794	1,942	2,104	2,312	3.4
Hydro	283	295	295	295	294	294	294	0.1
Wind	343	630	673	731	748	762	790	2.8
Geothermal	16	19	25	32	40	45	50	3.9
Solar	132	297	497	643	762	899	1,071	7.2
Other	76	83	87	94	99	104	108	1.2
Net generation to grid	4,061	4,336	4,475	4,650	4,871	5,142	5,458	1.0

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829; and EIA, *Annual Energy Outlook 2021* , (February 2021), www.eia.gov/aeo

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E4.gen. Electricity generation: Canada, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	5	5	1	0	0	0	0	-17.3
Natural gas	64	74	89	110	141	167	183	3.6
Coal	34	28	9	0	0	0	0	-100.0
Nuclear	87	71	77	72	51	39	28	-3.7
Renewables	430	484	526	563	599	633	666	1.5
Hydro	389	411	430	430	430	430	430	0.3
Wind	33	65	87	118	151	184	215	6.4
Geothermal	0	0	0	0	0	0	0	0.0
Solar	4	4	4	4	4	4	4	0.3
Other	4	4	5	11	13	16	18	5.1
Net generation to grid	620	662	701	745	791	839	878	1.2

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E5.gen. Electricity generation: Mexico and other OECD Americas, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	38	38	18	10	5	1	1	-10.6
Natural gas	256	273	280	302	312	295	262	0.1
Coal	39	27	27	27	27	29	30	-0.9
Nuclear	11	11	20	28	23	17	17	1.3
Renewables	153	178	214	245	295	374	455	3.7
Hydro	114	135	143	148	148	148	148	0.9
Wind	17	19	34	45	71	100	108	6.3
Geothermal	5	5	8	8	8	8	8	1.5
Solar	8	10	20	33	56	105	177	11.1
Other	9	10	10	11	12	13	14	1.4
Net generation to grid	497	527	558	612	662	716	765	1.4

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E6.gen. Electricity generation: OECD Europe, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	57	57	27	12	7	6	6	-7.0
Natural gas	796	767	781	745	693	697	702	-0.4
Coal	397	301	210	211	231	214	217	-2.0
Nuclear	741	728	674	658	608	459	363	-2.3
Renewables	1,378	1,816	2,185	2,570	2,896	3,343	3,725	3.4
Hydro	568	633	674	690	706	720	743	0.9
Wind	531	676	858	1,157	1,417	1,774	1,975	4.5
Geothermal	21	24	36	39	40	40	40	2.2
Solar	201	425	551	596	624	689	836	4.9
Other	58	58	66	88	109	120	131	2.8
Net generation to grid	3,369	3,668	3,877	4,195	4,435	4,719	5,014	1.3

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E7.gen. Electricity generation: Japan, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	48	48	25	15	9	5	4	-7.9
Natural gas	367	376	376	333	296	262	253	-1.2
Coal	283	255	251	280	285	250	207	-1.0
Nuclear	58	115	139	139	121	102	102	1.9
Renewables	204	214	228	256	314	407	472	2.8
Hydro	86	86	86	86	86	86	86	0.0
Wind	11	20	34	62	120	212	277	11.4
Geothermal	3	3	3	3	3	3	3	0.0
Solar	92	92	92	92	92	92	92	0.0
Other	11	11	11	11	12	13	13	0.7
Net generation to grid	959	1,008	1,020	1,024	1,026	1,027	1,038	0.3

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E8.gen. Electricity generation: South Korea, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	13	12	2	0	0	0	0	-14.2
Natural gas	173	197	202	181	159	131	131	-0.9
Coal	159	139	152	157	163	161	161	0.1
Nuclear	178	228	228	226	196	186	183	0.1
Renewables	27	39	60	95	152	205	220	7.3
Hydro	3	4	4	5	5	5	5	1.1
Wind	3	9	24	55	113	167	181	15.2
Geothermal	0	0	0	0	0	0	0	--
Solar	10	16	21	23	23	23	23	3.0
Other	11	10	10	11	10	10	11	-0.1
Net generation to grid	549	615	644	659	670	684	695	0.8

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E9.gen. Electricity generation: Australia and New Zealand, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	4	4	0	0	0	0	0	-11.1
Natural gas	61	56	56	46	40	32	32	-2.1
Coal	149	79	68	65	61	57	55	-3.3
Nuclear	0	0	0	0	0	0	0	0.0
Renewables	86	182	228	271	310	351	380	5.1
Hydro	36	38	39	41	45	51	51	1.2
Wind	22	70	100	131	146	161	162	6.8
Geothermal	7	7	7	7	7	7	7	0.0
Solar	19	65	80	89	108	128	155	7.3
Other	3	3	3	3	4	4	5	1.8
Net generation to grid	300	321	352	383	411	441	467	1.5

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E10.gen. Electricity generation: Non-OECD, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	511	513	244	110	51	24	11	-11.9
Natural gas	3,105	3,547	3,788	3,668	3,620	3,637	3,789	0.7
Coal	6,390	6,093	5,763	6,097	6,416	6,816	6,853	0.2
Nuclear	771	939	1,146	1,320	1,490	1,617	1,739	2.7
Renewables	3,862	5,934	7,730	9,455	11,415	13,346	15,248	4.7
Hydro	2,555	3,018	3,250	3,371	3,497	3,604	3,793	1.3
Wind	781	1,325	1,773	2,232	2,759	3,050	3,126	4.7
Geothermal	38	72	109	125	141	146	146	4.6
Solar	366	1,366	2,391	3,468	4,722	6,204	7,793	10.7
Other	120	153	207	259	297	342	391	4.0
Net generation to grid	14,638	17,026	18,671	20,650	22,993	25,439	27,639	2.1

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E11.gen. Electricity generation: Russia, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	7	7	0	0	0	0	0	-12.5
Natural gas	499	550	587	563	568	569	567	0.4
Coal	180	165	165	199	202	203	202	0.4
Nuclear	204	229	234	234	234	234	227	0.4
Renewables	189	206	218	247	271	281	295	1.5
Hydro	187	203	203	205	206	208	209	0.4
Wind	0	0	6	28	48	54	61	21.4
Geothermal	0	1	1	1	1	1	1	1.3
Solar	1	3	7	12	13	16	21	12.5
Other	0	0	1	2	3	3	3	13.6
Net generation to grid	1,078	1,158	1,204	1,243	1,274	1,286	1,290	0.6

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E12.gen. Electricity generation: Other Europe and Eurasia, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	9	9	6	5	6	6	6	-1.1
Natural gas	200	222	226	221	210	208	214	0.2
Coal	157	163	154	161	169	177	185	0.5
Nuclear	118	126	140	146	146	146	156	0.9
Renewables	141	177	205	251	308	361	395	3.5
Hydro	124	127	129	129	129	129	129	0.1
Wind	12	23	34	50	77	105	115	7.8
Geothermal	0	0	0	1	1	1	1	--
Solar	5	25	41	68	98	123	147	11.6
Other	0	2	0	2	3	3	3	--
Net generation to grid	625	697	731	784	839	898	956	1.4

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E13.gen. Electricity generation: China, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	10	10	2	0	0	0	0	-14.3
Natural gas	267	535	693	716	743	782	803	3.7
Coal	4,313	3,991	3,556	3,556	3,556	3,556	3,556	-0.6
Nuclear	331	416	538	674	795	905	1,002	3.8
Renewables	1,973	2,990	3,660	4,190	4,853	5,513	5,869	3.7
Hydro	1,117	1,266	1,334	1,381	1,448	1,448	1,448	0.9
Wind	574	899	1,001	1,001	1,001	1,001	1,001	1.9
Geothermal	0	0	0	0	0	0	0	0.0
Solar	281	824	1,304	1,774	2,368	3,025	3,379	8.6
Other	0	1	21	34	37	39	41	--
Net generation to grid	6,893	7,942	8,449	9,135	9,947	10,756	11,230	1.6

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E14.gen. Electricity generation: India, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	8	8	3	0	0	0	0	-15.3
Natural gas	90	73	73	61	51	43	43	-2.4
Coal	965	939	888	1,049	1,210	1,357	1,217	0.8
Nuclear	36	52	69	76	106	128	151	4.9
Renewables	332	882	1,510	2,028	2,565	3,279	4,325	8.9
Hydro	138	223	286	295	300	305	310	2.7
Wind	109	219	376	614	918	1,124	1,147	8.2
Geothermal	0	0	0	0	0	0	0	--
Solar	45	379	770	1,020	1,224	1,694	2,676	14.6
Other	40	61	78	99	123	155	192	5.4
Net generation to grid	1,431	1,953	2,542	3,215	3,933	4,807	5,737	4.7

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E15.gen. Electricity generation: Other Non-OECD Asia, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	86	87	47	23	11	4	0	-18.3
Natural gas	606	662	662	590	526	468	457	-0.9
Coal	559	618	770	893	1,032	1,292	1,514	3.4
Nuclear	37	36	36	36	36	36	36	-0.1
Renewables	293	465	632	875	1,135	1,254	1,355	5.2
Hydro	219	316	359	400	410	425	466	2.6
Wind	10	24	79	183	286	296	304	12.1
Geothermal	29	49	64	65	65	65	65	2.7
Solar	15	52	98	190	331	419	466	12.0
Other	20	23	32	38	43	49	53	3.3
Net generation to grid	1,582	1,869	2,147	2,417	2,739	3,054	3,361	2.5

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E16.gen. Electricity generation: Middle East, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	291	291	156	76	33	13	4	-13.2
Natural gas	872	933	933	836	836	878	951	0.3
Coal	0	0	9	0	10	33	32	--
Nuclear	6	41	58	73	83	83	83	9.2
Renewables	22	65	155	331	487	550	586	11.6
Hydro	18	18	25	25	25	25	25	1.2
Wind	1	14	46	54	59	64	69	15.8
Geothermal	0	0	1	1	1	1	1	--
Solar	3	34	82	250	401	458	490	18.2
Other	0	0	0	0	0	0	0	--
Net generation to grid	1,191	1,331	1,311	1,317	1,449	1,556	1,656	1.1

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E17.gen. Electricity generation: Africa, Reference case

billion kilowatthours

Fuel								Average annual percentage change, 2020–2050
	2020	2025	2030	2035	2040	2045	2050	
Liquid fuels	65	66	22	5	0	0	0	-15.9
Natural gas	351	360	419	488	511	533	598	1.8
Coal	187	193	206	222	210	167	131	-1.2
Nuclear	13	13	30	43	52	52	52	4.8
Renewables	158	282	374	466	635	849	1,061	6.6
Hydro	130	171	176	187	209	255	342	3.3
Wind	13	52	86	95	108	121	133	8.0
Geothermal	5	17	37	48	64	69	69	9.2
Solar	9	38	72	131	248	398	510	14.6
Other	2	3	4	5	6	7	8	5.0
Net generation to grid	774	914	1,051	1,223	1,409	1,602	1,844	2.9

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.

Table E18.gen. Electricity generation: Brazil, Reference case

billion kilowatthours

Fuel								Average annual
	2020	2025	2030	2035	2040	2045	2050	percentage change, 2020–2050
Liquid fuels	12	12	3	0	0	0	0	-14.7
Natural gas	56	61	61	46	36	28	28	-2.3
Coal	12	8	5	6	0	4	4	-3.7
Nuclear	14	14	23	23	23	18	18	0.9
Renewables	495	550	601	668	732	770	804	1.6
Hydro	389	410	411	413	418	428	448	0.5
Wind	56	81	122	181	235	259	270	5.4
Geothermal	0	0	0	0	0	0	0	0.0
Solar	3	7	8	9	10	11	11	4.9
Other	48	53	59	65	69	72	75	1.5
Net generation to grid	589	645	693	744	792	819	854	1.2

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

Table E19.gen. Electricity generation: Other Non-OECD Americas, Reference case

billion kilowatthours

Fuel	2020	2025	2030	2035	2040	2045	2050	Average annual percentage change, 2020–2050
Liquid fuels	23	23	5	0	0	0	0	-15.5
Natural gas	164	152	135	147	138	127	127	-0.8
Coal	18	15	11	11	28	28	13	-1.2
Nuclear	12	12	18	15	15	15	15	0.8
Renewables	258	316	373	397	429	490	557	2.6
Hydro	234	284	326	336	352	381	415	1.9
Wind	7	12	22	26	26	27	27	4.5
Geothermal	4	4	6	9	9	9	9	3.0
Solar	3	5	7	14	29	59	92	11.6
Other	10	11	12	12	13	14	15	1.4
Net generation to grid	475	518	542	571	610	661	713	1.4

Sources: U.S. Energy Information Administration (EIA), World Energy Projection System (2021), run r_210719.163829.

Notes:

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

* *Net generation to grid* represents gross generation less losses from thermal efficiency and parasitic load.