

Appendix E

Alternative Measures for the Energy Content of Noncombustible Renewables

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Energy sources are measured in different physical units: liquid fuels in barrels or gallons, gases in cubic feet, coal in short tons, and electricity in kilowatthours. EIA converts each source into common British thermal units (Btu) to allow comparison among different types of energy and to calculate total energy concepts.

Noncombustible renewables (hydroelectric, geothermal, solar, and wind energy) are resources from which energy is extracted without burning or combusting fuel. When noncombustible renewables generate electricity, there is no fuel combustion and, therefore, no set Btu conversion factors for the energy sources.¹

There are three broadly accepted ways to convert electricity generated from noncombustible renewables into Btu of primary energy—the captured energy, fossil fuel equivalency, and incident energy approaches. Each of these methods are described in detail below.

Captured Energy Approach

The captured energy approach converts primary energy consumption of noncombustible renewables from kilowatthours (kWh) to Btu using the constant conversion factor representing the heat content of electricity—3,412 Btu per kWh. Captured energy reflects the primary energy captured for economic use and does not include losses. In other words, it represents the net energy available for direct consumption after the transformation of a noncombustible renewable source of energy into electricity, where captured energy is the energy measured as the "output" of a generating unit, such as electricity from a wind turbine or solar plant.

The captured energy approach is often used to show the economically significant portion of the energy transformation associated with renewable energy sources. There is no market for the resource-specific energy apart from its immediate, site-specific energy conversion, and there is no substantive opportunity cost to its continued exploitation.² This approach is preferred by the *UN International Recommendations for Energy Statistics* (IRES) because the detailed data needed to estimate quantities of incident energy are not available now and are not likely to develop soon. This approach is also more closely tied to a physical market commodity, that is, electricity net generation, than the conceptual measure derived using the fossil fuel equivalency approach.

Fossil Fuel Equivalency Approach

The fossil fuel equivalency approach converts the consumption of noncombustible renewable electricity (in kWh) to Btu by applying a fossil fuel equivalency factor, based on the fossil-fuels heat rate (Table A6). The fossil-fuels heat rate is equal to the average thermal efficiency across fossil-fueled fired generating plants based on fuel consumption and net generation data reported to EIA. The fossil fuel equivalent consumption represents the energy consumed as if the electricity were generated by fossil fuels and is useful for analysis when considering the amount of primary fossil fuel energy displaced by renewable energy sources.

However, unlike the captured energy approach, the fossil fuel equivalency approach is not as directly tied to any real market or physical quantity. The fossil fuel equivalency approach measures neither primary energy consumption nor fossil fuels actually displaced. Additionally, its use becomes increasingly problematic as noncombustible renewables begin to displace other renewables instead of fossil fuels.

Incident Energy Approach

Incident energy is the mechanical, radiation, or thermal energy that is measurable as the "input" of the device. EIA defines "incident energy" for noncombustible renewables as the gross energy that first strikes an energy conversion device:

- For hydroelectric, the energy contained in the water passing through the penstock (a closed conduit for carrying water to the turbines)
- For geothermal, the energy contained in the hot fluid at the surface of the wellbore
- For wind, the energy contained in the wind that passes through the rotor disc
- For solar, the energy contained in the sunlight that strikes the panel or collector mirror

The incident energy approach converts noncombustible renewable electricity to Btu by accounting for the “losses” that result from an inability to convert 100% of incident energy to a useful form of energy. EIA has not published total primary energy consumption statistics based on this approach because it is difficult to obtain accurate estimates of input energy without creating undue burden on survey respondents and possible concern about the quality of the resulting data. Few renewable electricity power plants track cumulative input energy due to its lack of economic significance or other purpose. In addition, estimated energy efficiencies of renewable conversion technologies vary significantly across technologies, site-specific configurations, and environmental factors.³

EIA now using the captured energy approach

Starting with the September 2023 *Monthly Energy Review* (MER), EIA began converting electricity generation from noncombustible renewables into Btu using the captured energy approach rather than the fossil fuel equivalency approach in its main data tables (reflected in MER Sections 1, 2, and 10). The Btu values of hydroelectric, geothermal, solar, and wind energy consumption and, consequently, total primary energy consumption and total energy production are lower for all time periods because of the new conversion factor (the heat content of electricity from Table A6).

After a thorough review of the alternative approaches, EIA made the change for two primary reasons. First, adopting the captured energy approach promotes international comparability in energy statistics by adopting the standards provided in IRES. Second, as renewable energy continues to represent an increasingly larger portion of U.S. energy consumption over time, the fossil fuel equivalent values of generation from renewable sources become less relevant to our data users than the electrical energy provided by renewable sources.

Some analysts may still prefer to use the measures based on the fossil fuel equivalency approach, which was previously used by EIA. MER Tables E1–E4 present noncombustible renewable energy statistics using the fossil fuel equivalency approach.

¹Direct use of noncombustible renewables in the form of heat (e.g., solar thermal heating) is estimated separately and is measured in Btu.

²There is an initial opportunity cost when a facility is first built: water behind a dam might flood land that could have been used for other purposes, or a solar panel might shade an area that could have used the sunlight. But that is a “fixed” opportunity cost that does not change during the operation of the plant.

³Based on EIA research conducted in 2016, engineering estimates of conversion efficiencies for noncombustible renewables range from less than 20% for solar photovoltaics and geothermal to 90% for large-scale hydroelectricity plants. Those estimates are notional indications of the energy output as a percent of energy input at each technology based on typical equipment operating within the normal operating range for that technology.

Table E1. Primary Energy Overview, Fossil Fuel Equivalency Approach
(Quadrillion Btu)

	Production				Trade			Stock Change and Other ^d	Consumption			
	Fossil Fuels ^a	Nuclear Electric Power	Renewable Energy ^b	Total	Imports	Exports	Net Imports ^c		Fossil Fuels ^e	Nuclear Electric Power	Renewable Energy ^b	Total ^f
1950 Total	32.553	0.000	2.978	35.531	1.913	1.465	0.448	-1.380	31.615	0.000	2.978	34.599
1955 Total	37.347	.000	2.784	40.131	2.790	2.286	.504	-.457	37.380	.000	2.784	40.178
1960 Total	39.855	.006	2.928	42.789	4.188	1.477	2.710	-.458	42.091	.006	2.928	45.041
1965 Total	47.205	.043	3.396	50.644	5.892	1.829	4.063	-.754	50.515	.043	3.396	53.953
1970 Total	59.152	.239	4.070	63.462	8.342	2.632	5.709	-1.354	63.501	.239	4.070	67.817
1975 Total	54.697	1.900	4.687	61.284	14.032	2.323	11.709	-1.062	65.323	1.900	4.687	71.931
1980 Total	58.979	2.739	5.428	67.147	15.796	3.695	12.101	-1.227	69.782	2.739	5.428	78.021
1985 Total	57.502	4.076	6.084	67.661	11.781	4.196	7.584	1.088	66.035	4.076	6.084	76.334
1990 Total	58.523	6.104	6.040	70.668	18.817	4.752	14.065	-.299	72.281	6.104	6.040	84.433
1995 Total	57.496	7.075	6.557	71.129	22.180	4.496	17.684	2.118	77.162	7.075	6.559	90.931
2000 Total	57.307	7.862	6.102	71.271	28.865	3.962	24.904	2.528	84.620	7.862	6.104	98.702
2005 Total	54.995	8.161	6.221	69.377	34.659	4.462	30.197	.527	85.623	8.161	6.233	100.101
2010 Total	58.159	8.434	8.313	74.906	29.866	8.176	21.690	.916	80.723	8.434	8.266	97.512
2011 Total	60.529	8.269	9.306	78.104	28.748	10.373	18.375	.389	79.263	8.269	9.210	96.868
2012 Total	62.298	8.062	8.890	79.249	27.068	11.267	15.801	-.670	77.304	8.062	8.853	94.380
2013 Total	64.180	8.244	9.438	81.862	24.623	11.788	12.835	2.433	79.224	8.244	9.465	97.131
2014 Total	69.599	8.338	9.795	87.732	23.241	12.270	10.971	-.409	80.017	8.338	9.759	98.294
2015 Total	70.174	8.337	9.760	88.271	23.794	12.902	10.892	-1.764	79.090	8.337	9.743	97.398
2016 Total	65.447	8.427	10.469	84.343	25.378	14.119	11.259	1.771	78.319	8.427	10.401	97.373
2017 Total	68.492	8.419	11.253	88.164	25.458	17.946	7.512	1.967	77.901	8.419	11.132	97.644
2018 Total	75.784	8.438	11.575	95.797	24.833	21.224	3.610	1.829	81.281	8.438	11.365	101.236
2019 Total	81.407	8.452	11.624	101.483	22.865	23.476	-.610	-.397	80.425	8.452	11.465	100.475
2020 Total	76.182	8.251	11.583	96.016	19.988	23.464	-3.476	.459	73.169	8.251	11.418	92.999
2021 Total	77.994	8.131	12.220	98.344	21.455	25.071	-3.616	3.047	77.454	8.131	12.057	97.775
2022 Total	82.250	8.061	13.366	103.677	21.507	27.335	-5.828	2.032	78.529	8.061	13.149	99.880
2023 Total	86.115	8.099	13.309	107.523	21.657	29.656	-7.999	-.970	77.262	8.099	13.128	98.554
2024 January	7.071	.721	1.066	8.858	1.904	2.521	-.617	1.181	7.652	.721	1.043	9.422
February	6.917	.674	1.135	8.726	1.714	2.526	-.811	.243	6.363	.674	1.119	8.157
March	7.253	.662	1.263	9.178	1.736	2.650	-.914	-.032	6.330	.662	1.242	8.231
April	6.926	.601	1.265	8.792	1.770	2.362	-.591	-.517	5.832	.601	1.253	7.684
May	7.207	.679	1.277	9.162	1.939	2.564	-.625	-.516	6.067	.679	1.275	8.021
June	7.111	.712	1.274	9.098	1.824	2.595	-.771	-.179	6.171	.712	1.259	8.147
July	7.349	.729	1.198	9.277	1.967	2.551	-.583	-.031	6.738	.729	1.187	8.663
August	7.442	.729	1.195	9.365	1.785	2.625	-.840	.126	6.741	.729	1.174	8.651
September	7.150	.654	1.090	8.894	1.724	2.539	-.815	-.290	6.054	.654	1.073	7.789
October	7.452	.614	1.168	9.234	1.725	2.563	-.839	-.396	6.224	.614	1.155	7.999
November	7.151	.646	1.130	8.928	1.746	2.661	-.914	-.008	6.253	.646	1.104	8.006
December	7.448	.744	1.149	9.341	1.861	2.687	-.826	.575	7.220	.744	1.119	9.089
Total	86.477	8.165	14.211	108.853	21.696	30.844	-9.147	.155	77.644	8.165	14.004	99.860
2025 January	7.331	.749	1.207	9.287	1.893	R 2.530	R -.637	R 1.326	8.047	.749	1.170	9.976
February	6.663	.646	1.124	8.433	1.606	R 2.414	R -.808	R .879	6.753	.646	1.098	8.503
March	7.612	.652	1.366	9.630	1.663	R 2.693	R -1.030	R -.223	6.387	.652	1.335	8.377
April	R 7.270	.605	1.337	R 9.211	1.630	R 2.527	R -.896	R -.481	5.905	.605	1.318	7.834
May	R 7.525	.649	1.326	R 9.500	1.734	R 2.564	R -.829	-.726	5.995	.649	1.292	7.945
June	R 7.335	.692	1.318	R 9.345	1.680	R 2.518	R -.837	-.246	6.283	.692	1.281	8.262
July	R 7.654	.739	1.300	R 9.694	1.742	R 2.537	R -.795	R -.038	R 6.854	.739	1.264	R 8.860
August	7.745	.738	1.236	9.719	1.760	R 2.651	R -.891	R -.204	6.678	.738	1.204	8.624
September	R 7.470	.684	1.126	9.280	1.724	R 2.657	R -.933	R -.390	6.177	.684	1.092	7.957
October	7.671	.618	1.236	9.525	1.632	R 2.756	-1.124	R -.323	6.258	.618	1.202	8.077
November	7.511	.666	1.189	9.366	1.605	R 2.748	R -1.143	R -.005	6.409	.666	1.146	8.218
December	7.743	.757	1.273	9.773	1.870	R 2.906	R -1.036	R .694	7.437	.757	1.239	9.432
Total	R 89.530	8.195	15.037	R 112.762	20.540	R 31.500	R -10.960	R .262	79.184	8.195	14.643	R 102.064
2026 January	7.565	.765	1.290	9.620	1.869	2.760	-.891	1.052	7.775	.765	1.244	9.781
February	7.008	.651	1.200	8.859	1.652	2.588	-.936	.580	6.685	.651	1.165	8.503
March	7.785	.648	1.482	9.915	1.756	R 3.014	-1.258	-.151	6.410	.648	1.447	8.506
April	R 7.525	.599	R 1.412	R 9.536	1.640	R 3.147	R -1.506	R -.131	5.920	.599	1.382	7.899
May	7.702	.679	1.440	9.821	1.640	3.229	-1.588	-.234	5.916	.679	1.404	7.999
5-Month Total	37.586	3.343	6.824	47.752	8.558	14.738	-6.180	1.117	32.706	3.343	6.643	42.689
2025 5-Month Total	36.401	3.301	6.359	46.060	8.527	12.727	-4.200	.774	33.087	3.301	6.214	42.635
2024 5-Month Total	35.372	3.337	6.006	44.715	9.064	12.623	-3.559	.359	32.243	3.337	5.932	41.516

^a Coal, natural gas (dry), crude oil, and natural gas plant liquids.
^b See Table E4 for notes on series components and estimation.
^c Net imports equal imports minus exports.
^d Includes petroleum stock change and adjustments; natural gas net storage withdrawals and balancing item; coal stock change, losses, and unaccounted for; fuel ethanol stock change; and biodiesel stock change and balancing item.
^e Coal, coal coke net imports, natural gas, and petroleum.
^f Also includes electricity net imports.
R=Revised.
Notes: • See "Primary Energy," "Primary Energy Production," and "Primary

Energy Consumption," in Glossary. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#appendices> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: • **Production:** Table E2. • **Trade:** Tables 1.4a and 1.4b. • **Stock Change and Other:** Calculated as consumption minus production and net imports.
• **Consumption:** Table E3.

Table E2. Primary Energy Production by Source, Fossil Fuel Equivalency Approach
(Quadrillion Btu)

	Fossil Fuels					Nuclear Electric Power	Renewable Energy ^a						Total
	Coal ^b	Natural Gas (Dry)	Crude Oil ^c	NGPL ^d	Total		Hydro-electric Power ^e	Geo-thermal	Solar	Wind	Bio-mass	Total	
1950 Total	14.060	6.233	11.447	0.813	32.553	0.000	1.415	NA	NA	NA	1.562	2.978	35.531
1955 Total	12.370	9.345	14.410	1.223	37.347	.000	1.360	NA	NA	NA	1.424	2.784	40.131
1960 Total	10.817	12.656	14.935	1.447	39.855	.006	1.608	(s)	NA	NA	1.320	2.928	42.789
1965 Total	13.055	15.775	16.521	1.853	47.205	.043	2.059	.002	NA	NA	1.335	3.396	50.644
1970 Total	14.607	21.666	20.401	2.478	59.152	.239	2.634	.006	NA	NA	1.431	4.070	63.462
1975 Total	14.989	19.640	17.729	2.338	54.697	1.900	3.155	.034	NA	NA	1.499	4.687	61.284
1980 Total	18.598	19.908	18.249	2.225	58.979	2.739	2.900	.053	NA	NA	2.475	5.428	67.147
1985 Total	19.325	16.980	18.992	2.204	57.502	4.076	2.970	.097	(s)	(s)	3.016	6.084	67.661
1990 Total	22.488	18.326	15.571	2.138	58.523	6.104	3.046	.171	.059	.029	2.735	6.040	70.668
1995 Total	22.130	19.082	13.887	2.398	57.496	7.075	3.205	.152	.068	.033	3.099	6.557	71.129
2000 Total	22.735	19.662	12.358	2.551	57.307	7.862	2.811	.164	.063	.057	3.006	6.102	71.271
2005 Total	23.185	18.556	10.974	2.280	54.995	8.161	2.703	.181	.058	.178	3.101	6.221	69.377
2010 Total	22.038	21.806	11.610	2.705	58.159	8.434	2.539	.208	.090	.923	4.553	8.313	74.906
2011 Total	22.221	23.406	12.012	2.890	60.529	8.269	3.103	.212	.110	1.168	4.712	9.306	78.104
2012 Total	20.677	24.610	13.849	3.162	62.298	8.062	2.629	.212	.156	1.340	4.554	8.890	79.249
2013 Total	20.001	24.859	15.868	3.451	64.180	8.244	2.562	.214	.226	1.601	4.835	9.438	81.862
2014 Total	20.286	26.718	18.590	4.005	69.599	8.338	2.466	.214	.338	1.727	5.049	9.795	87.732
2015 Total	17.946	28.067	19.685	4.476	70.174	8.337	2.320	.212	.427	1.776	5.025	9.760	88.271
2016 Total	14.667	27.576	18.539	4.665	65.447	8.427	2.471	.210	.572	2.095	5.122	10.469	84.343
2017 Total	15.625	28.325	19.555	4.987	68.492	8.419	2.765	.210	.779	2.342	5.156	11.253	88.164
2018 Total	15.363	31.882	22.812	5.727	75.784	8.438	2.661	.209	.918	2.481	5.306	11.575	95.797
2019 Total	14.256	35.187	25.612	6.352	81.407	8.452	2.562	.201	1.021	2.633	5.207	11.624	101.483
2020 Total	10.703	35.062	23.612	6.805	76.182	8.251	2.501	.203	1.216	2.963	4.700	11.583	96.016
2021 Total	11.596	35.807	23.492	7.099	77.994	8.131	2.225	.205	1.529	3.345	4.916	12.220	98.344
2022 Total	12.043	37.560	24.905	7.742	82.250	8.061	2.245	.205	1.892	3.827	5.196	13.366	103.677
2023 Total	11.750	39.008	26.877	8.480	86.115	8.099	2.114	.205	2.154	3.634	5.202	13.309	107.523
2024 January	.911	3.271	2.208	.681	7.071	.721	.186	.017	.129	.300	.434	1.066	8.858
February	.910	3.145	2.166	.696	6.917	.674	.179	.016	.161	.353	.425	1.135	8.726
March	.866	3.289	2.326	.772	7.253	.662	.201	.017	.208	.389	.448	1.263	9.178
April	.741	3.153	2.272	.760	6.926	.601	.180	.016	.243	.406	.420	1.265	8.792
May	.814	3.263	2.338	.792	7.207	.679	.211	.016	.277	.338	.435	1.277	9.162
June	.890	3.196	2.262	.764	7.111	.712	.193	.016	.295	.333	.437	1.274	9.098
July	.897	3.344	2.330	.777	7.349	.729	.184	.016	.297	.244	.457	1.198	9.277
August	.972	3.313	2.365	.792	7.442	.729	.177	.016	.292	.252	.458	1.195	9.365
September	.942	3.184	2.248	.777	7.150	.654	.137	.016	.251	.251	.435	1.090	8.894
October	.912	3.336	2.386	.818	7.452	.614	.132	.016	.237	.341	.441	1.168	9.234
November	.844	3.229	2.286	.793	7.151	.646	.144	.017	.172	.346	.452	1.130	8.928
December	.882	3.397	2.370	.799	7.448	.744	.168	.017	.158	.341	.465	1.149	9.341
Total	10.579	39.121	27.557	9.221	86.477	8.165	2.093	.196	2.719	3.894	5.308	14.211	108.853
2025 January	.922	E 3.349	E 2.317	.742	7.331	.749	.185	.017	.186	.376	.443	1.207	9.287
February	.819	E 3.042	E 2.109	.693	6.663	.646	.168	.016	.199	.339	.402	1.124	8.433
March	.983	RE 3.446	E 2.373	.810	7.612	.652	.193	.017	.278	.436	.441	1.366	9.630
April	.863	RE 3.321	E 2.298	.788	R 7.270	.605	.197	.016	.317	.395	.411	1.337	R 9.211
May	.907	RE 3.421	E 2.371	.826	R 7.525	.649	.210	.016	.348	.318	.434	1.326	R 9.500
June	.871	RE 3.341	E 2.323	.801	R 7.335	.692	.191	.016	.368	.308	.435	1.318	R 9.345
July	.930	RE 3.468	E 2.417	.838	R 7.654	.739	.172	.016	.385	.274	.453	1.300	R 9.694
August	.967	E 3.489	E 2.436	.853	7.745	.738	.173	.017	.365	.235	.445	1.236	9.719
September	.900	E 3.365	E 2.360	.845	R 7.470	.684	.132	.016	.323	.221	.434	1.126	9.280
October	.916	E 3.447	E 2.445	.863	7.671	.618	.143	.016	.286	.341	.450	1.236	9.525
November	.890	E 3.427	E 2.353	.840	7.511	.666	.159	.016	.219	.353	.443	1.189	9.366
December	.909	E 3.585	E 2.408	.841	7.743	.757	.206	.017	.187	.405	.457	1.273	9.773
Total	10.876	RE 40.702	E 28.211	9.740	R 89.530	8.195	2.129	.199	3.461	4.002	5.247	15.037	R 112.762
2026 January	.928	E 3.493	E 2.346	.798	7.565	.765	.240	.018	.213	.383	.436	1.290	9.620
February	.849	E 3.210	E 2.184	.765	7.008	.651	.194	.016	.246	.342	.403	1.200	8.859
March	.938	RE 3.556	RE 2.421	.870	7.785	.648	.232	.017	.336	.450	.446	1.482	9.915
April	.848	RE 3.448	RE 2.384	.846	R 7.525	.599	.194	.016	.363	.423	R 4.16	R 1.412	R 9.536
May	.859	E 3.542	E 2.419	.883	7.702	.679	.196	.016	.417	.355	.456	1.440	9.821
5-Month Total ...	4.422	E 17.249	E 11.754	4.162	37.586	3.343	1.056	.082	1.575	1.953	2.157	6.824	47.752
2025 5-Month Total ...	4.493	16.579	11.469	3.860	36.401	3.301	.953	.083	1.327	1.864	2.132	6.359	46.060
2024 5-Month Total ...	4.240	16.121	11.310	3.701	35.372	3.337	.957	.083	1.017	1.786	2.163	6.006	44.715

^a Most data are estimates. See Table E4 for notes on series components and estimation.

^b Beginning in 1989, includes waste coal supplied. Beginning in 2001, also includes a small amount of refuse recovery. See Table 6.1.

^c Includes lease condensate.

^d Natural gas processing plant production of natural gas liquids (ethane, propane, normal butane, isobutane, and natural gasoline). Through 1980, also includes natural gas processing plant production of finished petroleum products (aviation gasoline, distillate fuel oil, jet fuel, kerosene, motor gasoline, special naphthas, and miscellaneous products).

^e Conventional hydroelectric power.

R=Revised. E=Estimate. NA=Not available. (s)=Less than 0.5 trillion Btu.

Notes: • See "Primary Energy Production" in Glossary. • Totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#appendices> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: • **Fossil Fuels** and **Nuclear Electric Power:** Table 1.2. • **Renewable Energy:** Table E4. • **Total:** Calculated as the sum of Fossil Fuels, Nuclear Electric Power, and Renewable Energy.

Table E3. Primary Energy Consumption by Source, Fossil Fuel Equivalency Approach
(Quadrillion Btu)

	Fossil Fuels ^a				Nuclear Electric Power	Renewable Energy ^b						Total ^g
	Coal	Natural Gas ^c	Petroleum ^d	Total ^e		Hydro-electric Power ^f	Geo-thermal	Solar	Wind	Bio-mass	Total	
1950 Total	12.347	5.968	13.298	31.615	0.000	1.415	NA	NA	NA	1.562	2.978	34.599
1955 Total	11.167	8.998	17.225	37.380	.000	1.360	NA	NA	NA	1.424	2.784	40.178
1960 Total	9.838	12.385	19.874	42.091	.006	1.608	(s)	NA	NA	1.320	2.928	45.041
1965 Total	11.581	15.769	23.184	50.515	.043	2.059	.002	NA	NA	1.335	3.396	53.953
1970 Total	12.265	21.795	29.499	63.501	.239	2.634	.006	NA	NA	1.431	4.070	67.817
1975 Total	12.663	19.948	32.699	65.323	1.900	3.155	.034	NA	NA	1.499	4.687	71.931
1980 Total	15.423	20.235	34.159	69.782	2.739	2.900	.053	NA	NA	2.475	5.428	78.021
1985 Total	17.478	17.703	30.866	66.035	4.076	2.970	.097	(s)	(s)	3.016	6.084	76.334
1990 Total	19.173	19.603	33.500	72.281	6.104	3.046	.171	.059	.029	2.735	6.040	84.433
1995 Total	20.089	22.671	34.341	77.162	7.075	3.205	.152	.068	.033	3.101	6.559	90.931
2000 Total	22.580	23.824	38.152	84.620	7.862	2.811	.164	.063	.057	3.008	6.104	98.702
2005 Total	22.797	22.565	40.217	85.623	8.161	2.703	.181	.058	.178	3.114	6.233	100.101
2010 Total	20.834	24.575	35.321	80.723	8.434	2.539	.208	.090	.923	4.506	8.266	97.512
2011 Total	19.658	24.955	34.639	79.263	8.269	3.103	.212	.110	1.168	4.616	9.210	96.868
2012 Total	17.378	26.089	33.833	77.304	8.062	2.629	.212	.156	1.340	4.517	8.853	94.380
2013 Total	18.039	26.805	34.398	79.224	8.244	2.562	.214	.226	1.601	4.861	9.465	97.131
2014 Total	17.998	27.383	34.658	80.017	8.338	2.466	.214	.338	1.727	5.013	9.759	98.294
2015 Total	15.549	28.191	35.368	79.090	8.337	2.320	.212	.427	1.776	5.008	9.743	97.398
2016 Total	14.226	28.400	35.712	78.319	8.427	2.471	.210	.572	2.095	5.053	10.401	97.373
2017 Total	13.837	28.049	36.043	77.901	8.419	2.765	.210	.779	2.342	5.035	11.132	97.644
2018 Total	13.252	31.163	36.892	81.281	8.438	2.661	.209	.918	2.481	5.096	11.365	101.236
2019 Total	11.316	32.264	36.866	80.425	8.452	2.562	.201	1.021	2.633	5.048	11.465	100.475
2020 Total	9.181	31.669	32.331	73.169	8.251	2.501	.203	1.216	2.963	4.535	11.418	92.999
2021 Total	10.549	31.711	35.243	77.454	8.131	2.225	.205	1.529	3.345	4.753	12.057	97.775
2022 Total	9.888	33.379	35.319	78.529	8.061	2.245	.205	1.892	3.827	4.980	13.149	99.880
2023 Total	8.171	33.676	35.448	77.262	8.099	2.114	.205	2.154	3.634	5.021	13.128	98.554
2024 January	.879	3.859	2.914	7.652	.721	.186	.017	.129	.300	.411	1.043	9.422
February	.562	3.069	2.734	6.363	.674	.179	.016	.161	.353	.410	1.119	8.157
March	.494	2.896	2.944	6.330	.662	.201	.017	.208	.389	.427	1.242	8.231
April	.467	2.480	2.888	5.832	.601	.180	.016	.243	.406	.408	1.253	7.684
May	.563	2.417	3.089	6.067	.679	.211	.016	.277	.338	.433	1.275	8.021
June	.721	2.513	2.942	6.171	.712	.193	.016	.295	.333	.422	1.259	8.147
July	.838	2.839	3.062	6.738	.729	.184	.016	.297	.244	.446	1.187	8.663
August	.818	2.816	3.111	6.741	.729	.177	.016	.292	.252	.437	1.174	8.651
September	.664	2.498	2.896	6.054	.654	.137	.016	.251	.251	.418	1.073	7.789
October	.589	2.513	3.127	6.224	.614	.132	.016	.237	.341	.428	1.155	7.999
November	.570	2.802	2.885	6.253	.646	.144	.017	.172	.346	.425	1.104	8.006
December	.747	3.478	2.999	7.220	.744	.168	.017	.158	.341	.435	1.119	9.089
Total	7.912	34.179	35.590	77.644	8.165	2.093	.196	2.719	3.894	5.101	14.004	99.860
2025 January	.940	4.051	3.057	8.047	.749	.185	.017	.186	.376	.406	1.170	9.976
February	.733	3.339	2.682	6.753	.646	.168	.016	.199	.339	.377	1.098	8.503
March	.597	2.841	2.950	6.387	.652	.193	.017	.278	.436	.410	1.335	8.377
April	.549	2.455	2.904	5.905	.605	.197	.016	.317	.395	.393	1.318	7.834
May	.590	2.384	3.024	5.995	.649	.210	.016	.348	.318	.401	1.292	7.945
June	.755	2.497	3.033	6.283	.692	.191	.016	.368	.308	.397	1.281	8.262
July	.921	2.814	3.123	6.854	.739	.172	.016	.385	.274	.416	1.264	8.860
August	.817	2.730	3.133	6.678	.738	.173	.017	.365	.235	.413	1.204	8.624
September	.695	2.506	2.976	6.177	.684	.132	.016	.323	.221	.400	1.092	7.957
October	.652	2.524	3.082	6.258	.618	.143	.016	.286	.341	.416	1.202	8.077
November	.651	2.874	2.882	6.409	.666	.159	.016	.219	.353	.400	1.146	8.218
December	.771	3.614	3.053	7.437	.757	.206	.017	.187	.405	.423	1.239	9.432
Total	8.671	34.631	35.899	79.184	8.195	2.129	.199	3.461	4.002	4.853	14.643	102.064
2026 January	.820	3.916	3.040	7.775	.765	.240	.018	.213	.383	.390	1.244	9.781
February	.653	3.216	2.818	6.685	.651	.194	.016	.246	.342	.368	1.165	8.503
March	.539	2.871	3.002	6.410	.648	.232	.017	.336	.450	.412	1.447	8.506
April	.481	2.467	2.974	5.920	.599	.194	.016	.363	.423	.386	1.382	7.899
May	.542	2.429	2.945	5.916	.679	.196	.016	.417	.355	.420	1.404	7.999
5-Month Total	3.036	14.899	14.779	32.706	3.343	1.056	.082	1.575	1.953	1.976	6.643	42.689
2025 5-Month Total	3.409	15.071	14.616	33.087	3.301	.953	.083	1.327	1.864	1.987	6.214	42.635
2024 5-Month Total	2.966	14.721	14.569	32.243	3.337	.957	.083	1.017	1.786	2.089	5.932	41.516

^a Includes non-combustion use of fossil fuels.
^b Most data are estimates. See Table E4 for notes on series components and estimation.
^c Natural gas only; excludes supplemental gaseous fuels. See Note 3, "Supplemental Gaseous Fuels," at end of Section 4.
^d Petroleum products supplied; excludes biofuels. Biofuels are included in "Biomass."
^e Includes coal coke net imports. See Tables 1.4c.
^f Conventional hydroelectric power.
^g Includes coal coke net imports and electricity net imports, which are not separately displayed. See Tables 1.4c.
R=Revised. NA=Not available. (s)=Less than 0.5 trillion Btu.

Notes: • See "Primary Energy Consumption" in Glossary.
• See Table D1 for estimated energy consumption for 1635–1945. • Totals may not equal sum of components due to independent rounding.
• Geographic coverage is the 50 states and the District of Columbia.
Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#appendices> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.
Sources: • **Fossil Fuels** and **Nuclear Electric Power:** Table 1.3. • **Renewable Energy:** Table E4. • **Total:** Calculated as the sum of Fossil Fuels, Nuclear Electric Power, Renewable Energy, and Electricity Net Imports (see Table 1.4c).

Table E4. Renewable Energy Production and Consumption by Source, Fossil Fuel Equivalency Approach (Trillion Btu)

	Production ^a				Consumption								
	Biomass			Total Renewable Energy ^o	Noncombustible (Fossil Fuel Equivalent)				Biomass				Total Renewable Energy
	Wood ^b	Bio-fuels ^c	Total ^d		Hydro-electric Power ^f	Geo-thermal ^g	Solar ^h	Wind ⁱ	Wood ^j	Waste ^k	Bio-fuels ^l	Total	
1950 Total	1,562	NA	1,562	2,978	1,415	NA	NA	NA	1,562	NA	NA	1,562	2,978
1955 Total	1,424	NA	1,424	2,784	1,360	NA	NA	NA	1,424	NA	NA	1,424	2,784
1960 Total	1,320	NA	1,320	2,928	1,608	(s)	NA	NA	1,320	NA	NA	1,320	2,928
1965 Total	1,335	NA	1,335	3,396	2,059	2	NA	NA	1,335	NA	NA	1,335	3,396
1970 Total	1,429	NA	1,431	4,070	2,634	6	NA	NA	1,429	2	NA	1,431	4,070
1975 Total	1,497	NA	1,499	4,687	3,155	34	NA	NA	1,497	2	NA	1,499	4,687
1980 Total	2,474	NA	2,475	5,428	2,900	53	NA	NA	2,474	2	NA	2,475	5,428
1985 Total	2,687	93	3,016	6,084	2,970	97	NA	(s)	2,687	236	93	3,016	6,084
1990 Total	2,216	111	2,735	6,040	3,046	171	59	29	2,216	408	111	2,735	6,040
1995 Total	2,370	198	3,099	6,557	3,205	152	68	33	2,370	531	200	3,101	6,559
2000 Total	2,262	233	3,006	6,102	2,811	164	63	57	2,262	511	236	3,008	6,104
2005 Total	2,137	561	3,101	6,221	2,703	181	58	178	2,137	403	574	3,114	6,233
2010 Total	2,217	1,868	4,553	8,313	2,539	208	90	923	2,217	468	1,821	4,506	8,266
2011 Total	2,213	2,037	4,712	9,306	3,103	212	110	1,168	2,213	462	1,941	4,616	9,210
2012 Total	2,151	1,936	4,554	8,890	2,629	212	156	1,340	2,151	467	1,899	4,517	8,853
2013 Total	2,338	2,000	4,835	9,438	2,562	214	226	1,601	2,338	496	2,026	4,861	9,465
2014 Total	2,398	2,135	5,049	9,795	2,466	214	338	1,727	2,398	516	2,099	5,013	9,759
2015 Total	2,305	2,201	5,025	9,760	2,320	212	427	1,776	2,305	518	2,185	5,008	9,743
2016 Total	2,290	2,329	5,122	10,469	2,471	210	572	2,095	2,217	503	2,333	5,053	10,401
2017 Total	2,254	2,407	5,156	11,253	2,765	210	779	2,342	2,176	495	2,364	5,035	11,132
2018 Total	2,348	2,471	5,306	11,575	2,661	209	918	2,481	2,254	487	2,355	5,096	11,365
2019 Total	2,333	2,432	5,207	11,624	2,562	201	1,021	2,633	2,229	442	2,376	5,048	11,465
2020 Total	2,066	2,194	4,700	11,583	2,501	203	1,216	2,963	1,960	440	2,136	4,535	11,418
2021 Total	2,111	2,374	4,916	12,220	2,225	205	1,529	3,345	1,992	430	2,331	4,753	12,057
2022 Total	2,273	2,511	5,196	13,366	2,245	205	1,892	3,827	2,135	412	2,433	4,980	13,149
2023 Total	2,103	2,705	5,202	13,309	2,114	205	2,154	3,634	1,968	394	2,659	5,021	13,128
2024 January	173	226	434	1,066	186	17	129	300	165	35	212	411	1,043
February	166	227	425	1,135	179	16	161	353	154	32	223	410	1,119
March	174	241	448	1,263	201	17	208	389	161	33	232	427	1,242
April	166	223	420	1,265	180	16	243	406	155	31	222	408	1,253
May	170	232	435	1,277	211	16	277	338	158	33	242	433	1,275
June	169	238	437	1,274	193	16	295	333	157	30	235	422	1,259
July	173	252	457	1,198	184	16	297	244	162	32	252	446	1,187
August	176	250	458	1,195	177	16	292	252	163	32	242	437	1,174
September	169	236	435	1,090	137	16	251	251	157	31	231	418	1,073
October	164	245	441	1,168	132	16	237	341	153	32	243	428	1,155
November	169	251	452	1,130	144	17	172	346	157	32	235	425	1,104
December	178	255	465	1,149	168	17	158	341	166	33	236	435	1,119
Total	2,046	2,875	5,308	14,211	2,093	196	2,719	3,894	1,909	387	2,806	5,101	14,004
2025 January	177	233	443	1,207	185	17	186	376	165	33	208	406	1,170
February	160	212	402	1,124	168	16	199	339	148	30	199	377	1,098
March	176	232	441	1,366	193	17	278	436	163	33	214	410	1,335
April	162	218	411	1,337	197	16	317	395	151	31	212	393	1,318
May	170	234	434	1,326	210	16	348	318	158	31	212	401	1,292
June	170	235	435	1,318	191	16	368	308	158	30	209	397	1,281
July	180	243	453	1,300	172	16	385	274	166	30	220	416	1,264
August	177	237	445	1,236	173	17	365	235	165	30	218	413	1,204
September	172	233	434	1,126	132	16	323	221	160	29	211	400	1,092
October	171	248	450	1,236	143	16	286	341	158	31	226	416	1,202
November	169	243	443	1,189	159	16	219	353	156	31	212	400	1,146
December	175	249	457	1,273	206	17	187	405	163	32	228	423	1,239
Total	2,058	2,817	5,247	15,037	2,129	199	3,461	4,002	1,912	372	2,569	4,853	14,643
2026 January	172	232	436	1,290	240	18	213	383	159	31	199	390	1,244
February	154	220	403	1,200	194	16	246	342	145	29	194	368	1,165
March	166	248	446	1,482	232	17	336	450	155	32	225	412	1,447
April	154	233	415	1,412	194	16	363	423	140	30	216	386	1,382
May	169	257	456	1,440	196	16	417	355	157	30	234	420	1,404
5-Month Total	815	1,190	2,157	6,824	1,056	82	1,575	1,953	755	152	1,069	1,976	6,643
2025 5-Month Total	845	1,129	2,132	6,359	953	83	1,327	1,864	785	157	1,045	1,987	6,214
2024 5-Month Total	849	1,150	2,163	6,006	957	83	1,017	1,786	794	164	1,131	2,089	5,932

^a For hydroelectric power, geothermal, solar, wind, and biomass waste, production equals consumption.

^b Wood and wood-derived fuels. Through 2015, wood production equals consumption. Beginning in 2016, wood production equals consumption plus densified biomass exports.

^c Total biomass inputs to the production of fuel ethanol and biodiesel. Beginning in 2011, also includes production of renewable diesel fuel. Beginning in 2014, also includes production of other biofuels.

^d Includes biomass waste.

^e Hydroelectric power, geothermal, solar, wind, and biomass.

^f Conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^g Geothermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and geothermal heat pump and direct use energy.

^h Solar photovoltaic (PV) and solar thermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and solar thermal direct use energy.

ⁱ Wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6).

^j Wood and wood-derived fuels.

^k Municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass. Through 2000, also includes non-renewable waste (municipal solid waste from non-biogenic sources, and

tire-derived fuels).

^l Fuel ethanol (minus denaturant), biodiesel, renewable diesel fuel, and other biofuels consumption; plus losses and co-products from the production of fuel ethanol and biodiesel.

R=Revised. NA=Not available. (s)=Less than 0.5 trillion Btu.

Notes: • Production data are estimates. Consumption data are estimates, except for hydroelectric power in 1949–1978 and 1989 forward, and wind. • Totals may not equal sum of components due to independent rounding.

• Geographic coverage is the 50 states and the District of Columbia.

Web Page: See <http://www.eia.gov/totalenergy/data/monthly/#appendices> (Excel and CSV files) for all available annual data beginning in 1949 and monthly data beginning in 1973.

Sources: • **Biomass:** Table 10.1. • **Hydroelectric Power and Wind:** Calculated as electricity net generation (see Table 7.2a) multiplied by the total fossil fuels heat rate factors (see Table A6). • **Geothermal:** Calculated as geothermal electricity net generation (see Table 7.2a) multiplied by the total fossil fuels heat rate factors (see Table A6); plus geothermal heat pump and direct use energy in the residential, commercial, and industrial sectors (see Tables 10.2a and 10.2b). • **Solar:** Calculated as solar electricity net generation (see Table 7.2a) multiplied by the total fossil fuels heat rate factors (see Table A6); plus solar thermal direct use energy (see Table 10.5). • **Total Production:** Calculated as the sum of biomass production and noncombustible consumption. • **Total Consumption:** Calculated as the sum of biomass consumption and noncombustible consumption.

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