



ALASKA AND HAWAII
Data for several locations in Alaska are given. SOLMET radiation data for Anchorage (about midway between Homer and Gulkana) are not available.

Location	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Anchorage	1961	77	77	77	77	77	77	77	77	77	77	77	77	77
	1962	77	77	77	77	77	77	77	77	77	77	77	77	77

map of

Solar Energy

in the
United States
and
Southern Canada

1 centimeter equals approximately 50 kilometers
1 inch equals approximately 80 miles

Lambert conformal conic projection based on standard parallels 33° and 45°

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USE OF COLOR ON SOLAR ENERGY MAP
The annual distribution of solar radiation is shown by red contour lines. To emphasize this distribution, the areas between each contour line have been colored in yellow or in one of three shades of orange. The scheme is as follows:
YELLOW AREAS: These areas (Great Lakes region and the Pacific Northwest) receive the least amount of radiation (less than 1100 BTU/ft²/day)
LIGHT ORANGE AREAS: These receive between 1100 and 1400 BTU/ft²/day
MEDIUM ORANGE AREAS: These receive between 1400 and 1700 BTU/ft²/day
DEEP ORANGE AREA: This area (most of the U.S. Southeast) receives the most radiation. Radiation values here are greater than 1700 BTU/ft²/day

HEATING DEGREE DAYS
Heating degree-day values give a measure of the amount of heat or fuel required to keep a house at a temperature comfortable for living. Thus, it would require about 4 times more fuel to heat a house for 1 year in Boise, Idaho (number of heating degree days is 5830—sum of the four seasonal values) as to heat a similar building in New Orleans, Louisiana (number of heating degree days is 1470).

Heating degree days, rounded to the nearest 10 on this map, are described as follows in the National Climatic Center publication: Climatic Atlas of the United States

Heating degree days are the number of degrees the daily average temperature is below 65°F. Normally, heating is not required in a building when the outdoor average daily temperature is 65°. Heating degree days are determined by subtracting the average daily temperature below 65° from the base 65°. A day with an average temperature of 50° has 15 heating degree days (65 - 50 = 15), while one with an average temperature of 67° or higher has none.

Several characteristics make the degree-day data especially useful. They are cumulative, so that the degree-day sum for a period of days represents the total heating need for that period. The relationship between degree days and fuel consumption is linear, i.e., doubling the degree days usually doubles the fuel consumption.

All heating degree-day data are given in Fahrenheit degree days. The temperature base for values in the United States is 65°F; in Canada 64.4°F (18°C). The Canadian values, available only in certain areas, were converted to Fahrenheit degree days using the 19°C base.

SOLAR RADIATION
All solar radiation data, both the seasonal values for cities and the numbers for the contoured annual radiation, are unrounded. The data are given in units of BTU/sq. ft. per day, rounded to the nearest 10.

These values represent the mean daily amounts of radiation that would be received on a south-facing surface such as a solar collector that forms an angle with the horizon equal to the city latitude plus 15°. Thus, for Denver, Colorado, which is located at latitude 39.8°N, a tilt of 54.8° between a collector and the horizon is assumed. This orientation for solar collectors is widely accepted to be near the optimum tilt angle for space heating systems during the heating season. It can also be used throughout the year for water-heating systems although slightly smaller tilt angles often are recommended for such systems (e.g., tilt angle equal to the latitude). But variations in the tilt angle of 10° to 15° make little difference in the amount of solar radiation received. Similarly, solar collection facing within about 15° east or west of south will receive nearly the same amount of radiation as a collector facing true south.

Since the solar radiation data presented are based on long-term average climatic conditions, any particular year may produce more or less energy than shown on this map. Also, in some locations, such as mountains or coastal regions, changes in cloud cover over relatively short distances can cause significant changes in the amount of radiation received.

Radiation, temperature, and heating degree-day values are included for 222 U.S. and 21 Canadian cities. Data for the cities are given for each season: spring (March-May), summer (June-August), autumn (September-November), and winter (December-February). Generalized contours show the daily solar radiation averaged over the year. All data are in English units (BTU, British thermal unit or BTU/sq. ft. and feet). The table given below allows easy conversion to other commonly used units. Data appear on the map as follows:

TEMPERATURES
Temperature values (shown in degrees Fahrenheit) represent the average temperature during the 3 months of each season.

*Radiation data are the sum of the direct, diffuse, and ground reflection components on tilted surface. A ground reflectance of 0.2 was assumed. The values were calculated using a method modified from Collares-Pereira and Rabl (Solar Energy, vol. 23, 1979) for determining horizontal diffuse and direct radiation, together with standard geometric techniques applied to tilted surfaces.

Temperature and heating degree-day data for the United States and Canada are averages from 1940-70. Most radiation data are based on measurements varying from 8 years (1973-76) for Sept.-Dec. to 40 years (1937-76) for Toronto, Ontario.

Although ENMAP has attempted to give an accurate presentation of solar radiation, temperature, and heating degree-day data, some errors and omissions are inevitable, or the usefulness of the data presented.

CONVERSION FACTORS AND TABLES

SOLAR RADIATION		TEMPERATURE		HEATING DEGREE DAYS	
1 BTU/ft ² = 0.2778 kilowatt-hours/m ²	1 BTU/ft ² = 0.01055 kilowatt-hours/m ²	°C = 5/9 (°F - 32)	Celsius HDD = 9/5 (Fahrenheit HDD)		
100	27.78	0	32	0	0
200	55.56	10	50	18	32
300	83.34	20	68	36	64
400	111.11	30	86	54	96
500	138.89	40	104	72	128
600	166.67	50	122	90	160
700	194.44	60	140	108	192
800	222.22	70	158	126	224
900	250.00	80	176	144	256
1000	277.78	90	194	162	288
1100	305.56	100	212	180	320
1200	333.33	110	230	198	352
1300	361.11	120	248	216	384
1400	388.89	130	266	234	416
1500	416.67	140	284	252	448
1600	444.44	150	302	270	480
1700	472.22	160	320	288	512
1800	500.00	170	338	306	544
1900	527.78	180	356	324	576
2000	555.56	190	374	342	608
2100	583.33	200	392	360	640
2200	611.11	210	410	378	672
2300	638.89	220	428	396	704
2400	666.67	230	446	414	736
2500	694.44	240	464	432	768
2600	722.22	250	482	450	800
2700	750.00	260	500	468	832
2800	777.78	270	518	486	864
2900	805.56	280	536	504	896
3000	833.33	290	554	522	928
3100	861.11	300	572	540	960
3200	888.89	310	590	558	992
3300	916.67	320	608	576	1024
3400	944.44	330	626	594	1056
3500	972.22	340	644	612	1088
3600	1000.00	350	662	630	1120
3700	1027.78	360	680	648	1152
3800	1055.56	370	698	666	1184
3900	1083.33	380	716	684	1216
4000	1111.11	390	734	702	1248
4100	1138.89	400	752	720	1280
4200	1166.67	410	770	738	1312
4300	1194.44	420	788	756	1344
4400	1222.22	430	806	774	1376
4500	1250.00	440	824	792	1408
4600	1277.78	450	842	810	1440
4700	1305.56	460	860	828	1472
4800	1333.33	470	878	846	1504
4900	1361.11	480	896	864	1536
5000	1388.89	490	914	882	1568
5100	1416.67	500	932	900	1600
5200	1444.44	510	950	918	1632
5300	1472.22	520	968	936	1664
5400	1500.00	530	986	954	1696
5500	1527.78	540	1004	972	1728
5600	1555.56	550	1022	990	1760
5700	1583.33	560	1040	1008	1792
5800	1611.11	570	1058	1026	1824
5900	1638.89	580	1076	1044	1856
6000	1666.67	590	1094	1062	1888
6100	1694.44	600	1112	1080	1920
6200	1722.22	610	1130	1098	1952
6300	1750.00	620	1148	1116	1984
6400	1777.78	630	1166	1134	2016
6500	1805.56	640	1184	1152	2048
6600	1833.33	650	1202	1170	2080
6700	1861.11	660	1220	1188	2112
6800	1888.89	670	1238	1206	2144
6900	1916.67	680	1256	1224	2176
7000	1944.44	690	1274	1242	2208
7100	1972.22	700	1292	1260	2240
7200	2000.00	710	1310	1278	2272
7300	2027.78	720	1328	1296	2304
7400	2055.56	730	1346	1314	2336
7500	2083.33	740	1364	1332	2368
7600	2111.11	750	1382	1350	2400
7700	2138.89	760	1400	1368	2432
7800	2166.67	770	1418	1386	2464
7900	2194.44	780	1436	1404	2496
8000	2222.22	790	1454	1422	2528
8100	2250.00	800	1472	1440	2560
8200	2277.78	810	1490	1458	2592
8300	2305.56	820	1508	1476	2624
8400	2333.33	830	1526	1494	2656
8500	2361.11	840	1544	1512	2688
8600	2388.89	850	1562	1530	2720
8700	2416.67	860	1580	1548	2752
8800	2444.44	870	1598	1566	2784
8900	2472.22	880	1616	1584	2816
9000	2500.00	890	1634	1602	2848
9100	2527.78	900	1652	1620	2880
9200	2555.56	910	1670	1638	2912
9300	2583.33	920	1688	1656	2944
9400	2611.11	930	1706	1674	2976
9500	2638.89	940	1724	1692	3008
9600	2666.67	950	1742	1710	3040
9700	2694.44	960	1760	1728	3072
9800	2722.22	970	1778	1746	3104
9900	2750.00	980	1796	1764	3136
10000	2777.78	990	1814	1782	3168