INSTREAM USE

Hydroelectric Power

3,160,000 million gallons per day

Water used for hydroelectric power generation in 1995 was an estimated 3,160,000 Mgal/d, or 4 percent less than during 1990. (See tables 27, 28.) This total is 2.6 times the average annual runoff in the conterminous United States. (Graczyk and others, 1986). It is possible for the hydroelectric power water use to exceed average annual runoff because some water is used several times as it passes through several hydroelectric dams on a river.

Water used for hydroelectric power generation is classified as an instream use and refers to the water used in the generation of electricity at plants where the turbine generators are driven by falling water. Estimates of water used for hydroelectric power generation may vary because of the way individual estimates are made of the quantities of water passed through the plants. If the water is passed through the plants only one time, then accurate estimates of water use can be obtained by streamflow measurements and gate openings. However, it is difficult to define and obtain net water use at pumped-storage hydroelectric plants because the same water is recycled a number of times. Pumped-storage plants usually generate electric energy during peak-load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the pumped-storage reservoir through a conduit to turbine generators located in a power plant at a lower level.

State agencies were asked in 1995 for the first time to report offstream hydroelectric power generation. Offstream hydroelectric power generation water use was reported for ten states and totaled 90,000 Mgal/d. California reported the most water use (69,000 Mgal/d), followed by Maine (6,290 Mgal/d), Oregon (5,880 Mgal/d) and Pennsylvania (5,260 Mgal/d). The reported offstream uses were included in the instream uses to be consistent with previous reports in this series.

Estimates of hydroelectric power water use and power generation, as with the thermoelectric power category, are based on more information and fewer extrapolations than for the other water-use categories. Most of the information is obtained from hydroelectric utility companies. If information is not available from utilities, then records of the power generated are obtained from the U.S. Department of Energy's Energy Information Administration (1996). The power-generation data are multiplied by water-use coefficients to obtain estimates of hydroelectric power water use. In this report, it is assumed that none of the water used for hydroelectric power generation is consumptively used. Although the quantity of water evaporated in the actual generation of hydroelectric power (consumptive use) is small, considerable depletion of the available water supply for hydroelectric power generation occurs as an indirect result of evaporation from reservoirs and repeated reuse of water within a pumped-storage power facility.

Fresh surface water provides virtually all water for hydroelectric power generation. The Pacific Northwest water-resources region had by far the largest use of water for hydroelectric power generation during 1995, more than triple the use in the Great Lakes region (figure 29), and accounts for about 40 percent of the water use for hydroelectric power generation in the Nation. Almost one-half of the water use for hydroelectric power generation in the United States occurs in Washington; Oregon, primarily on the Columbia River system; and New York (figure 30), on the Niagara and the St. Lawrence River systems.

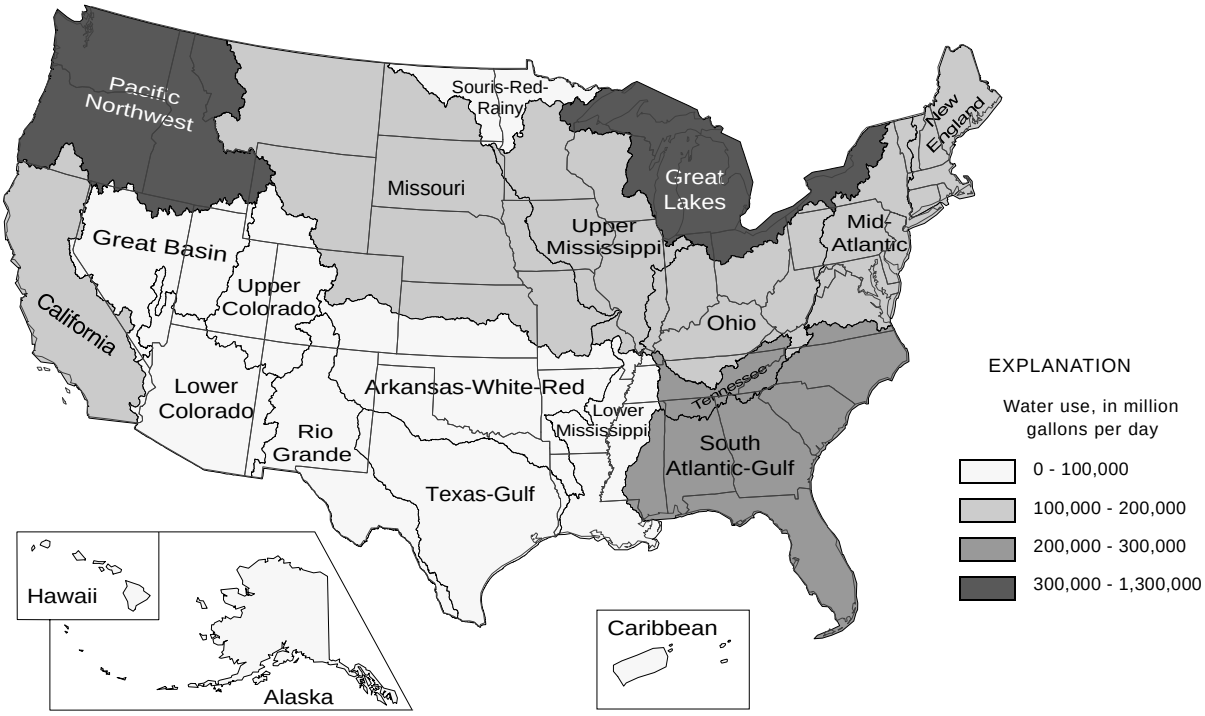

Figure 29. Hydroelectric power water use by water-resources region, 1995.

Table 27. Hydroelectric power water use by water-resources region, 1995

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day; kWh = kilowatthour]

REGION	WATER USE		POWER GENERATED, in million kWh
	Mgal/d	Thousand acre-feet per year	
New England	156,000	175,000	6,720
Mid-Atlantic	144,000	162,000	5,260
South Atlantic-Gulf	229,000	256,000	17,100
Great Lakes	340,000	382,000	24,200
Ohio	172,000	192,000	5,250
Tennessee	209,000	235,000	16,000
Upper Mississippi	119,000	133,000	2,990
Lower Mississippi	78,200	87,700	1,320
Souris-Red-Rainy	3,970	4,450	100
Missouri Basin	141,000	159,000	16,000
Arkansas-White-Red	95,400	107,000	6,740
Texas-Gulf	14,500	16,300	1,050
Rio Grande	3,860	4,320	464
Upper Colorado	17,900	20,000	7,220
Lower Colorado	23,400	26,300	9,740
Great Basin	5,060	5,670	633
Pacific Northwest	1,260,000	1,410,000	140,000
California	140,000	157,000	47,000
Alaska	2,090	2,340	1,440
Hawaii	229	256	148
Caribbean	349	391	101
Total	3,160,000	3,540,000	310,000

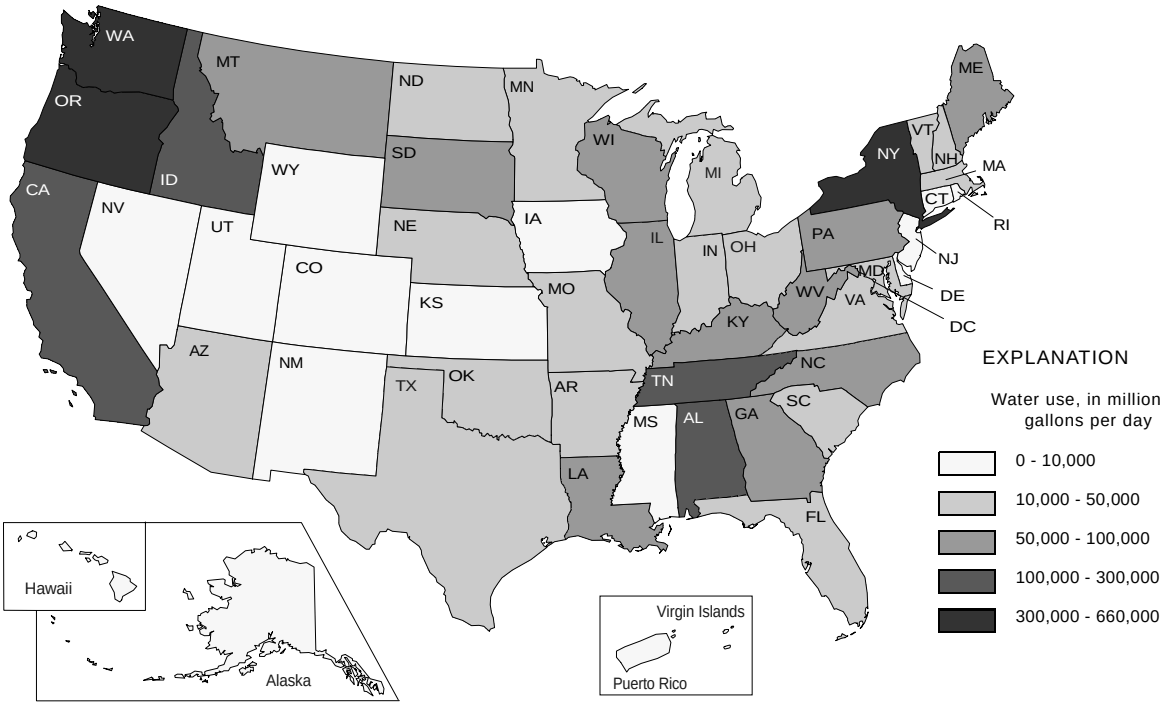

Figure 30. Hydroelectric power water use by State, 1995.

Table 28. Hydroelectric power water use by State, 1995

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day; kWh = kilowatthour]

STATE	WATER USE		POWER GENERATED, in million kWh
	Mgal/d	Thousand acre-feet per year	
Alabama	157,000	177,000	9,510
Alaska	2,090	2,340	1,440
Arizona	21,200	23,700	7,960
Arkansas	42,700	47,900	2,630
California	146,000	164,000	47,100
Colorado	6,810	7,630	2,140
Connecticut	3,610	4,050	317
Delaware	0	0	0
D.C.	0	0	0
Florida	16,900	19,000	443
Georgia	50,900	57,100	4,850
Hawaii	229	256	148
Idaho	115,000	129,000	11,300
Illinois	55,800	62,500	1,010
Indiana	12,300	13,800	467
Iowa	2,350	2,630	21
Kansas	1,250	1,410	11
Kentucky	83,000	93,100	2,880
Louisiana	76,100	85,400	1,110
Maine	85,200	95,500	3,440
Maryland	14,400	16,100	1,450
Massachusetts	24,200	27,100	992
Michigan	39,800	44,600	1,410
Minnesota	19,800	22,200	1,030
Mississippi	0	0	0
Missouri	17,100	19,200	1,920
Montana	66,200	74,200	10,400
Nebraska	15,000	16,800	1,040
Nevada	6,080	6,810	6,320
New Hampshire	33,000	37,000	1,460
New Jersey	309	346	241
New Mexico	2,750	3,090	353
New York	356,000	399,000	24,600
North Carolina	56,400	63,200	5,810
North Dakota	13,900	15,600	2,480
Ohio	14,200	15,900	227
Oklahoma	49,100	55,100	3,300
Oregon	456,000	511,000	40,400
Pennsylvania	55,900	62,600	352
Rhode Island	339	380	6.1
South Carolina	42,200	47,300	3,070
South Dakota	62,400	69,900	6,420
Tennessee	122,000	137,000	9,430
Texas	18,600	20,900	1,520
Utah	3,720	4,170	931
Vermont	17,500	19,600	983
Virginia	14,800	16,600	922
Washington	653,000	733,000	82,300
West Virginia	51,500	57,700	1,210
Wisconsin	50,800	57,000	1,600
Wyoming	5,150	5,770	793
Puerto Rico	349	391	101
Virgin Islands	0	0	0
Total	3,160,000	3,540,000	310,000