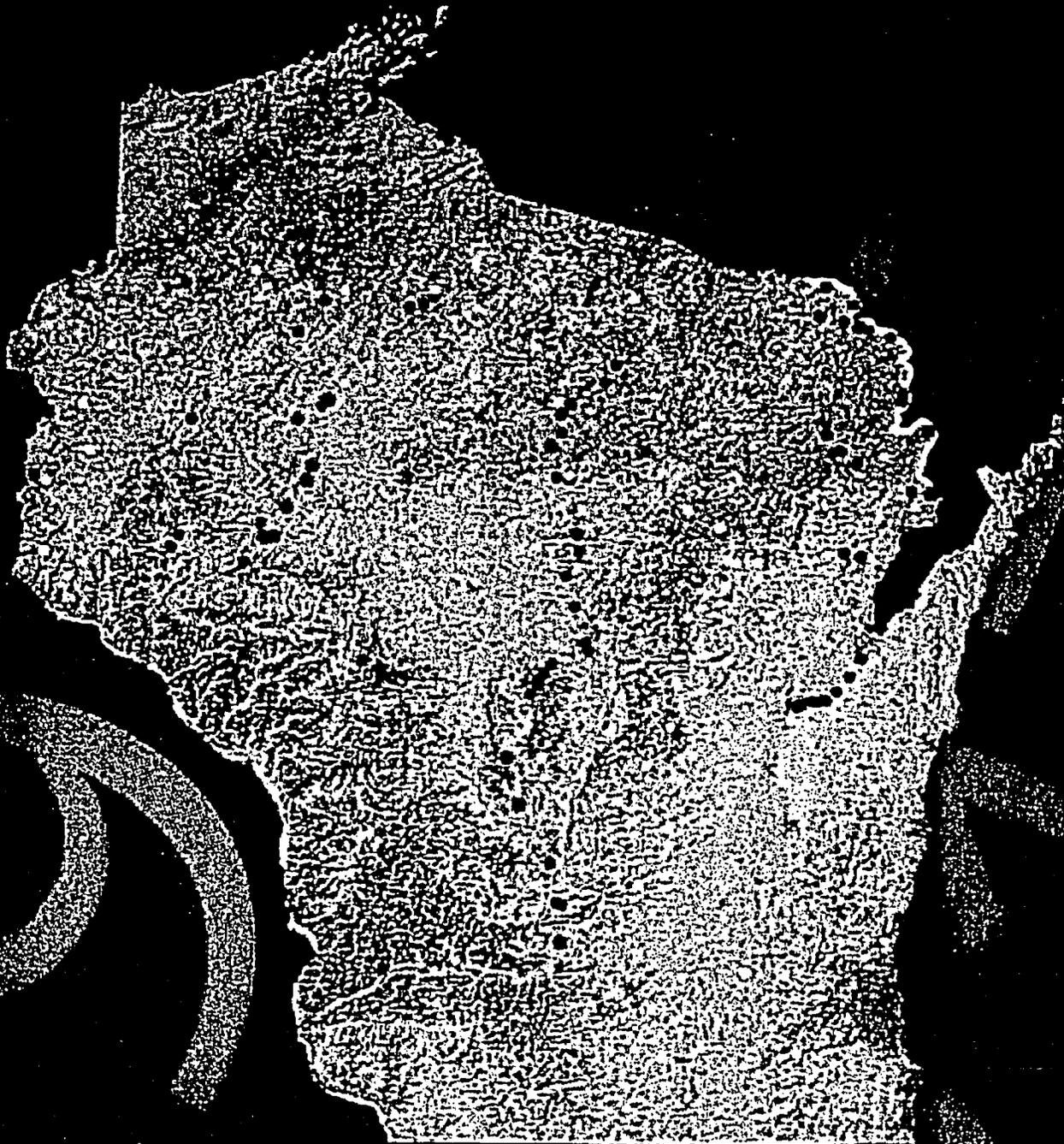


2003

Wisconsin Energy Statistics



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Wisconsin Energy Statistics

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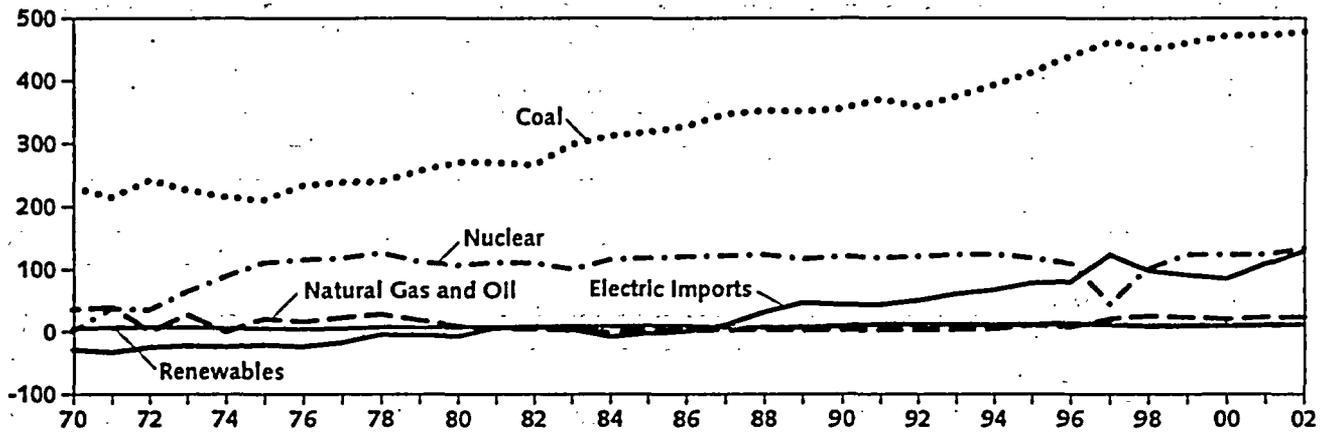
Wisconsin Department of Administration

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## Wisconsin Energy Use for Electricity Generation, in Btu, by Type of Fuel, 1970-2002

(Trillions of Btu and Percent of Total)

Energy use for electricity generation increased 5.1 percent in 2002. While electricity imports grew 18.8 percent, Wisconsin's three nuclear plants, Point Beach I and II and Kewaunee, set a record for electricity generation and nuclear fuel use because plant renovations reduced the time the plants were off-line for nuclear refueling. Energy used by independent power producers is included in this category.



Year	Petroleum	Natural Gas	Coal <sup>a</sup>	Renewables	Nuclear <sup>b</sup>	Electric Imports <sup>c</sup>	Total
1970	7.9 (3.2%)	31.1 (12.5%)	231.1 (92.6%)	6.0 (2.4%)	1.7 (0.7%)	(28.2) (-11.3%)	249.6
1975	7.8 (2.3)	19.8 (5.9)	210.5 (62.8)	6.3 (1.9)	111.2 (33.2)	(20.4) (-6.1)	335.2
1980	4.8 (1.2)	14.1 (3.5)	270.7 (68.0)	7.7 (1.9)	107.0 (26.9)	(6.5) (-1.6)	397.8
1985	1.4 (0.3)	1.4 (0.3)	317.7 (71.0)	10.4 (2.3)	118.6 (26.5)	(1.8) (-0.4)	447.7
1990	1.0 (0.2)	2.4 (0.4)	354.5 (66.4)	10.4 (2.0)	121.2 (22.7)	44.1 (8.3)	533.7
1995	0.8 (0.1)	10.1 (1.6)	412.4 (65.1)	13.0 (2.1)	118.5 (18.7)	78.6 (12.4)	633.4
1998	1.8 (0.3)	24.2 (3.5)	448.9 (65.5)	11.0 (1.6)	101.5 (14.8)	98.4 (14.3)	685.8
1999	2.0 (0.3)	22.1 (3.1)	459.6 (64.6)	12.2 (1.7)	124.1 (17.4)	91.6 (12.9)	711.7
2000	1.6 (0.2)	19.6 (2.7)	471.4 (65.9)	12.3 (1.7)	124.3 (17.4)	85.9 (12.0)	715.2
2001	1.3 (0.2)	22.6 (3.0)	471.8 (63.6)	13.3 (1.8)	124.3 (16.7)	108.8 (14.7)	742.1
2002 <sup>p</sup>	0.9 (0.1)	23.2 (3.0)	477.4 (61.2)	15.1 (1.9)	134.4 (17.2)	129.2 (16.6)	780.3

<sup>a</sup> Includes petroleum coke.

<sup>b</sup> Based on 10,800 Btu per kWh.

<sup>c</sup> Estimated assuming 11,300 Btu of resource energy per kWh imported into Wisconsin. Numbers in parentheses and negative percentages indicate resource energy used in Wisconsin to produce electricity that was exported.

<sup>p</sup> Preliminary estimates.

Source: Public Service Commission of Wisconsin, Accounts and Finance Division, *Statistics of Wisconsin Public Utilities*, Bulletin #8 (1970-1994); U.S. Department of Agriculture, Rural Electrification Administration, *Annual Statistical Report*, REA Bulletin 1-1 (1970-1995); Wisconsin Department of Natural Resources, Annual Survey of Point Source Emissions, unpublished (1971-1995); American Gas Association, *Gas Facts* (1970-1995); U.S. Department of Energy, Energy Information Administration, *Electric Power Monthly*, [DOE/EIA-0226(02/05)] (May 2002).

## Energy Use – Coal

# Wisconsin Electric Utility Coal Use, by Plant<sup>a</sup> 1975-2002 (Thousands of Tons)

Coal use by Wisconsin's electric utilities increased 1.2 percent in 2002 as Wisconsin's need for electricity increased. The two largest power plants, Pleasant Prairie and Columbia, used nearly 40 percent of the utility coal burned in Wisconsin.

Utility/Plant Name	1975	1980	1985	1990	1995	1997	1998	1999	2000	2001	2002
<b>Dairyland Power Cooperative</b>											
Alma	502	1,188	1,268	1,506	1,231	1,349	1,646	1,631	1,754	1,812	1,887
Genoa	801	915	914	680	788	1,077	731	946	928	937	942
Stoneman	111	74	44	30	0	0	0	0	0	0	0
<b>Madison Gas and Electric Co.</b>											
Blount Street	77	144	61	95	137	137	163	146	215	213	218
<b>Northern States Power Co.</b>											
Bay Front	52	100	36	45	30	86	69	76	115	137	142
<b>Wisconsin Public Service Corp.</b>											
Pulliam	753	744	489	674	1,130	1,405	1,469	1,444	1,444	1,445	1,503
Weston	239	329	1,275	1,555	1,702	1,965	2,008	1,965	1,972	1,970	1,987
<b>Wisconsin Electric Power Co.</b>											
Oak Creek	2,873	2,542	2,528	1,522	2,093	2,469	2,545	3,032	3,410	3,184	3,237
Pleasant Prairie	0	581	2,564	4,703	5,073	5,544	4,612	5,450	5,295	5,301	5,336
Port Washington	691	683	348	126	430	576	577	474	641	506	545
Valley	536	774	528	463	458	679	643	632	690	704	715
<b>Wisconsin Power and Light Co.</b>											
Blackhawk	24	30	8	0	0	0	0	0	0	0	0
Columbia	1,025	3,603	2,991	3,665	4,238	4,546	4,524	4,027	4,355	4,413	4,453
Edgewater	976	1,056	2,112	2,180	2,702	2,597	2,898	2,814	2,531	2,740	2,689
Nelson Dewey	512	552	541	497	615	669	577	566	580	584	576
Rock River	293	245	317	198	253	360	349	151	2	6	5
<b>Municipal Utilities</b>											
Manitowoc <sup>a</sup>	142	67	91	116	160	105	89	89	108	111	112
Marshfield	90	40	48	7	0	0	0	0	0	0	0
Menasha	58	28	25	25	2	7	4	7	10	9	8
Richland Center	21	20	20	0	0	0	0	0	0	0	0
<b>Total</b>	<b>9,776</b>	<b>13,715</b>	<b>16,208</b>	<b>18,087</b>	<b>21,042</b>	<b>23,571</b>	<b>22,904</b>	<b>23,450</b>	<b>24,050</b>	<b>24,072</b>	<b>24,355</b>

<sup>a</sup> Includes petroleum coke co-fired with coal.

Source: Wisconsin Department of Natural Resources, Annual Survey of Point Source Emissions, unpublished (1975-1994); annual reports of various Wisconsin electric generating utilities (1995-2001); U.S. Department of Energy, *Electric Power Monthly* [DOE/EIA-0226 (2003/04)](April 2003).

## Energy Use – Electricity

# Wisconsin Electric Utility Sales, by Economic Sector 1970-2002

(Millions of kWh and Percent of Total)

Total electricity sales grew 2.9 percent in 2002 and have grown 33.3 percent over the past ten years. In 2002, electricity sales to all sectors increased and over the past ten years electric sales have had an annual average growth rate of over 2.9 percent per year.

Year	Residential		Commercial <sup>a</sup>		Industrial		Agricultural		Total
1970	8,761	(35.4%)	5,738	(23.2%)	9,188	(37.2%)	1,028	(4.2%)	24,715
1975	10,893	(34.8)	8,452	(27.0)	10,721	(34.3)	1,210	(3.9)	31,276
1980	12,513	(33.2)	11,243	(29.8)	12,450	(33.0)	1,539	(4.1)	37,745
1985	13,257	(31.8)	12,783	(30.6)	13,940	(33.4)	1,745	(4.2)	41,725
1990 <sup>b</sup>	14,670	(29.8)	15,808	(32.1)	17,005	(34.6)	1,715	(3.5)	49,198
1991	15,614	(30.6)	16,397	(32.1)	17,286	(33.9)	1,735	(3.4)	51,032
1992	14,860	(29.2)	16,328	(32.1)	17,982	(35.3)	1,755	(3.4)	50,925
1993	15,598	(29.3)	16,773	(31.6)	19,010	(35.8)	1,775	(3.3)	53,156
1994	15,865	(28.6)	17,438	(31.5)	20,314	(36.7)	1,795	(3.2)	55,412
1995	16,820	(29.0)	18,042	(31.1)	21,290	(36.7)	1,815	(3.1)	57,967
1996	16,850	(28.7)	18,588	(31.6)	21,471	(36.6)	1,835	(3.1)	58,744
1997	16,655	(27.7)	18,881	(31.4)	22,703	(37.8)	1,855	(3.1)	60,094
1998	17,212	(27.7)	19,334	(31.2)	23,640	(38.1)	1,875	(3.0)	62,061
1999	17,607	(27.7)	20,781	(32.7)	23,264	(36.6)	1,895	(3.0)	63,547
2000	17,839	(27.6)	21,407	(33.1)	23,528	(36.4)	1,915	(3.0)	64,689
2001	18,605	(28.2)	21,614	(32.8)	23,823	(36.1)	1,935	(2.9)	65,977
2002 <sup>c</sup>	19,862	(29.3)	22,124	(32.6)	23,931	(35.3)	1,955	(2.9)	67,872

<sup>a</sup> Includes sales to public authorities (including sales for street and highway lighting) and utility company interdepartmental sales (for example, from electric to gas department of a combined utility).

<sup>b</sup> Beginning in 1989, U.S. DOE data sources have been used.

<sup>c</sup> Preliminary estimates.

Source: Sectoral disaggregation by Wisconsin Department of Administration, Division of Energy, based on Public Service Commission of Wisconsin, *Statistics of Wisconsin Public Utilities*, Bulletin #8 (1970-1994); U.S. Department of Agriculture, Rural Electrification Administration, *Annual Statistical Report*, REA Bulletin 1-1 (1970-1994); U.S. Department of Energy, *Electric Sales and Revenue 1989-1999* [DOE/EIA-0540 (99)] (October 2000), and *Electric Power Monthly* [DOE/EIA-0226 (2002/03)] (March 2003).

## Energy Use – Electricity

### Eastern Wisconsin Electric Utility Power Load and Non-Coincident Peak Demand<sup>a,b</sup> 1970-2002

Wisconsin's 2002 summer peak electricity demand for the eastern Wisconsin utilities decreased 2.1 percent due to milder summer weather. The decrease compared to 2001 was 244 megawatts. Winter peak demand increased in 2002 due to colder December weather. Summer peak demand in 2002 exceeded winter peak demand by 2,484 megawatts.

Year	Load <sup>c</sup> (Millions of kWh)	Peak Demand <sup>b</sup>		Load Factor <sup>c</sup> (Percent)
		Summer (MW)	Winter (MW)	
1970	22,818	4,125	3,964	63.1
1975	28,616	5,314	4,903	61.5
1980	34,836	6,009	5,525	66.0
1985	39,325	6,464	6,166	69.4
1990 <sup>d</sup>	47,381	8,326	7,210	65.0
1991	49,749	8,731	7,368	65.0
1992	49,441	8,399	7,399	67.0
1993	51,459	8,767	7,869	67.0
1994	53,777	9,052	7,819	67.8
1995	55,821	9,833	8,275	64.8
1996	58,408	9,061	8,285	73.4
1997	59,946	9,313	8,302	73.5
1998	59,563	10,099	8,644	67.3
1999	61,990	10,756	8,977	65.8
2000	64,084	10,814	9,152	67.6
2001	61,701	11,645	8,440	60.5
2002 <sup>e</sup>	67,698	11,401	8,917	67.8

<sup>a</sup> Wisconsin Electric Power Co., Wisconsin Power and Light Co., Wisconsin Public Service Corp., and Madison Gas and Electric Co.

<sup>b</sup> Non-coincident peak demand is the sum of the individual monthly peak electric demands from the four utilities listed above.

<sup>c</sup> Load Factor =  $\frac{\text{Annual Energy Demand (kWh)}}{\text{Peak Demand (kW)} \times 8,760 \text{ (hours/year)}}$

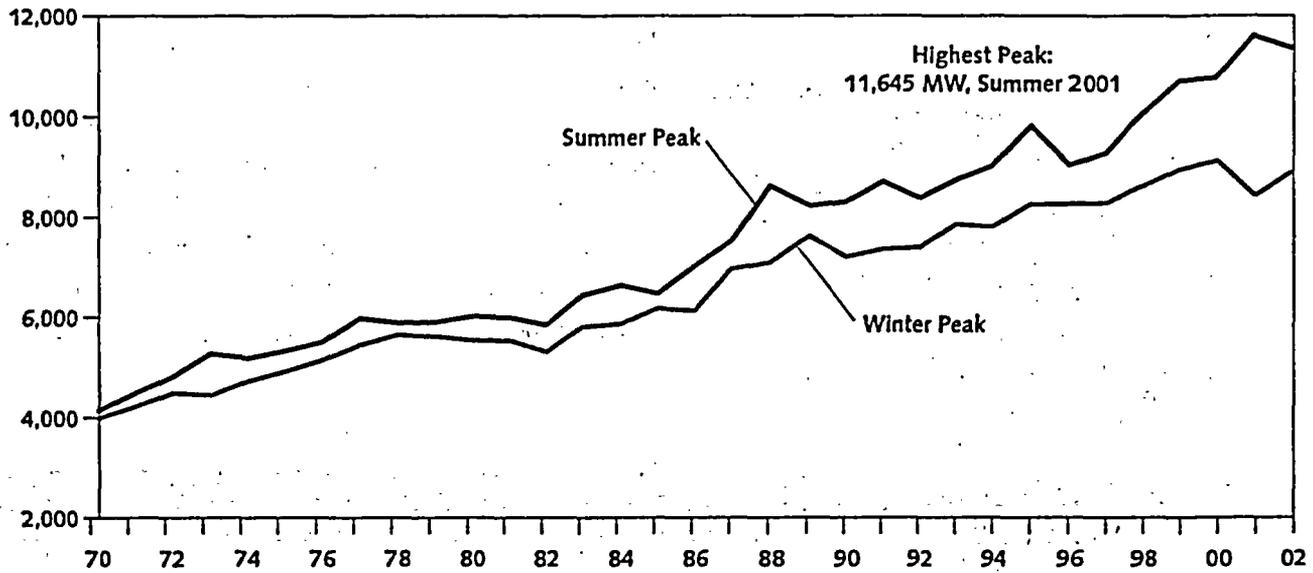
<sup>d</sup> Beginning in January 1988, data includes Wisconsin Electric Power Co. generation from Presque Isle, Michigan.

<sup>e</sup> Preliminary estimates.

<sup>f</sup> Revised.

Source: Wisconsin electric utility annual reports submitted to the Public Service Commission of Wisconsin (1970-2002); personal communication.

## Eastern Wisconsin Electric Utility Non-Coincident Peak Demand<sup>a,b</sup> 1970-2002 (Megawatts)



## Eastern Wisconsin Electric Utility Power Load and Non-Coincident Peak Demand, by Month<sup>a,b</sup> 2002

Month	Load (Millions of kWh)	Non-Coincident Peak Demand (MW) <sup>b</sup>
January	5,040	8,406
February	4,951	8,178
March	5,158	8,290
April	5,078	8,157
May	5,438	8,737
June	5,857	10,837
July	6,802	11,401
August	6,488	11,386
September	5,946	11,085
October	5,677	8,680
November	5,469	8,359
December	5,794	8,917
<b>Total</b>	<b>67,698</b>	

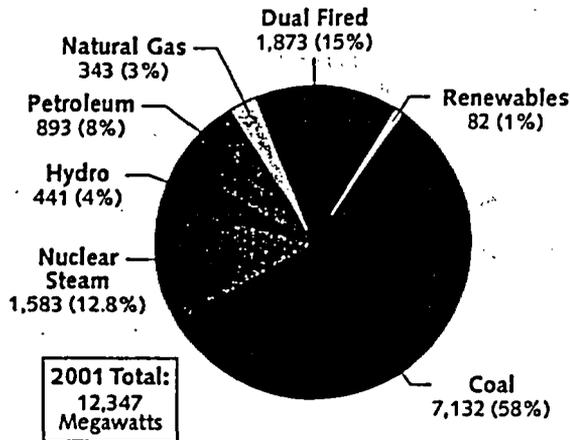
<sup>a</sup> Wisconsin Electric Power Co., Wisconsin Power and Light Co., Wisconsin Public Service Corp., and Madison Gas and Electric Co.

<sup>b</sup> Non-coincident peak demand is the sum of the individual monthly peak electric demands from the four utilities listed above for each month.

Source: Wisconsin electric utility annual reports submitted to the Public Service Commission of Wisconsin (2002).

# Wisconsin Electric Utility Generating Capacity, by Type of Plant 1970-2001

(Megawatts and Percent of Total)



In 2001, Wisconsin's electric utility generating capacity increased 137 MW, or 1.1 percent. In all, 79 MW of coal capacity were transferred to electric utilities, along with small changes in hydro and renewable capacity. Over the past four years, 276 megawatts of gas turbine capacity has been added. Fossil fuel steam generating capacity had been declining since 1985 due to small coal plant retirements. The Wisconsin system provides about 2.2 kW of capacity per capita.

Year	Coal <sup>b</sup> (MW)	Nuclear Steam (MW)	Hydro (MW)	Petroleum (MW)	Natural Gas (MW)	Dual Fired (MW)	Renewables (MW)	Total <sup>a</sup> (MW)
1990	7,455 (67.4)	1,583 (14.3)	447 (4.0)	836 (7.6)	110 (1.0)	538 (4.9)	97 (0.9)	11,066
1991	7,297 (67.1)	1,583 (14.5)	445 (4.1)	836 (7.7)	97 (0.9)	526 (4.8)	97 (0.9)	10,881
1992	7,297 (67.0)	1,583 (14.5)	445 (4.1)	836 (7.7)	110 (1.0)	526 (4.8)	97 (0.9)	10,894
1993	7,282 (65.3)	1,583 (14.2)	445 (4.0)	836 (7.5)	110 (1.0)	804 (7.2)	97 (0.9)	11,157
1994	7,219 (62.5)	1,583 (13.7)	445 (3.9)	835 (7.2)	104 (0.9)	1,262 (10.9)	97 (0.8)	11,545
1995	7,169 (60.5)	1,583 (13.4)	445 (3.8)	844 (7.1)	79 (0.7)	1,623 (13.7)	97 (0.8)	11,840
1996	7,209 (60.1)	1,583 (13.2)	495 (4.1)	854 (7.1)	80 (0.7)	1,705 (14.2)	61 (0.5)	11,987
1997	7,194 (60.2)	1,583 (13.2)	452 (3.8)	890 (7.4)	67 (0.6)	1,705 (14.3)	61 (0.5)	11,952
1998	7,053 (59.0)	1,583 (13.2)	433 (3.6)	894 (7.5)	217 (1.8)	1,717 (14.4)	61 (0.5)	11,958
1999	7,053 (58.6)	1,583 (13.2)	455 (3.8)	898 (7.5)	217 (1.8)	1,747 (14.5)	81 (0.7)	12,034
2000	7,053 (57.8)	1,583 (13.0)	453 (3.7)	906 (7.4)	272 (2.2)	1,861 (15.2)	82 (0.7)	12,210
2001 <sup>p</sup>	7,132 (57.8)	1,583 (12.8)	441 (3.6)	893 (7.2)	343 (2.8)	1,873 (15.2)	82 (0.7)	12,347

<sup>a</sup> Does not include industrial generating capacity or non-utility generators. Capacity is as of December 31 of each year.

<sup>b</sup> Generating capacity designed to use coal, but in some cases the coal may be supplemented by wood, RDF and tires.

<sup>p</sup> Preliminary estimates.

Sources: Energy Information Administration, *Electric Power Annual*, [DOE/EIA-0348(2001)](March 2003), [http://www.eia.doe.gov/cneal/electricity/epa/epa\\_sprdshts.html](http://www.eia.doe.gov/cneal/electricity/epa/epa_sprdshts.html).

# Wisconsin Electric Utility Power Generation, by Type of Plant 1970-2002

(Millions of kWh and Percent of Total)

Total electric generation by Wisconsin utilities decreased 0.3 percent in 2002. Increased electric generation by independent power producers (IPP) and increased imports of electricity were needed to satisfy the 2.9 percent increase in demand for electricity. Fossil fuel steam generation plants continue to provide the majority of Wisconsin's electricity. Primarily, these plants are fueled by coal, but they also burn wood, natural gas and petroleum. Due to improvements at the Point Beach I and II and Kewaunee nuclear facilities, nuclear generation is at peak output. Gas turbine generation continues to help meet summer peak demand requirements.

Year	Utility Electric Generation					IPP <sup>b</sup>			Total Sales
	Fossil Fuel Steam	Nuclear Steam	Hydro	Turbine & Reciprocating	Total	Total	Imports & Losses <sup>c</sup>		
1970	25,253 (92.8%)	155 (0.6%)	1,413 (5.2%)	390 (1.4%)	27,211	0	-2,496	24,715	
1975	20,615 (62.3)	10,292 (31.1)	1,483 (4.5)	691 (2.1)	33,081	0	-1,805	31,276	
1980	26,383 (68.9)	9,912 (25.9)	1,628 (4.2)	393 (1.0)	38,316	0	-571	37,745	
1985	28,840 (68.9)	10,978 (26.2)	2,046 (4.9)	20 (0.0)	41,884	0	-159	41,725	
1990	32,500 (71.8)	11,224 (24.8)	1,525 (3.4)	43 (0.1)	45,292	0	3,906	49,198	
1991 <sup>a</sup>	33,816 (71.7)	10,991 (23.3)	2,270 (4.8)	71 (0.2)	47,148	0	3,884	51,032	
1992	33,117 (71.3)	11,207 (24.1)	2,123 (4.6)	17 (0.0)	46,464	0	4,461	50,925	
1993	34,062 (71.3)	11,465 (24.0)	2,191 (4.6)	45 (0.1)	47,763	0	5,393	53,156	
1994	35,827 (72.5)	11,516 (23.3)	1,914 (3.9)	180 (0.4)	49,437	0	5,975	55,412	
1995	37,456 (73.4)	10,970 (21.5)	2,097 (4.1)	489 (1.0)	51,012	0	6,955	57,967	
1996	38,777 (75.1)	10,121 (19.6)	2,402 (4.7)	351 (0.7)	51,651	0	7,093	58,744	
1997	41,558 (85.6)	3,916 (8.1)	2,182 (4.5)	905 (1.9)	48,561	640	10,893	60,094	
1998	40,686 (77.5)	9,397 (17.9)	1,518 (2.9)	929 (1.8)	52,530	827	8,704	62,061	
1999	40,570 (74.2)	11,495 (21.0)	1,734 (3.2)	905 (1.7)	54,704	735	8,108	63,547	
2000	41,512 (74.6)	11,512 (20.7)	1,749 (3.1)	895 (1.6)	55,668	1,420	7,601	64,689	
2001	40,654 (74.0)	11,507 (20.9)	1,888 (3.4)	910 (1.7)	54,959	1,389	9,629	65,977	
2002 <sup>p</sup>	39,098 (71.4)	12,449 (22.7)	2,306 (4.2)	915 (1.7)	54,768	1,667	11,437	67,872	

a Beginning in 1991, the U.S. DOE data source has been used.

b IPPs are independent power producers. Currently, these IPPs have contracted to sell almost all the power they produce to Wisconsin utilities, for end-use sale in Wisconsin. The primary fuel used by IPPs is natural gas; however, small amounts of coal, oil, wind and biogas are also used.

c A negative sign indicates Wisconsin utilities exported electric power to other states.

p Preliminary estimates.

Source: Public Service Commission of Wisconsin, Accounts and Finance Division, *Generating Plants Operated by Wisconsin Electric Utilities*, Bulletin #46 (1971-1994) and personal communications 2002; U.S. Department of Agriculture, Rural Electrification Administration, *Annual Statistical Report*, REA Bulletin 1-1 (1971-1994); U.S. Department of Energy, Energy Information Administration, *Electric Power Annual*, [DOE/EIA-0348(99)/1] (August 2001), and *Electric Power Monthly*, [DOE/EIA-0226 (2002/03)] (March 2003).

## Energy Use – Electricity

### Wisconsin Electric Utility Fuel Costs of Power Generation, by Type of Plant, 1970-2002 (Cents Per kWh)

In this table only the cost of fuel per kilowatt-hour of generation is reported. The table on the next page includes all costs of generation. Hydroelectric plants are not included here since they have no associated fuel costs. The fuel costs for all plants have decreased nearly 37 percent since the peak of 1.77cents per kWh in 1983.

Year	Fossil Fuel Steam	Nuclear Steam	Internal Combustion*	All Plants
1970	0.43	0.16	0.75	0.44
1975	1.01	0.36	1.47	0.75
1980	1.72	0.50	3.58	1.40
1985	2.02	0.61	6.76	1.60
1990 <sup>†</sup>	1.61	0.52	4.50	1.27
1991 <sup>†</sup>	1.62	0.49	5.10	1.28
1992 <sup>†</sup>	1.55	0.43	3.93	1.21
1993 <sup>†</sup>	1.45	0.43	5.92	1.14
1994 <sup>†</sup>	1.40	0.45	4.80	1.14
1995 <sup>†</sup>	1.33	0.48	3.62	1.12
1996 <sup>†</sup>	1.26	0.49	3.15	1.07
1997 <sup>†</sup>	1.28	0.50	4.30	1.22
1998 <sup>†</sup>	1.25	0.52	3.76	1.13
1999 <sup>†</sup>	1.21	0.53	3.70	1.07
2000 <sup>†</sup>	1.24	0.52	6.41	1.14
2001 <sup>†</sup>	1.27	0.54	6.36	1.15
2002 <sup>†</sup>	1.31	0.50	4.61	1.12

\* Internal combustion includes both gas powered turbines and diesel powered engines.

† Estimate by Wisconsin Department of Administration, Division of Energy.

† Revised based on amount of generation by the five major Wisconsin utilities.

Source: Public Service Commission of Wisconsin, Accounts and Finance Division, *Generating Plants Operated by Wisconsin Electric Utilities*, Bulletin #46 (1971-1994).

## Wisconsin Electric Utility Total Costs of Power Generation, by Type of Plant and Cost of Purchase Power, 1970-2002 (Cents Per kWh)

This table shows the total cost of generating one kWh of electricity by various technologies in Wisconsin's electric utility plants. The average cost of power at all plants has decreased 11 percent since it peaked in 1983 at 2.21 cents per Kwh. The cost of purchased power has risen in recent years.

Year	Fossil Fuel Steam	Nuclear Steam	Internal Combustion <sup>a</sup>	Hydro	All Plants	Purchased Power	Average Cost
1970	0.55	0.29	1.76	0.27	0.53	NA	NA
1975	1.25	0.51	2.73	0.32	0.97	NA	NA
1980	2.13	0.86	5.74	0.52	1.72	NA	NA
1985	2.55	1.32	19.12	0.61	2.09	NA	NA
1990 <sup>e,f</sup>	2.13	1.50	10.87	1.00	1.94	2.22	1.99
1991 <sup>e,f</sup>	2.14	1.74	11.99	0.84	2.00	2.42	2.07
1992 <sup>e,f</sup>	2.12	1.71	23.02	0.92	1.98	2.32	2.05
1993 <sup>e,f</sup>	2.04	1.65	14.72	0.82	1.91	2.15	1.96
1994 <sup>e,f</sup>	1.88	1.58	7.53	0.90	1.80	2.21	1.88
1995 <sup>e,f</sup>	1.80	1.63	4.71	0.71	1.75	2.17	1.83
1996 <sup>e,f</sup>	1.68	1.73	4.69	0.64	1.67	2.15	1.77
1997 <sup>e,f</sup>	1.68	4.37	5.09	0.69	1.94	2.27	2.04
1998 <sup>e,f</sup>	1.68	2.83	4.70	1.02	1.94	2.67	2.11
1999 <sup>e,f</sup>	1.68	2.03	4.83	0.87	1.79	2.96	2.05
2000 <sup>e,f</sup>	1.75	2.16	7.73	0.86	1.91	3.36	2.24
2001 <sup>e,f</sup>	1.76	2.37	7.63	0.90	1.95	3.90	2.41
2002 <sup>e,f</sup>	1.87	2.18	6.09	0.75	1.97	3.64	2.40

<sup>a</sup> Internal combustion includes both gas powered turbines and diesel powered engines.

<sup>e</sup> Estimate by Wisconsin Department of Administration, Division of Energy.

<sup>f</sup> Revised based on amount of generation by the five major Wisconsin utilities.

NA – Not Available

Source: Public Service Commission of Wisconsin, Accounts and Finance Division, *Generating Plants Operated by Wisconsin Electric Utilities*, Bulletin #46 (1971-1994).

## Energy Use – Electricity

# Wisconsin Utility Power Plant Inventory, 2002<sup>a</sup>

Utility/Site	Nameplate Capacity (MW)	Number of Units	Primary Fuel
<b>Dairyland Power Cooperative</b>			
Alma 1-3	45.0	3	Coal
Alma 4,5	130.0	2	Coal
J.P. Madgett	387.0	1	Coal
Flambeau	15.0	3	Hydro <sup>b</sup>
Genoa 3	345.6	1	Coal
<b>Madison Gas and Electric Co.</b>			
Blount Street 1,3,4,5,6,7	187.5	6	Coal/RDF <sup>c</sup>
Fitchburg 1,2	57.6	2	Gas
Nine Springs	16.2	1	Gas
Sycamore	41.6	2	Gas
Rosiere	11.2	17	Wind
<b>Northern States Power Co.</b>			
Bay Front 4,5,6	68.0	3	Wood/Coal
Flambeau	16.0	1	Gas
French Island 1,2	31.3	2	Wood/RDF <sup>c</sup>
French Island 3,4	157.6	2	Oil
Wheaton 1-6	322.0	6	Oil
Various Hydro	237.4	62	Hydro <sup>b</sup>
<b>Wisconsin Electric Power Co.</b>			
Concord	381.6	4	Gas
Germantown 1,2,3,4	244.8	4	Oil
Germantown 5	85.4	1	Gas
Milwaukee	11.0	1	Coal
Kenosha (Paris)	381.6	4	Gas
S. Oak Creek 5-8	1191.6	4	Coal
S. Oak Creek 9	19.6	1	Gas
Pleasant Prairie 1,2	1233.2	2	Coal
Pleasant Prairie 3	2.0	1	Oil
Point Beach 1,2	1047.6	2	Nuclear
Point Beach 5	25.0	1	Oil
Port Washington 1-4	320.0	4	Coal
Port Washington 6	19.6	1	Oil
Valley 1,2	272.0	2	Coal
Valley 3	2.8	1	Oil
Various Hydro	5.5	5	Hydro <sup>b</sup>
Byron	1.3	2	Wind

<sup>a</sup> Does not include non-utility generation.

<sup>b</sup> Hydroelectric capacity differs from sum on other tables due to different definitions of capacity in data sources.

<sup>c</sup> RDF is Refuse Derived Fuel.

<sup>d</sup> The Kewaunee unit is owned by Wisconsin Public Service Corp. (59%) and Alliant Energy (41.0%).

<sup>e</sup> The West Marinette 33 unit is jointly owned by Wisconsin Public Service Corp. (68%) and the City of Marshfield (32%).

Utility/Site	Nameplate Capacity (MW)	Number of Units	Primary Fuel
<b>Wisconsin Public Service Corp.</b>			
Kewaunee <sup>d</sup>	535.0	1	Nuclear
Pulliam 3-5	110.0	3	Coal
Pulliam 6-8	262.5	3	Coal
Weston 1-3	456.6	3	Coal
Weston 31,32	72.5	2	Gas
W. Marinette 31,32,33 <sup>e</sup>	167.3	3	Gas
Oneida Casino	4.0	2	Oil
Eagle River	4.0	2	Oil
Various Hydro	57.4	38	Hydro <sup>b</sup>
Glenmore	1.2	2	Wind
Lincoln	9.2	14	Wind
<b>Wisconsin Power and Light Co.</b>			
Blackhawk 3,4	50.0	2	Gas
Columbia 1 <sup>f</sup>	512.0	1	Coal
Columbia 2 <sup>f</sup>	511.0	1	Coal
Edgewater 3	60.0	1	Coal
Edgewater 4 <sup>g</sup>	330.0	1	Coal
Edgewater 5 <sup>h</sup>	380.0	1	Coal
Fond du Lac	344.0	4	Gas
Nelson Dewey 1,2	200.0	2	Coal
Portable	0.5	1	Oil
Rock River 1,2	150.0	2	Coal
Rock River 3-6	144.0	4	Oil
Sheepskin	40.0	1	Gas
Various Hydro	37.5	13	Hydro <sup>b</sup>
<b>Municipal Utilities</b>			
Manitowoc, City of	10.5	2	Gas
	79.0	5	Coal/RDF <sup>c</sup>
	24.5	1	Gas
Menasha, City of	1.0	1	Oil
	21.2	2	Coal
<b>Other Municipal Utilities and Power Cooperatives</b>			
	99.7	95	Hydro <sup>b</sup>
	25.0	5	Gas
	105.5	78	Oil

<sup>f</sup> The Columbia 1 & 2 units are owned by Alliant Energy (46.2%), Wisconsin Public Service Corp. (31.8%) and Madison Gas & Electric Co.(22.0%).

<sup>g</sup> The Edgewater 4 unit is owned by Alliant Energy (68.2%) and Wisconsin Public Service Corp.(31.8%).

<sup>h</sup> The Edgewater 5 unit is owned by Alliant Energy (75%) and Wisconsin Electric Power Co.(25%).

Source: U.S. Department of Energy, Energy Information Administration, *Inventory of Power Plants in the United States*, [DOE/EIA-0095(2000/1)] (March 2001); annual reports of various electric generating utilities (2002).

# 4

## Renewable Energy

Renewable energy resources play a key role in Wisconsin's efforts to reduce dependence on imported fuels. Renewable resource use in Wisconsin is dominated by wood burning for space and process heat, primarily in homes and industry. In 2002, the residential and industrial sectors accounted for 49.3 percent and 42.6 percent, respectively, of the wood burned. About two million cords of wood are burned for energy in the state each year. Wood energy use increased 0.7 percent in 2002 primarily due to increased wood burned in homes for heating. Industrial wood use grew slightly. However, electric utility wood use decreased, primarily because Northern States Power decreased power production from its Bay Front and French Island generating plants, which rely on wood for a significant amount of their electricity generating fuel.

Hydroelectric power currently ranks second as a renewable energy source in Wisconsin. Hydroelectric power production comes from approximately 72 utility and about 50 privately owned sites; production is closely tied to annual rainfall. Historic data on state average rainfall is provided to help gauge the importance of rainfall in the state's overall energy patterns.

Biogas is produced from the state's landfills and wastewater treatment plants that have installed collection and conversion equipment. Bio-solid waste is derived from pre- and post-commercial waste used as fuel, such as waste from paper mills.

Ethanol, a renewable energy source primarily made from corn, is used as the oxygenate in reformulated gasoline sold in southeastern Wisconsin and is also used as an octane booster in a portion of conventional gasoline sold in Wisconsin. In 2002, Wisconsin's use of ethanol in motor fuel increased 2.7 percent to 88.2 million gallons. However, since 1994, ethanol use has jumped by 461 percent. The reason for the dramatic jump is that starting in 1995, the federal government mandated the sale of reformulated gasoline (RFG) in six southeastern Wisconsin counties to improve air quality. In 2002, all of the RFG sold in the state (674 million gallons) used ethanol as the oxygenate.

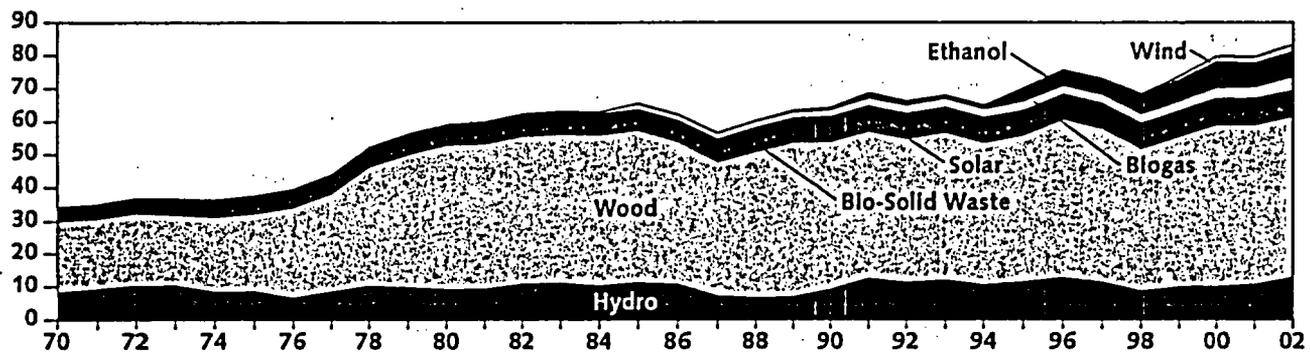
Installation of passive and active solar systems in Wisconsin remains slow compared to the early 1980s. However, in the future, it is anticipated that increased use of passive solar technologies for heating and daylighting will occur.

In 2002, Wisconsin utilities operated 55 large wind turbines at five sites in Wisconsin. These utility-scale wind turbines, along with smaller, individually owned wind turbines, generated 109.2 million kWh. For perspective, the electricity generated by wind is just 3.6 percent of the electricity generated by utilities from hydro in Wisconsin in 2002, or enough electricity to meet the needs of 12,141 average Wisconsin households in 2002. While the amount of generation is small, utility electricity generated by wind is a growing reality in Wisconsin and increased over 55 percent in 2002.

## Renewable Energy

# Wisconsin Renewable Energy Use, by Type of Fuel, 1970-2002 (Trillions of Btu)

Renewable energy use in Wisconsin increased 4.6 percent in 2002 primarily because of increased hydro generation of electricity. Over the past ten years, various industries have been increasing their use of alternative fuels in industrial boilers, and landfill gas collection systems are increasing production. The solar energy listing here includes both active solar collectors and estimated passive solar applications. Hydro generation includes electricity generation by Wisconsin utilities and estimates of privately owned dams. In 2002, ethanol use in the transportation sector increased 2.7 percent. While still small, the use of wind energy continues to significantly increase each year.



Year	Hydro	Wood	Bio-Solid Waste <sup>a</sup>	Solar	Biogas	Ethanol <sup>b</sup>	Wind	Total
1970	8.2	22.1	1.0	2.9	0.1	0.0	0.0	34.3
1975	8.6	23.9	2.0	3.1	0.2	0.0	0.0	37.8
1980	9.3	43.9	2.4	3.3	0.5	0.0	0.0	59.5
1985	11.4	46.2	2.9	3.5	1.6	0.1	0.0	65.8
1990	9.2	44.9	3.9	3.7	2.1	0.7	0.0	64.5
1991	12.6	44.7	3.9	3.8	2.3	1.7	0.0	69.0
1992	11.4	43.6	3.9	3.8	2.5	1.4	0.0	66.6
1993	12.1	44.9	3.8	3.8	2.6	1.1	0.0	68.3
1994	10.6	43.2	3.8	3.9	2.6	1.1	0.0	65.1
1995	11.5	44.6	3.6	3.9	2.8	4.1	0.0	70.5
1996	12.8	48.2	3.6	3.9	2.7	4.8	0.0	76.0
1997	11.5	46.7	3.7	3.9	2.7	4.9	0.0	73.5
1998	8.7	43.3	3.7	4.0	2.9	6.0	0.0	68.6
1999	10.0	45.7	3.9	4.0	2.9	6.4	0.2	73.0
2000	10.1	49.1	3.9	4.1	3.3	7.9	0.5	78.9
2001	10.8	48.5	3.9	4.1	3.5	7.3	0.7	78.8
2002 <sup>p</sup>	12.9	48.9	3.7	4.1	4.3	7.4	1.1	82.4

<sup>a</sup> Includes municipal and industrial solid waste.

<sup>b</sup> Ethanol is blended with a petroleum based fuel to produce reformulated gasoline or gasohol.

<sup>p</sup> Preliminary estimates.

Source: Compiled from tables in this publication for Wisconsin wood and hydro and unpublished administrative data (2002).

## Renewable Energy

# Wisconsin Wood Use, by Economic Sector 1970-2002

(Trillions of Btu and Percent of Total)

Wood energy use in Wisconsin increased 0.7 percent in 2002, primarily because wood energy use in the residential sector increased 1.7 percent. This increased wood use was driven by a colder winter and higher residential oil, propane and natural gas prices.

Year	Residential <sup>a</sup>	Commercial	Industrial	Electric Utility	Total
1970	11.9 (53.8%)	0.2 (0.9%)	10.0 (45.2%)	0.0 (0.0%)	22.1
1975	11.8 (49.3)	0.2 (0.8)	11.9 (49.8)	0.0 (0.0)	23.9
1980	26.9 (61.2)	0.6 (1.4)	15.7 (35.7)	0.7 (1.7)	43.9
1985	26.1 (56.5)	0.8 (1.7)	17.6 (38.2)	1.7 (3.6)	46.2
1990	21.1 (47.0)	0.7 (1.6)	20.0 (44.6)	3.1 (6.9)	44.9
1991	21.7 (48.5)	0.7 (1.6)	19.3 (43.1)	3.1 (6.8)	44.7
1992	21.5 (49.4)	0.7 (1.6)	18.3 (41.9)	3.1 (7.2)	43.6
1993	22.2 (49.4)	0.7 (1.6)	18.6 (41.4)	3.4 (7.6)	44.9
1994	21.0 (48.6)	0.7 (1.6)	18.0 (41.7)	3.5 (8.1)	43.2
1995	21.9 (49.1)	0.7 (1.6)	18.5 (41.5)	3.5 (7.9)	44.6
1996	24.6 (51.0)	0.7 (1.5)	19.1 (39.5)	3.8 (8.0)	48.2
1997	23.3 (49.9)	0.7 (1.5)	19.4 (41.5)	3.3 (7.1)	46.7
1998	19.0 (43.9)	0.7 (1.6)	19.8 (45.6)	3.9 (8.9)	43.3
1999	21.2 (46.3)	0.7 (1.5)	20.1 (43.9)	3.8 (8.2)	45.7
2000	24.6 (50.1)	0.7 (1.4)	20.4 (41.5)	3.4 (7.0)	49.1
2001	23.7 (48.8)	0.7 (1.4)	20.7 (42.5)	3.5 (7.2)	48.5
2002 <sup>p</sup>	24.1 (49.3)	0.7 (1.4)	20.8 (42.6)	3.3 (6.7)	48.9

<sup>a</sup> Revised.

<sup>p</sup> Preliminary estimates.

Source: U.S. Department of Energy, Energy Information Administration, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981* (August 1983); Wisconsin Department of Natural Resources, *Annual Survey of Point Source Emissions*, unpublished (1972-1994); USDA Forest Service, *Residential Fuelwood Consumption and Production in Wisconsin* (1994); Wisconsin Department of Administration, Division of Energy, "Wisconsin Residential Wood Energy Model," unpublished (2002), and *Directory of Wisconsin Wood Burning Facilities* (1995).

## Wisconsin Electric Utility Use of Wood Fuel 1970-2002

Wood energy used for electricity in Wisconsin decreased slightly in 2002 when Northern States Power Co. decreased generation at its Bay Front and French Island plants. Northern States Power Co. began using wood fuel at its Bay Front electric generation facility in 1976 and at its French Island facility in 1980. These are the only electric utility generation sites in Wisconsin using significant amounts of wood.

Year	Tons	Billions of Btu
1970-1975	0	0
1980	76,282	740
1985	155,717	1,666
1990	299,464	3,112
1991	296,197	3,061
1992	297,436	3,115
1993	307,478	3,399
1994	379,106	3,536
1995	327,201	3,506
1996	339,803	3,837
1997	304,618	3,326
1998	334,231	3,871
1999	330,491	3,765
2000	296,739	3,430
2001	301,580	3,484
2002 <sup>P</sup>	283,774	3,260

<sup>P</sup> Preliminary estimates.

Source: Wisconsin Department of Natural Resources, Annual Survey of Point Source Emissions, unpublished (1972-1994); annual reports of various Wisconsin electric generating utilities (1995-2002).

## Wisconsin Electric Utility and Non-Utility Hydroelectric Generation<sup>a</sup>, 1970-2002

(Millions of kWh)

Total Wisconsin electric utility hydroelectric production increased 22.1 percent in 2002. While statewide average precipitation decreased 0.8 percent, to 35.2 inches, precipitation in northern Wisconsin, where it is more critical for hydroelectric generation, increased 12.2 percent to 38 inches in 2002.

Year	Wisconsin Owned Utility Plant Location		Total Utility	Wisconsin Non-Utility <sup>b</sup>	Total Wisconsin	Total Wisconsin Precipitation (Inches per year)
	Wisconsin	Michigan				
1970	1,413.2	448.1	1,861.3	510.0	1,923.2	32.0
1975	1,482.9	450.3	1,933.2	529.4	2,012.3	32.4
1980	1,628.3	488.9	2,117.2	560.4	2,188.7	32.5
1985	2,046.3	543.6	2,589.9	635.9	2,682.2	37.0
1990	1,525.0	340.2	1,865.2	637.8	2,162.8	36.2
1991 <sup>c</sup>	2,270.0	436.0	2,706.0	684.7	2,954.7	38.7
1992	2,123.4	425.6	2,549.0	554.2	2,677.6	31.2
1993	2,191.0	449.1	2,640.1	636.7	2,827.7	35.6
1994	1,914.4	395.9	2,310.3	558.7	2,473.1	31.1
1995	2,097.1	440.1	2,537.2	593.3	2,690.4	32.9
1996	2,401.9	500.7	2,902.6	595.5	2,997.4	32.8
1997	2,182.2	458.5	2,640.7	521.3	2,703.5	28.6
1998	1,517.8	324.0	1,841.8	512.6	2,030.4	32.7
1999	1,734.0	416.1	2,150.1	600.1	2,334.1	34.0
2000	1,749.0	369.6	2,118.6	595.3	2,344.3	34.8
2001	1,888.0	383.3	2,280.3	617.0	2,505.0	35.5
2002 <sup>d</sup>	2,306.0	440.8	2,746.8	692.4	2,998.4	35.2

<sup>a</sup> Including Wisconsin power cooperatives.

<sup>b</sup> Estimated.

<sup>c</sup> Beginning in 1991, the U.S. DOE data source has been used.

<sup>d</sup> Preliminary estimates.

<sup>e</sup> Revised.

Source: Public Service Commission of Wisconsin, Accounts and Finance Division, *Generating Plants Operated by Wisconsin Electric Utilities*, Bulletin #46 (1971-1994); U.S. Department of Agriculture, Rural Electrification Administration, *Annual Statistical Report*, REA Bulletin 1-1 (1971-1994); Wisconsin Department of Administration, Division of Energy, Wisconsin Hydroelectric Generation Model, unpublished (1994); National Oceanic and Atmospheric Administration, *Monthly State Heating Degree Days, Historical Climatology Series 5-1* (April 2003); U.S. Department of Energy, Energy Information Administration, *Electric Power Monthly* [DOE/EIA-0226 (2003/04)] (April 2003).

## Wisconsin Renewable Energy Electricity Generated and Purchased, 1990-2002

(Millions of kWh)

In 2002, Wisconsin's electric utilities increased their sales of electricity generated from renewable energy sources by almost 18 percent. The primary renewable energy source used was hydropower. However, the fastest growing renewable energy source was wind. Use of biogas also increased and has more than doubled over the past five years. Electricity generated by renewable energy, but not purchased from utilities – such as residential photovoltaic systems and biomass to electricity systems within paper mills – is not included in this table.

Year	Hydro	Wood	Bio-Solid Waste <sup>b</sup>	Biogas	Wind	Total <sup>a</sup>
1990	2,162.8	196.9	64.7	75.1	0	2,499.5
1991	2,954.7	193.7	66.4	85.1	0	3,299.9
1992	2,677.6	197.2	67.0	95.1	0	3,036.9
1993	2,827.7	215.1	43.8	100.1	0	3,186.7
1994	2,473.1	223.8	53.8	100.1	0	2,850.8
1995	2,690.4	221.9	50.2	110.1	0	3,072.6
1996	2,997.4	242.8	52.6	112.8	0	3,405.6
1997	2,703.5	210.5	53.6	121.2	0	3,088.8
1998	2,030.4	245.0	56.8	131.7	0	2,463.9
1999	2,334.1	238.3	63.4	127.1	23.7	2,786.6
2000	2,344.3	217.1	73.3	197.2	46.6	2,878.5
2001	2,505.0	220.5	85.6	203.3	70.2	3,084.5
2002 <sup>p</sup>	2,998.4	206.3	71.1	252.8	109.2	3,637.8

<sup>a</sup> Wisconsin utilities generate a small amount of electricity, less than 0.2 million kilowatt-hours annually, through solar power using photovoltaic systems.

<sup>b</sup> Includes municipal and industrial solid waste.

<sup>p</sup> Preliminary estimates.

Source: Other renewable energy tables in this publication, renewable portfolio reporting and personal conversations with utility staff.